APPLICATION FOR RENEWAL OF ANNUAL LETTERS OF AUTHORIZATION FOR THE EMPLOYMENT OF SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE (SURTASS LFA) SONAR ONBOARD FOUR VESSELS

UNDER SECTION 101 (a)(5)(A) OF THE MARINE MAMMAL PROTECTION ACT

MARCH 2015

SUBMITTED BY: DEPARTMENT OF THE NAVY
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SUBMITTED TO: NATIONAL MARINE FISHERIES SERVICE
OFFICE OF PROTECTED SPECIES
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ACRONYMS AND ABBREVIATIONS

%	percent
≥	greater than or equal to
<	less than
>	greater than
±	plus or minus
µ	micro (10^{-6})
animals/km^2	animals per square kilometer
APPS	Act to Prevent Pollution from Ships
BO	biological opinion
BRS	behavioral response study
CEE	controlled exposure experiment
CI	confidence interval
CNO	Chief of Naval Operations
CNP	Central North Pacific
CV	coefficient of variance
CWA	Clean Water Act
dB	decibel(s)
dB re 1 µPa @ 1 m	decibels relative to one micro Pascal measured at one meter from center of acoustic source
dB re 1 µPa^2-sec	decibels relative to one micro Pascal squared per second
DPS	distinct population segment
ECS	East China Sea
EEZ	exclusive economic zone
EIS	environmental impact statement
EO	Executive Order
EOG	Executive Oversight Group
ESA	Endangered Species Act
ETP	eastern tropical Pacific
FM	frequency modulated
ft	feet
HF	high frequency
HF/M3	high frequency marine mammal monitoring
HLA	horizontal line array
hr	hour(s)

ACRONYMS AND ABBREVIATIONS

Hz	Hertz
IA	Inshore Archipelago
ITS	Incidental Take Statement
IWC	International Whaling Commission
km	kilometer(s)
km^2	kilometers squared
kHz	kiloHertz
kph	kilometers per hour
kt	knot(s)
LF	low frequency
LFA	Low Frequency Active
LOA	Letter of Authorization
LFS	low frequency sound
LMR	Living Marine Resources
m	meter(s)
M3	Marine Mammal Monitoring
MFA	mid-frequency active
MMB	Marine Mammals and Biology
MMPA	Marine Mammal Protection Act
MPA	marine protected area
msec	millisecond(s)
N2/N6F24	Navy's Intelligence, Surveillance and Reconnaissance Capabilities Division
NDAA	National Defense Authorization Act
NMFS	National Marine Fisheries Service
nmi	nautical mile(s)
NMI	Northern Mariana Islands
NP	North Pacific
NWHI	Northwestern Hawaiian Islands
OAWRS	Ocean Acoustic Waveguide Remote Sensing
OBIA(s)	offshore biologically important area(s)
ONR	Office of Naval Research
OPR	Office of Protected Resources
Pa	Pascal

ACRONYMS AND ABBREVIATIONS

PAM	passive acoustic monitoring
PTS	permanent threshold shift
RIMPAC	Rim of the Pacific Exercises
RL	received level
rms	root mean squared
SAG	Scientific Advisory Group
SAR	Stock Assessment Report
SE	standard error
sec	second(s)
SEIS	supplemental environmental impact statement
SEL	sound exposure level
SL	source level
SOCAL	Southern California
SOEIS	supplemental overseas environmental impact statement
SOJ	Sea of Japan
SPE	single ping equivalent
SPL	sound pressure level
SPLASH	Structure of Populations, Levels of Abundance, and Status of Humpbacks
SRP	Scientific Research Program
SURTASS	Surveillance Towed Array Sensor System
T-AGOS	Tactical-Auxiliary General Ocean Surveillance
TTS	temporary threshold shift
U.S.	United States of America
USC	United States Code
USNS	United States Naval Ship
VLA	vertical line array
WNP	Western North Pacific

Requirement 1: *A detailed description of the specific activity or class of activities that can be expected to result in the incidental taking of marine mammals.*

1 DESCRIPTION OF THE PROPOSED ACTIVITY

1.1 INTRODUCTION

Pursuant to Section 101 (a)(5)(A) of the Marine Mammal Protection Act of 1972, as amended (MMPA;16 United States Code [USC] 1371), the Department of the Navy (hereafter, the Navy) is applying to the National Marine Fisheries Service (NMFS) for renewals of annual Letters of Authorization (LOAs) for the employment of Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA)[1] sonar during training, testing, and routine military operations in the western and central North Pacific Ocean. Marine mammals may be harassed incidentally due to the underwater sound generated by the employment of SURTASS LFA sonar systems during at-sea operations. As a result, the Navy is requesting annual LOAs under the MMPA for incidental taking of marine mammals by Level A (no lethal taking) and Level B harassment during the employment of SURTASS LFA sonar systems onboard the United States Naval Ship (USNS) VICTORIOUS (Tactical-Auxiliary General Ocean Surveillance [T-AGOS] 19); USNS ABLE (T-AGOS 20); USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23) for the annual period from 15 August 2015 through 14 August 2016 for no more than 20 total at-sea missions. The four SURTASS LFA sonar vessels will operate in the same eleven mission areas in the western and central North Pacific Ocean currently authorized under the 2014 to 2015 LOAs for SURTASS LFA sonar (NOAA, 2014).

The basis of this application for annual LOAs is: (1) the analysis of spatial and temporal distributions of protected marine mammals in potential mission areas for SURTASS LFA sonar, (2) a review of activities that have the potential to affect marine mammals, and (3) a technical risk assessment to determine the likelihood of effects from use of LFA sonar during Navy training, testing, and routine military operations in the western and central North Pacific Ocean, with specific geographic areas exempted from operations. For this application for LOAs, analysis of SURTASS LFA proposed sonar operations examined the potential exposure to marine mammals resulting from proposed at-sea missions, each of seven days duration, conducted by four vessels using SURTASS LFA sonar with a maximum number of actual LFA sonar transmission hours per vessel that would not exceed 432 hours (hr) annually.

1.2 SURTASS LFA SONAR OPERATIONS

The Chief of Naval Operations' (CNO) mission for SURTASS LFA sonar includes the training of Navy crews that man SURTASS LFA sonar vessels as well as testing and operating the SURTASS and LFA sonar systems in as many and varied at-sea environments as possible. The Navy has determined that operations of the SURTASS LFA sonar, which are the subject of NMFS's Final Rule (NOAA, 2012), include testing, training, and military operations. Furthermore, SURTASS LFA sonar operations constitute a military readiness activity as that term is defined in Public Law 107-314 (16 USC § 703 note), and these activities constitute "training and operations of the Armed Forces that relate to combat" and "adequate and realistic testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use."

A complete description of the SURTASS LFA sonar system as well as information on the Navy's current and proposed employment of the sonar may be found in the Navy's June 2012 Supplemental Environmental Impact Statement/Supplemental Overseas Environmental Impact Statement (SEIS/SOEIS)

1 In this document, the phrase SURTASS LFA sonar systems refers to both the LFA and compact LFA (CLFA) systems, each having similar acoustic transmission characteristics.

for SURTASS LFA sonar (DoN, 2012). SURTASS LFA sonar systems are and will be operated in accordance with the geographic restrictions[2] and mitigation monitoring protocols delineated in the 2012 Navy SEIS/SOEIS, the Navy's Record of Decision (DoD, 2012), the NMFS' MMPA Final Rule (NOAA, 2012), annual LOAs, as issued (NOAA, 2014), the 2012 to 2017 biological opinion (BO) (NMFS, 2012), and annual BO/Incidental Take Statements (ITSs) (NMFS, 2014).

1.2.1 SURTASS LFA SONAR SYSTEM

The SURTASS LFA sonar system is comprised of a passive acoustic component, SURTASS, and an active sonar component, LFA. SURTASS is the passive or sound-receiving component that receives sound signals on a series of hydrophones mounted together to form a horizontal line array (HLA). The HLA is towed behind a SURTASS LFA sonar vessel at a speed of about 5.6 kilometers per hour (kph) (3 knots [kt]). Since the SURTASS component only receives sound signals and transmits no sonar or sound energy into the marine environment and is towed at such a slow speed, the SURTASS component will result in no reasonably foreseeable impact to potentially occurring marine mammals.

The LFA sonar source is a vertical line array (VLA) composed of up to 18 source projectors that is suspended beneath the SURTASS LFA sonar vessel. The LFA source operates within the frequency range of 100 to 500 Hertz (Hz) with each individual source projector transmitting signals with a source level (SL) of approximately 215 decibels relative to 1 microPascal at a reference of 1 meter (dB re 1 µPa @ 1 m) (root mean squared [rms]) or less. The typical LFA sonar signal is not transmitted as a constant tone but is instead transmitted as various waveforms that fluctuate in frequency and duration. A complete sequence of sound transmissions is referred to as a wavetrain or ping. These pings have the duration of 6 and 100 seconds (sec), with an average duration of 60 sec and no more than 10 sec at any single frequency. The time between sonar ping transmissions is typically 6 to 15 minutes. The average duty cycle (ratio of sound "on" time to total time) is less than 20%, with a typical duty cycle, based on LFA operational parameters since 2003, ranging nominally between 7.5 to 10%.

1.2.2 OPERATION OF SURTASS LFA SONAR

Past operation of SURTASS LFA sonar in the western and central North Pacific Ocean over the twelve-year period spanning 2002 through 2014 (i.e., through the end of the August 2014 LOA reporting period) includes 163 completed missions conducted over 500 days during which LFA sonar was transmitted for 969 hr (or about 40.4 days of a possible 4,380 days) in total. During those missions, only 10 marine mammals or sea turtles were visually observed, eight marine animals were detected passive-acoustically, and 159 marine mammals/animals were detected active-acoustically by the high frequency marine mammal monitoring (HF/M3) sonar system. These combined detections of marine animals led to 165[3] suspensions/delays of LFA sonar transmissions, per the mitigation protocol for the operation of SURTASS LFA sonar.

The mitigation monitoring program required for the use of SURTASS LFA sonar has successfully and effectively prevented harm to protected marine species and has affected the least practicable adverse impacts on marine mammal species or stocks. Throughout the operational history of SURTASS LFA sonar, no vessel strikes of marine animals, physical injury to any marine animals, or marine mammal strandings have ever been reported or associated with the use of LFA sonar. Such results demonstrate the efficacy of SURTASS LFA sonar's mitigation monitoring program, which includes geographic restrictions[2] as well as a tripartite system of acoustic and visual mitigation monitoring measures.

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2 Broadly, the geographic restrictions for operation of SURTASS LFA sonar include no operation of the sonar in polar waters and no transmission of LFA sonar at received levels greater than 180 decibels relative to 1 microPascal (root mean square) (dB re 1 µPa [rms]) within 22 kilometers [km] (12 nautical miles [nmi]) of land, including islands, or within 1 km (0.5 nmi) of offshore biologically important areas (OBIAs) for marine mammals, of which 22 OBIAs have been designated for SURTASS LFA sonar.

3 Since some of the passive and active acoustic detections were of the same animal, the sum of visual, passive acoustic, and active acoustic detections exceeds the number of LFA sonar suspensions/shutdowns.

The acoustic (passive and active [HF/M3]) and visual mitigation monitoring measures have been employed aboard four SURTASS LFA sonar vessels/systems that have operated in the western North Pacific Ocean during the annual LOA and ITS reporting period from August 2013 through August 2014 and the most recent reporting period commencing 15 August 2014. For the 2013 through 2014 annual reporting period, 38.6 hr of LFA sonar were transmitted during seven missions over 20.4 mission days (Table 1). In accordance with the mitigation monitoring protocol, during the 2013 to 2014 annual reporting period, LFA sonar was suspended five times due to five active acoustic (HF/M3) detections of marine animals (Table 1). No dead or injured marine species were observed in conjunction with LFA sonar operations. The LOAs for SURTASS LFA permit up to 432 hr of LFA sonar transmissions per SURTASS LFA vessel annually for a combined total of 1,728 hr of LFA sonar transmissions in the western and central North Pacific Ocean. However, during the 2013 to 2014 LOA reporting period, all four SURTASS LFA vessels only transmitted a total of 38.6 hr of LFA sonar or 2.2% of the permitted sonar transmit time (Table 1).

During the first two quarters of the current LOA reporting period (15 August 2014 through 14 February 2015), five SURTASS LFA sonar missions have been completed over 9.8 days, with 21.5 hr of LFA sonar transmissions. During the five LFA sonar missions of the effective LOA period thus far during 2014 to 2015, two visual, no passive acoustic, and two active acoustic detections of marine animals were made, resulting in four shutdowns/suspensions of LFA sonar transmissions due to the detection of marine animals; five additional shutdowns/suspensions of LFA sonar transmissions during one mission were the result of system/equipment faults and not detections of marine animals (Table 2). No dead or injured marine species were observed during any SURTASS LFA sonar operations.

Table 1. Summary of SURTASS LFA sonar operations for the LOA annual reporting period, 15 August 2013 through 14 August 2014.

LFA Vessel	Missions	Mission Duration (days)	LFA Sonar Transmissions (hours)	Visual Detections	Passive Acoustic Detections	Active Acoustic/ HF/M3 Detections	Suspensions/ Delays Per Mitigation Protocol (Total Duration of Suspension/Delay [hrs])
USNS VICTORIOUS (T-AGOS 19)	1	3.81	7.68	0	0	1	1
USNS ABLE (T-AGOS 20)	3	11.13	18.10	0	0	9	4[4]
USNS EFFECTIVE (T-AGOS 21)	3	5.50	12.85	0	0	0	0
USNS IMPECCABLE (T-AGOS 23)	0	0	0	0	0	0	0
ANNUAL TOTALS	**7**	**20.4**	**38.6**	**0**	**0**	**10**	**5**

4 Although 9 HF/M3 sonar detections occurred during the USNS ABLE's missions, SURTASS LFA sonar operators determined that 5 of the HF/M3 detections were not biological sonar returns. Thus, LFA sonar transmissions were not suspended or delayed as a result of those 5 HF/M3 detections.

Table 2. Summary of SURTASS LFA sonar operations for the first two quarters (15 August 2014 to 14 February 2015) of the 2014 to 2015 LOA annual reporting period.

LFA Vessel	Missions	Mission Duration (days)	LFA Sonar Transmissions (hours)	Visual Detections	Passive Acoustic Detections	Active Acoustic/ HF/M3 Detections	Suspensions/ Delays Per Mitigation Protocol (Total Duration of Suspension/Delay [hrs])
USNS VICTORIOUS (T-AGOS 19)	1	0.6	1.3	0	0	0	5[5]
USNS ABLE (T-AGOS 20)	1	1.6	2.6	0	0	1	1
USNS EFFECTIVE (T-AGOS 21)	3	7.6	17.6	2	0	1	3
USNS IMPECCABLE (T-AGOS 23)	0	0	0	0	0	0	0
ANNUAL TOTALS	**5**	**9.8**	**21.5**	**2**	**0**	**2**	**9**

5 These five shutdowns/suspensions of LFA sonar transmissions were due to system/equipment faults and not detections of marine animals.

Requirement 2: *Date(s) and duration of such activity and the specific geographic region where it will occur.*

2 DURATION AND LOCATION OF SURTASS LFA SONAR USE

2.1 ACTIVITY DURATION

Due to uncertainties in the world's political climate, a detailed account of future operating locations for SURTASS LFA sonar cannot be predicted. However, for planning and analysis purposes, a nominal annual deployment schedule has been developed that is based on actual LFA operations conducted since January 2003 and projected Navy requirements.

Annually, a nominal schedule for each SURTASS LFA sonar vessel entails approximately 240 days spent performing active at-sea operations (Table 3). Between missions, an estimated 71 days per year would be spent in port for maintenance, repair, and to exchange crew members. Although the actual number and length of individual missions within the 240 days of estimated active sonar operations are difficult to predict, the maximum number of actual transmission hours per vessel per year will not exceed 432 hr. For estimation purposes in this application, individual SURTASS LFA missions are based on 7-day mission duration. A total of 20 missions are estimated for all SURTASS LFA sonar vessels during the annual 2015 to 2016 LOA effective period, with 16 of those missions predicted to occur in the western North Pacific Ocean and four missions predicted to occur in the central North Pacific Ocean.

Table 3. Nominal annual deployment schedule for SURTASS LFA sonar vessels.

UNDERWAY-MISSION	DAYS	NOT UNDERWAY	DAYS
Transit to/from mission areas	54	In-port maintenance	40
Active sonar operations (432 hours of permitted sonar transmissions per vessel based on 7.5% duty cycle)	240	Regular overhaul	31
Total underway	294	Total not underway	71
Total			365

The maximum number of LFA sonar transmission hours and mission days actually conducted by the Navy has historically been far fewer than the number used in planning and modeling; likewise, the number of actual LFA sonar transmit time has been far, far less than the total number authorized by NMFS. For instance, during the last full annual LOA reporting period (i.e., August 2013 through August 2014; Table 1), seven missions were conducted by the four SURTASS LFA sonar vessels in the western North Pacific Ocean during which SURTASS LFA sonar was only transmitted for 38.6 hr or 2.2% of the permitted total transmit duration. In the first three months of the current LOAs reporting period (15 August 2014 through 14 August 2015), four missions have been conducted over 9.2 days during which a total of 20.2 hr of LFA sonar signals were transmitted (Table 2).

2.2 GEOGRAPHIC REGIONS OF OPERATION

The locations of the ocean areas requested for SURTASS LFA sonar employment during the August 2015 to August 2016 LOAs effective period are 11 mission areas in the western and central North Pacific Ocean; these areas are the same mission areas in which SURTASS LFA sonar is currently authorized to operate. Nine mission areas are requested in the western North Pacific Ocean and two mission areas are requested in the central North Pacific Ocean (Table 4). Specifically, the Navy is planning to deploy and transmit SURTASS LFA sonar in 11 mission areas in the Sea of Japan, East China Sea, and South China Sea; the western and northern Philippine Sea; ocean areas east and offshore of Japan and Guam as well as north and south of the Main and Northwestern Hawaiian Islands. No more than three missions are proposed for any one mission area (Table 4).

Table 4. Mission areas and number of SURTASS LFA missions proposed to occur 15 August 2015 through 14 August 2016 in the western and central North Pacific Ocean.

MISSION AREA NUMBER	SURTASS LFA MISSION AREA	NUMBER PROPOSED MISSIONS
Western North Pacific Ocean		
1	East of Japan	1
2	North Philippine Sea	3
3	West Philippine Sea	3
4	Offshore Guam	3
5	Sea of Japan	2
6	East China Sea	1
7	South China Sea	1
8	Offshore Japan (25° to 40° N)	1
9	Offshore Japan (10° to 25° N)	1
Central North Pacific Ocean		
10	Hawaii North	2
11	Hawaii South	2

No seasonal limitations are associated with any of the areas requested for LFA sonar use, except in offshore biologically important areas (OBIAs) (Table 5), in which SURTASS LFA sonar cannot be transmitted to levels above received levels (RLs) of 180 dB re 1 µPa (rms) within 1 kilometer (km) (0.54 nautical miles [nmi]) of the OBIA during biologically significant time periods. Two OBIAs, the Piltun and Chayvo Offshore Feeding Grounds, Sea of Okhotsk and Penguin Bank, Hawaiian Islands Humpback Whale National Marine Sanctuary are located adjacent to and within, respectively, a mission area for SURTASS LFA sonar (Table 5). Additionally, the sound field generated by SURTASS LFA sonar will be transmitted below RLs of 180 dB re 1 µPa (rms) in coastal areas within 22 km (12 nmi) of any coastline, including islands, (hereafter known as the coastal standoff distance).

Table 5. SURTASS LFA OBIAs for marine mammals and their period of effectiveness.

OBIA	PERIOD OF EFFECTIVENESS
Georges Bank	Year-round
Roseway Basin Right Whale Conservation Area	June through December, annually
Great South Channel, U.S. Gulf of Maine, and Stellwagen Bank National Marine Sanctuary	January 1 to November 14, annually
Southeastern U.S. Right Whale Seasonal Habitat	November 15 to April 15, annually
North Pacific Right Whale Critical Habitat	March through August, annually
Silver Bank and Navidad Bank	December through April, annually
Coastal waters of Gabon, Congo and Equatorial Guinea	June through October, annually
Patagonian Shelf Break	Year-round
Southern Right Whale Seasonal Habitat	May through December, annually
Central California National Marine Sanctuaries	June through November, annually
Antarctic Convergence	October through March, annually
Piltun and Chayvo Offshore Feeding Grounds in the Sea of Okhotsk	June through November, annually
Coastal waters off Madagascar	July through September, annually for humpback whale breeding and November through December, annually for migrating blue whales
Madagascar Plateau, Madagascar Ridge, and Walters Shoal	November through December, annually
Ligurian-Corsican-Provencal Basin and Western Pelagos Sanctuary in the Mediterranean Sea	July to August, annually
Penguin Bank, Hawaiian Islands Humpback Whale National Marine Sanctuary	November through April, annually
Costa Rica Dome	Year-round
Great Barrier Reef Between 16° S and 21° S	May through September, annually
Bonney Upwelling on the southern coast of Australia	December through May, annually
Northern Bay of Bengal and Head of Swatch-of-No-Ground	Year-round
Olympic Coast National Marine Sanctuary and Prairie, Barkley Canyon, and Nitnat Canyon	Olympic NMS: December, January, March, and May, annually The Prairie, Barkley Canyon, and Nitnat Canyon: June through September, annually
Abrolhos Bank	August through November

Requirement 3: *The species and numbers of marine mammals likely to be found within an activity area.*

3 MARINE MAMMALS

As many as 38 marine mammal species may occur at least seasonally in the LFA mission areas of the western and central North Pacific Ocean that are requested for use of SURTASS LFA sonar (Table 6). These species include nine mysticetes (baleen whales), 28 odontocetes (toothed whales/dolphins/porpoises), and one pinniped (seals, sea lions, and walruses). Several of these species only occur seasonally while others occur year-round in the potential mission areas for SURTASS LFA sonar. Some species, such as the *Mesoplodon* beaked whales and *Kogia* species are not only difficult to identify or differentiate at sea, and for these reasons, little occurrence information is often available for the individual species in some geographic areas. In recognition of this lack of information, two undifferentiated species groups, *Mesoplodon* spp. (Blainville's, Deraniyagala's, ginkgo-toothed, Hubb's, and Stejneger's beaked whales) and *Kogia* spp. (dwarf and pygmy sperm whales) are included to account for these species in a less specific way in some mission areas.

Of the potentially occurring marine mammals, eight species are listed as endangered under the Endangered Species Act (ESA). Of the ESA-listed marine mammal species, only the Hawaiian monk seal has critical habitat designated in the vicinity of any of the North Pacific mission areas for SURTASS LFA sonar. Critical habitat for the Hawaiian monk seal includes designated use areas of the Northwestern Hawaiian Islands (NWHI) to a depth of 37 meters (m) (120 feet [ft]). The critical habitat boundaries for the Hawaiian monk seal lie within the coastal exclusion zone for SURTASS LFA sonar, wherein the sound field generated by LFA sonar cannot exceed 180 dB re 1 µPa (rms) (sound pressure level [SPL]) within 22 km (12 nmi) of the coastline.

3.1 MARINE MAMMAL STOCKS

The 2012 MMPA Final Rule and the annual LOAs for SURTASS LFA sonar specify that incidental taking by MMPA Level B harassment cannot exceed 12% of any marine mammal stock. The MMPA defines a marine mammal stock as "a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature" (16 USC 1362). For SURTASS LFA sonar, the Navy must determine the stock(s) of each marine mammal species that occurs in each of the mission areas in which it proposes to employ SURTASS LFA sonar during each LOA annual effective period.

Stock structure can sometimes be highly refined, especially in the insular waters of oceanic islands such as the Hawaiian Islands, where insular stocks of several dolphin and small whale species have been defined (Baird et al., 2009; Aschettino et al. 2012; Oleson et al. 2013, Carretta et al., 2014; Courbis et al. 2014). Stock structure for other species is often less well defined, especially for rare or less well studied species, with only one stock known to occur over a wide geographic extent, such as the North Pacific Ocean. Stock information for each marine mammal species in a given geographic or mission area were compiled or derived using the best available scientific information.

3.2 MARINE MAMMAL ABUNDANCE AND DENSITY ESTIMATES

Although the distribution of many marine mammal species is irregular and highly dependent upon geography, oceanography, and seasonality, density and abundance estimates for each marine mammal species and stock occurring in SURTASS LFA mission areas are critical components of the analytical estimation methodology used to assess risk to marine mammal populations from activities occurring in the marine environment. Consequently, density and abundance estimates have been derived for the stocks of marine mammal species potentially occurring in the proposed 2015 to 2016 mission areas for

Table 6. Marine mammal species potentially occurring in SURTASS LFA sonar mission areas of the western and central North Pacific Ocean and their status under the ESA and MMPA.

SPECIES	ESA STATUS	MMPA STATUS
Mysticetes		
Blue whale (*Balaenoptera musculus)*	Endangered	Depleted
Bryde's whale (*Balaenoptera edeni)*		
Common Minke whale (*Balaenoptera acutorostrata)*		
Fin whale (*Balaenoptera physalus)*	Endangered	Depleted
Humpback whale (*Megaptera novaeangliae*)	Endangered	Depleted
North Pacific right whale (*Eubalaena japonica*)	Endangered	Depleted
Omura's whale (*Balaenoptera omurai)*		
Sei whale (*Balaenoptera borealis*)	Endangered	Depleted
Western North Pacific Gray whale (*Eschrichtius robustus*)	Western North Pacific DPS Only—Endangered	Depleted
Odontocetes		
Baird's beaked whale (*Berardius bairdii)*		
Blainville's beaked whale (*Mesoplodon densirostris)*		
Common bottlenose dolphin (*Tursiops truncatus*)		
Cuvier's beaked whale (*Ziphius cavirostris*)		
Dall's porpoise (*Phocoenoides dalli*)		
Deraniyagala's beaked whale (*Mesoplodon hotaula*)		
Dwarf sperm whale (*Kogia sima*)		
False killer whale (*Pseudorca crassidens*)	Main Hawaiian Islands Insular DPS[6]—Endangered	Depleted
Fraser's dolphin (*Lagenodelphis hosei*)		
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens)*		
Harbor porpoise (*Phocoena phocoena*)		
Hubbs beaked whale (*Mesoplodon carhubbsi)*		
Killer whale (*Orca orcinus*)[7]		
Kogia spp.		
Long-beaked common dolphin (*Delphinus capensis)*		
Longman's beaked whale (*Indopacetus pacificus*)		
Melon-headed whale (*Peponocephala electra*)		
Mesoplodon spp.		
Pacific white-sided dolphin (*Lagenorhynchus obliquidens)*		
Pantropical spotted dolphin (*Stenella attenuata*)		
Pygmy killer whale (*Feresa attenuata*)		
Pygmy sperm whale (*Kogia breviceps*)		
Risso's dolphin (*Grampus griseus*)		
Rough-toothed dolphin (*Steno bredanensis*)		
Short-beaked common dolphin (*Delphinus delphis*)		

6 DPS=Distinct population segment

7 Only the Southern Resident killer whale DPS, found principally in U.S. and Canadian inland waters, is listed as endangered.

Table 6. Marine mammal species potentially occurring in SURTASS LFA sonar mission areas of the western and central North Pacific Ocean and their status under the ESA and MMPA.

SPECIES	ESA STATUS	MMPA STATUS
Short-finned pilot whale (*Globicephala macrorhynchus)*		
Sperm whale (*Physeter macrocephalus*)	Endangered	Depleted
Spinner dolphin (*Stenella longirostris)*		
Stejneger's beaked whale (*Mesoplodon stejnegeri)*		
Striped dolphin (*Stenella coeruleoalba)*		
Pinnipeds		
Hawaiian monk seal (*Monachus schauinslandi*)	Endangered	Depleted

SURTASS LFA sonar (Table 7). These population data were derived using the best available information and data (Appendix A), including the most current NMFS final Stock Assessment Reports (SARs) for Alaska and the United States (U.S.) Pacific (Allen and Angliss, 2014; Carretta et al., 2014, respectively).

Abundance estimates are typically more available than are density estimates, which require more sophisticated sampling and analysis and are not always available for each species/stocks in all mission areas. In the rare cases where no abundance estimates were available for the stock of a species, an abundance derived for another stock of the same species or for a similar species in the same geographic area might be used as a surrogate abundance. When density estimates were not available for a species' stock in a mission area, density estimates from a region with similar oceanographic characteristics were extrapolated to that mission area and species. The eastern tropical Pacific (ETP), for example, has been extensively surveyed, with those survey data providing a comprehensive understanding of marine mammal populations in temperate oceanic waters (Ferguson and Barlow, 2001 and 2003). Data from such well-studied areas are the foundation for population estimates of data poor species of the western North Pacific. Further, density estimates are sometimes pooled for species of the same genus if sufficient data are not available to compute a density for individual species. This is often the case for pilot whales and beaked whales as well as the pygmy and dwarf sperm whales; density estimates in some mission areas are available for these species groups rather than the individual species. Last, density estimates are usually not available for very rare marine mammal species or for those that have been newly defined (e.g., the Deraniyagala's beaked whale). For such species, the lowest density estimate of 0.0001 animals per square kilometer (animals/km^2) was used in the risk analysis for SURTASS LFA sonar to reflect the very low probability of occurrence in a specific SURTASS LFA mission area for data sparse species, such as the North Pacific right whale (Table 7). When possible, seasonality for species' stocks has been provided.

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Mission Area #1: East of Japan								
Bryde's whale	WNP	20,501	1	0.0006	0.0006	0.0006	0.0006	2
Common minke whale	WNP "O"	25,049	3	0.0022	0.0022	0.0022	0.0022	3
Fin whale	WNP	9,250	4, 5			0.0002	0.0002	5
North Pacific right whale	WNP	922	6	0.0001	0.0001[10]			
Sei whale	NP	8,600	5	0.0006	0.0006	0.0006	0.0006	5, 7
Baird's beaked whale	WNP	8,000	8	0.0029	0.0029	0.0029	0.0029	8
Common bottlenose dolphin	WNP	168,791	9	0.0171	0.0171	0.0171	0.0171	9
Cuvier's beaked whale	WNP	90,725	10, 11	0.0031	0.0031	0.0031	0.0031	10, 11
False killer whale	WNP Pelagic	16,668	9	0.0036	0.0036	0.0036	0.0036	9
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Harbor porpoise	WNP	31,046	39, 40	0.1900	0.1900	0.1900	0.1900	39
Hubbs' beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Kogia spp.	WNP	350,553	10, 11	0.0031	0.0031	0.0031	0.0031	10, 11

8 NP=North Pacific; WNP=Western North Pacific; CNP=Central North Pacific; ECS=East China Sea; SOJ=Sea of Japan; IA=Inshore Archipelago; NMI=Northern Mariana Islands

9 No density in a season means that the marine mammal does not occur in that mission area during that season.

10 A density value of 0.0001 with no reference citation indicates that no density was available for this species, but because a density was necessary to compute takes, the lowest value possible was assigned to the data sparse species for the purpose of impact estimation.

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Pacific white-sided dolphin	WNP	931,000	13	0.0082	0.0082	0.0082	0.0082	10, 11
Pantropical spotted dolphin	WNP	438,064	9			0.0259	0.0259	9
Pygmy killer whale	WNP	30,214	10, 11	0.0021	0.0021	0.0021	0.0021	10, 11
Risso's dolphin	WNP	83,289	9	0.0097	0.0097	0.0097	0.0097	9
Rough-toothed dolphin	WNP	145,729	10, 11	0.0059	0.0059	0.0059	0.0059	10, 11
Short-beaked common dolphin	WNP	3,286,163	10, 11	0.0761	0.0761	0.0761	0.0761	10, 11
Short-finned pilot whale	WNP	53,608	9	0.0128	0.0128	0.0128	0.0128	9
Sperm whale	NP	102,112	15	0.0012	0.0012	0.0012	0.0012	16
Spinner dolphin	WNP	1,015,059	10, 11			0.0008	0.0008	14
Striped dolphin	WNP	570,038	9	0.0111	0.0111	0.0111	0.0111	9
Mission Area #2: North Philippine Sea								
Blue whale	CNP	9,250	5, 17, 18	0.0001	0.0001		0.0001	5, 10, 11, 19
Bryde's whale	WNP	20,501	1	0.0006	0.0006	0.0006	0.0006	2
Common minke whale	WNP "O"	25,049	3	0.0044	0.0044	0.0044	0.0044	3
Fin whale	WNP	9,250	4, 5	0.0002	0.0002			5
Humpback whale	WNP	1,107	20	0.0009	0.0009		0.0009	19, 21
North Pacific right whale	WNP	922	6	0.0001	0.0001			
Omura's whale	WNP	1,800	29	0.0001	0.0001	0.0001	0.0001	28
Blainville's beaked whale	WNP	8,032	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Common bottlenose dolphin	WNP	168,791	9	0.0146	0.0146	0.0146	0.0146	9
Cuvier's beaked whale	WNP	90,725	10, 11	0.0054	0.0054	0.0054	0.0054	10, 11
False killer whale	WNP Pelagic	16,668	9	0.0029	0.0029	0.0029	0.0029	9
Fraser's dolphin	WNP	220,789	10, 11	0.0069	0.0069	0.0069	0.0069	33
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Kogia spp.	WNP	350,553	10, 11	0.0031	0.0031	0.0031	0.0031	10, 11
Long-beaked common dolphin	WNP	279,182	41	1.1580	1.1580	1.1580	1.1580	41
Longman's beaked whale	WNP	4,571	33	0.0003	0.0003	0.0003	0.0003	12
Melon-headed whale	WNP	36,770	10, 11	0.0043	0.0043	0.0043	0.0043	16
Pacific white-sided dolphin	WNP	931,000	13	0.0119	0.0119			10, 11
Pantropical spotted dolphin	WNP	438,064	9	0.0137	0.0137	0.0137	0.0137	9
Pygmy killer whale	WNP	30,214	10, 11	0.0021	0.0021	0.0021	0.0021	10, 11
Risso's dolphin	WNP	83,289	9	0.0106	0.0106	0.0106	0.0106	9
Rough-toothed dolphin	WNP	145,729	10, 11	0.0059	0.0059	0.0059	0.0059	10, 11
Short-beaked common dolphin	WNP	3,286,163	10, 11	0.0562	0.0562	0.0562	0.0562	10, 11
Short-finned pilot whale	WNP	53,608	9	0.0153	0.0153	0.0153	0.0153	9
Sperm whale	NP	102,112	15	0.0012	0.0012	0.0012	0.0012	16

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Spinner dolphin	WNP	1,015,059	10, 11	0.0008	0.0008	0.0008	0.0008	14
Striped dolphin	WNP	570,038	9	0.0329	0.0329	0.0329	0.0329	9
Mission Area #3: West Philippine Sea								
Blue whale	CNP	9,250	5, 17, 18	0.0001	0.0001		0.0001	5, 10, 11, 19
Bryde's whale	WNP	20,501	1	0.0006	0.0006	0.0006	0.0006	2
Common minke whale	WNP "O"	25,049	3	0.0033	0.0033	0.0033	0.0033	3
Fin whale	WNP	9,250	4, 5	0.0002	0.0002			5
Humpback whale	WNP	1,107	20	0.0009	0.0009		0.0009	19, 21
Omura's whale	WNP	1,800	29	0.0001	0.0001	0.0001	0.0001	28
Blainville's beaked whale	WNP	8,032	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Common bottlenose dolphin	WNP	168,791	9	0.0146	0.0146	0.0146	0.0146	9
Cuvier's beaked whale	WNP	90,725	10, 11	0.0003	0.0003	0.0003	0.0003	10, 11
False killer whale	WNP Pelagic	16,668	9	0.0029	0.0029	0.0029	0.0029	9
Fraser's dolphin	WNP	220,789	10, 11	0.0069	0.0069	0.0069	0.0069	33
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Kogia spp.	WNP	350,553	10, 11	0.0017	0.0017	0.0017	0.0017	10, 11
Long-beaked common dolphin	WNP	279,182	41	1.1580	1.1580	1.1580	1.1580	41
Longman's beaked whale	WNP	4,571	33	0.0003	0.0003	0.0003	0.0003	12
Melon-headed whale	WNP	36,770	10, 11	0.0043	0.0043	0.0043	0.0043	16

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Pantropical spotted dolphin	WNP	438,064	9	0.0137	0.0137	0.0137	0.0137	9
Pygmy killer whale	WNP	30,214	10, 11	0.0021	0.0021	0.0021	0.0021	10, 11
Risso's dolphin	WNP	83,289	9	0.0106	0.0106	0.0106	0.0106	9
Rough-toothed dolphin	WNP	145,729	10, 11	0.0059	0.0059	0.0059	0.0059	10, 11
Short-finned pilot whale	WNP	53,608	9	0.0076	0.0076	0.0076	0.0076	9
Sperm whale	NP	102,112	15	0.0012	0.0012	0.0012	0.0012	16
Spinner dolphin	WNP	1,015,059	10, 11	0.0008	0.0008	0.0008	0.0008	14
Striped dolphin	WNP	570,038	9	0.0164	0.0164	0.0164	0.0164	9
Mission Area #4: Offshore Guam								
Blue whale	CNP	9,250	5, 17, 18	0.0001	0.0001		0.0001	5, 10, 11, 16, 19
Bryde's whale	WNP	20,501	1	0.0004	0.0004	0.0004	0.0004	16
Common minke whale	WNP "O"	25,049	3	0.0003	0.0003		0.0003	10, 11
Fin whale	WNP	9,250	4, 5	0.0001	0.0001		0.0001	10, 11
Humpback whale	WNP	1,107	20	0.0009	0.0009		0.0009	19, 21
Omura's whale	WNP	1,800	28, 29	0.0001	0.0001	0.0001	0.0001	28
Sei whale	NP	8,600	5	0.0003	0.0003		0.0003	16
Blainville's beaked whale	WNP	8,032	10, 11	0.0010	0.0010	0.0010	0.0010	33
Common bottlenose dolphin	WNP	168,791	9	0.0025	0.0025	0.0025	0.0025	33
Cuvier's beaked whale	WNP	90,725	10, 11	0.0008	0.0008	0.0008	0.0008	33

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Deraniyagala's beaked whale	NP	22,799	10, 11, 38	0.0009	0.0009	0.0009	0.0009	10, 11
Dwarf sperm whale	WNP	350,553	10, 11	0.0071	0.0071	0.0071	0.0071	14
False killer whale	WNP Pelagic	16,668	9	0.0011	0.0011	0.0011	0.0011	16
Fraser's dolphin	CNP	16,992	33	0.0069	0.0069	0.0069	0.0069	33
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0009	0.0009	0.0009	0.0009	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	33
Longman's beaked whale	WNP	4,571	33	0.0019	0.0019	0.0019	0.0019	33
Melon-headed whale	NMI	2,450	16	0.0043	0.0043	0.0043	0.0043	16
Pantropical spotted dolphin	WNP	438,064	9	0.0226	0.0226	0.0226	0.0226	16
Pygmy killer whale	WNP	30,214	10, 11	0.0001	0.0001	0.0001	0.0001	16
Pygmy sperm whale	WNP	350,553	10, 11	0.0029	0.0029	0.0029	0.0029	14
Risso's dolphin	WNP	83,289	9	0.0030	0.0030	0.0030	0.0030	33
Rough-toothed dolphin	WNP	145,729	10, 11	0.0026	0.0026	0.0026	0.0026	33
Short-finned pilot whale	WNP	53,608	9	0.0051	0.0051	0.0051	0.0051	33
Sperm whale	NP	102,112	15	0.0012	0.0012	0.0012	0.0012	16
Spinner dolphin	WNP	1,015,059	10, 11	0.0008	0.0008	0.0008	0.0008	14
Striped dolphin	WNP	570,038	9	0.0062	0.0062	0.0062	0.0062	16
Mission Area #5: Sea of Japan								
Bryde's whale	WNP	20,501	1	0.0001	0.0001	0.0001	0.0001	10, 11
Common minke whale	WNP "O"	25,049	3	0.0004	0.0004	0.0004	0.0004	10, 11
	WNP "J"	893	22	0.0002	0.0002	0.0002	0.0002	10, 11

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Fin whale	WNP	9,250	4, 5	0.0009	0.0009	0.0009	0.0009	10, 11
North Pacific right whale	WNP	922	6	0.0001	0.0001			
Omura's whale	WNP	1,800	28, 29	0.0001	0.0001	0.0001	0.0001	28
Western North Pacific gray whale	WNP	140	42	0.0001	0.0001	0.0001	0.0001	
Baird's beaked whale	WNP	8,000	8	0.0003	0.0003	0.0003	0.0003	8
Common bottlenose dolphin	IA	105,138	9, 23	0.0008	0.0008	0.0008	0.0008	12
Cuvier's beaked whale	WNP	90,725	10, 11	0.0031	0.0031	0.0031	0.0031	10, 11
Dall's porpoise	SOJ	76,720	10, 11	0.0520	0.0520	0.0520	0.0520	10, 11
False killer whale	IA	9,777	9, 23	0.0027	0.0027	0.0027	0.0027	10, 11
Harbor porpoise	WNP	31,046	39, 40	0.1900	0.1900	0.1900	0.1900	39
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Kogia spp.	WNP	350,553	10, 11	0.0017	0.0017	0.0017	0.0017	10, 11
Long-beaked common dolphin	WNP	279,182	41	1.1580	1.1580	1.1580	1.1580	41
Pacific white-sided dolphin	IA	931,000	9, 13	0.0030	0.0030			11
Risso's dolphin	IA	83,289	9	0.0073	0.0073	0.0073	0.0073	9
Rough-toothed dolphin	WNP	145,729	10, 11	0.0026	0.0026	0.0026	0.0026	33
Short-beaked common dolphin	WNP	3,286,163	10, 11	0.0860	0.0860	0.0860	0.0860	10, 11
Short-finned pilot whale	WNP	53,608	9	0.0014	0.0014	0.0014	0.0014	9

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Sperm whale	NP	102,112	15	0.0012	0.0012	0.0012	0.0012	16
Spinner dolphin	WNP	1,015,059	10, 11			0.0008	0.0008	14
Stejneger's beaked whale	WNP	8,000	8	0.0005	0.0005	0.0005	0.0005	10, 11
Striped dolphin	IA	570,038	9	0.0058	0.0058	0.0058	0.0058	12
Mission Area #6: East China Sea								
Bryde's whale	ECS	137	43	0.0003	0.0003	0.0003	0.0003	33
Common minke whale	WNP "O"	25,049	3	0.0044	0.0044	0.0044	0.0044	3
	WNP "J"	893	22	0.0018	0.0018	0.0018	0.0018	3
Fin whale	ECS	500	4, 5, 32	0.0002	0.0002	0.0002	0.0002	5
North Pacific right whale	WNP	922	6	0.0001	0.0001			
Omura's whale	WNP	1,800	28, 29	0.0001	0.0001	0.0001	0.0001	28
Western North Pacific gray whale	WNP	140	42	0.0001	0.0001		0.0001	
Blainville's beaked whale	WNP	8,032	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Common bottlenose dolphin	IA	105,138	9, 23	0.0008	0.0008	0.0008	0.0008	12
Cuvier's beaked whale	WNP	90,725	10, 11	0.0003	0.0003	0.0003	0.0003	10, 11
False killer whale	IA	9,777	9, 23	0.0011	0.0011	0.0011	0.0011	16
Fraser's dolphin	WNP	220,789	10, 11	0.0069	0.0069	0.0069	0.0069	33
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Kogia spp.	WNP	350,553	10, 11	0.0017	0.0017	0.0017	0.0017	10, 11

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Long-beaked common dolphin	WNP	279,182	41	1.1580	1.1580	1.1580	1.1580	41
Longman's beaked whale	WNP	4,571	33	0.0003	0.0003	0.0003	0.0003	12
Melon-headed whale	WNP	36,770	10, 11	0.0043	0.0043	0.0043	0.0043	16
Pacific white-sided dolphin	IA	931,000	9, 13	0.0028	0.0028			10, 11
Pantropical spotted dolphin	IA	219,032	9	0.0137	0.0137	0.0137	0.0137	9
Pygmy killer whale	WNP	30,214	10, 11	0.0001	0.0001	0.0001	0.0001	16
Risso's dolphin	IA	83,289	9	0.0106	0.0106	0.0106	0.0106	9
Rough-toothed dolphin	WNP	145,729	10, 11	0.0026	0.0026	0.0026	0.0026	33
Short-beaked common dolphin	WNP	3,286,163	10, 11	0.0461	0.0461	0.0461	0.0461	10, 11
Short-finned pilot whale	WNP	53,608	9	0.0016	0.0016	0.0016	0.0016	16
Sperm whale	NP	102,112	15	0.0012	0.0012	0.0012	0.0012	16
Spinner dolphin	WNP	1,015,059	10, 11	0.0008	0.0008	0.0008	0.0008	14
Striped dolphin	IA	570,038	9	0.0058	0.0058	0.0058	0.0058	12
Mission Area #7: South China Sea								
Bryde's whale	WNP	20,501	1	0.0006	0.0006	0.0006	0.0006	2
Common minke whale	WNP "O"	25,049	3	0.0033	0.0033	0.0033	0.0033	3
	WNP "J"	893	22	0.0018	0.0018	0.0018	0.0018	3
Fin whale	WNP	9,250	4, 5	0.0002	0.0002	0.0002	0.0002	5
North Pacific right whale	WNP	922	6	0.0001	0.0001			
Omura's whale	WNP	1,800	28, 29	0.0001	0.0001	0.0001	0.0001	28

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Western North Pacific gray whale	WNP	140	42	0.0001	0.0001		0.0001	
Blainville's beaked whale	WNP	8,032	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Common bottlenose dolphin	IA	105,138	23	0.0008	0.0008	0.0008	0.0008	12
Cuvier's beaked whale	WNP	90,725	10, 11	0.0003	0.0003	0.0003	0.0003	10, 11
Deraniyagala's beaked whale	NP	22,799	10, 11, 38	0.0005	0.0005	0.0005	0.0005	10, 11
False killer whale	IA	9,777	23	0.0011	0.0011	0.0011	0.0011	16
Fraser's dolphin	WNP	220,789	10, 11	0.0069	0.0069	0.0069	0.0069	33
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Kogia spp.	WNP	350,553	10, 11	0.0017	0.0017	0.0017	0.0017	10, 11
Long-beaked common dolphin	WNP	279,182	41	1.1580	1.1580	1.1580	1.1580	41
Longman's beaked whale	WNP	4,571	33	0.0003	0.0003	0.0003	0.0003	12
Melon-headed whale	WNP	36,770	10, 11	0.0043	0.0043	0.0043	0.0043	16
Pantropical spotted dolphin	IA	219,032	9	0.0137	0.0137	0.0137	0.0137	9
Pygmy killer whale	WNP	30,214	10, 11	0.0001	0.0001	0.0001	0.0001	16
Risso's dolphin	IA	83,289	9	0.0106	0.0106	0.0106	0.0106	9
Rough-toothed dolphin	WNP	145,729	10, 11	0.0026	0.0026	0.0026	0.0026	33

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Short-finned pilot whale	WNP	53,608	9	0.0016	0.0016	0.0016	0.0016	16
Sperm whale	NP	102,112	15	0.0012	0.0012		0.0012	16
Spinner dolphin	WNP	1,015,059	10, 11	0.0008	0.0008	0.0008	0.0008	14
Striped dolphin	IA	570,038	9	0.0058	0.0058	0.0058	0.0058	12
Mission Area #8: Offshore Japan/Pacific (25º to 40ºN)								
Bryde's whale	WNP	20,501	1	0.0004	0.0004	0.0004	0.0004	16
Common minke whale	WNP "O"	25,049	3	0.0003	0.0003	0.0003	0.0003	3
Fin whale	WNP	9,250	4, 5			0.0001	0.0001	5
Sei whale	NP	8,600	5	0.0003	0.0003	0.0003	0.0004	16
Baird's beaked whale	WNP	8,000	8	0.0001	0.0001	0.0001	0.0001	8
Blainville's beaked whale	WNP	8,032	12, 41	0.0007	0.0007	0.0007	0.0007	12
Common bottlenose dolphin	WNP	168,791	9	0.0008	0.0008	0.0008	0.0008	12
Cuvier's beaked whale	WNP	90,725	10, 11	0.0037	0.0037	0.0037	0.0037	12
Dwarf sperm whale	WNP	350,553	10, 11, 41	0.0043	0.0043	0.0043	0.0043	12
False killer whale	WNP	16,668	9	0.0036	0.0036	0.0036	0.0036	9
Hubbs' beaked whale	NP	22,799	10, 11	0.0005	0.0005	0.0005	0.0005	10, 11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Longman's beaked whale	WNP	4,571	33	0.0003	0.0003	0.0003	0.0003	12
Melon-headed whale	WNP	36,770	10, 11	0.0027	0.0027	0.0027	0.0027	12
Mesoplodon spp.	WNP	22,799	10, 11, 41	0.0005	0.0005	0.0005	0.0005	10, 11

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Pacific white-sided dolphin	WNP	931,000	13	0.0048	0.0048	0.0048	0.0048	10, 11
Pantropical spotted dolphin	WNP	438,064	9	0.0113	0.0113	0.0113	0.0113	12
Pygmy killer whale	WNP	30,214	10, 11	0.0001	0.0001	0.0001	0.0001	12
Pygmy sperm whale	WNP	350,553	10, 11, 41	0.0018	0.0018	0.0018	0.0018	12
Risso's dolphin	WNP	83,289	9	0.0005	0.0005	0.0005	0.0005	12
Rough-toothed dolphin	WNP	145,729	10, 11	0.0019	0.0019	0.0019	0.0019	12
Short-beaked common dolphin	WNP	3,286,163	10, 11	0.0863	0.0863	0.0863	0.0863	10, 11
Short-finned pilot whale	WNP	53,608	9	0.0021	0.0021	0.0021	0.0021	12
Sperm whale	NP	102,112	15	0.0022	0.0022	0.0022	0.0022	12
Spinner dolphin	WNP	1,015,059	10, 11	0.0019	0.0019	0.0019	0.0019	12
Striped dolphin	WNP	570,038	9	0.0058	0.0058	0.0058	0.0058	12
Hawaiian monk seal	Hawaiian	1,209	17	0.0001	0.0001	0.0001	0.0001	
Mission Area #9: Offshore Japan/Pacific (10° to 25°N)								
Blue whale	CNP	9,250	5, 17, 18	0.0001	0.0001		0.0001	5, 10, 11, 19
Bryde's whale	WNP	20,501	1	0.0003	0.0003	0.0003	0.0003	12
Fin whale	WNP	9,250	4, 5	0.0001	0.0001			
Omura's whale	WNP	1,800	28, 29	0.0001	0.0001	0.0001	0.0001	28
Sei whale	NP	8,600	5	0.0001	0.0001			12
Blainville's beaked whale	WNP	8,032	12, 41	0.0007	0.0007	0.0007	0.0007	12
Common bottlenose dolphin	WNP	168,791	9	0.0008	0.0008	0.0008	0.0008	12

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Cuvier's beaked whale	WNP	90,725	10, 11	0.0037	0.0037	0.0037	0.0037	12
Deraniyagala's beaked whale	NP	22,799	10, 11, 38	0.0009	0.0009	0.0009	0.0009	11
Dwarf sperm whale	WNP	350,553	10, 11	0.0043	0.0043	0.0043	0.0043	12
False killer whale	WNP	16,668	9	0.0006	0.0006	0.0006	0.0006	12
Fraser's dolphin	CNP	16,992	33	0.0025	0.0025	0.0025	0.0025	12
Ginkgo-toothed beaked whale	NP	22,799	10, 11	0.0009	0.0009	0.0009	0.0009	11
Killer whale	WNP	12,256	10, 11	0.0001	0.0001	0.0001	0.0001	12
Longman's beaked whale	WNP	4,571	33	0.0003	0.0003	0.0003	0.0003	12
Melon-headed whale	WNP	36,770	10, 11	0.0027	0.0027	0.0027	0.0027	12
Pantropical spotted dolphin	WNP	438,064	9	0.0113	0.0113	0.0113	0.0113	12
Pygmy killer whale	WNP	30,214	10, 11	0.0001	0.0001	0.0001	0.0001	12
Pygmy sperm whale	WNP	350,553	10, 11	0.0018	0.0018	0.0018	0.0018	12
Risso's dolphin	WNP	83,289	9	0.0005	0.0005	0.0005	0.0005	12
Rough-toothed dolphin	WNP	145,729	10, 11	0.0019	0.0019	0.0019	0.0019	12
Short-finned pilot whale	WNP	53,608	9	0.0021	0.0021	0.0021	0.0021	12
Sperm whale	NP	102,112	15	0.0022	0.0022	0.0022	0.0022	12
Spinner dolphin	WNP	1,015,059	10, 11	0.0019	0.0019	0.0019	0.0019	12
Striped dolphin	WNP	570,038	9	0.0058	0.0058	0.0058	0.0058	12
Mission Area #10: Hawaii North								
Blue whale	CNP	81	17, 33	0.0001	0.0001		0.0001	33
Bryde's whale	Hawaii	798	17, 33	0.0003	0.0003	0.0003	0.0003	33

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Common minke whale	Hawaii	25,049	3	0.0002	0.0002		0.0002	10, 11
Fin whale	Hawaii	58	17, 33	0.0001	0.0001		0.0001	33
Humpback whale	CNP	10,103	20	0.0009	0.0009		0.0009	19, 21
Sei whale	Hawaii	178	17, 33	0.0001	0.0001		0.0001	33
Blainville's beaked whale	Hawaii	2,338	17, 33	0.0010	0.0010	0.0010	0.0010	33
Common bottlenose dolphin	Hawaii Pelagic	5,950	17, 33	0.0025	0.0025	0.0025	0.0025	33
	Kauai/Niihau	184	17, 25	0.0001	0.0001	0.0001	0.0001	33, 34
	4-Islands	191	17, 25	0.0001	0.0001	0.0001	0.0001	33, 34
	Oahu	743	17, 25	0.0003	0.0003	0.0003	0.0003	33, 34
	Hawaii Island	128	17, 25	0.0001	0.0001	0.0001	0.0001	33, 34
Cuvier's beaked whale	Hawaii	1,941	17, 33	0.0008	0.0008	0.0008	0.0008	33
Dwarf sperm whale	Hawaii	17,519	14, 17	0.0071	0.0071	0.0071	0.0071	14
False killer whale	Hawaii Pelagic	1,503	17, 26	0.0006	0.0006	0.0006	0.0006	26
	Main Hawaiian Islands Insular	151	17, 27	0.0012	0.0012	0.0012	0.0012	27
	Northwestern Hawaiian Islands	552	17, 26	0.0013	0.0013	0.0013	0.0013	26
Fraser's dolphin	Hawaii	16,992	17, 33	0.0069	0.0069	0.0069	0.0069	33
Killer whale	Hawaii	101	17, 33	0.0001	0.0001	0.0001	0.0001	33
Longman's beaked whale	Hawaii	4,571	17, 33	0.0019	0.0019	0.0019	0.0019	33
Melon-headed whale	Hawaiian Islands	5,794	17, 35, 36	0.0012	0.0012	0.0012	0.0012	33
	Kohala Resident	447	17, 35, 36	0.0373	0.0373	0.0373	0.0373	17

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Pantropical spotted dolphin	Hawaiian Pelagic	15,917	17, 33	0.0067	0.0067	0.0067	0.0067	33
	Hawaii Island	220	37	0.0067	0.0067	0.0067	0.0067	33
	Oahu	220	37	0.0067	0.0067	0.0067	0.0067	33
	4-Islands	220	37	0.0067	0.0067	0.0067	0.0067	33
Pygmy killer whale	Hawaii	3,433	17, 33	0.0014	0.0014	0.0014	0.0014	33
Pygmy sperm whale	Hawaii	7,138	14, 17	0.0029	0.0029	0.0029	0.0029	14
Risso's dolphin	Hawaii	7,256	17, 33	0.0030	0.0030	0.0030	0.0030	33
Rough-toothed dolphin	Hawaii	6,288	17, 33	0.0026	0.0026	0.0026	0.0026	33
Short-finned pilot whale	Hawaii	12,422	17, 33	0.0051	0.0051	0.0051	0.0051	33
Sperm whale	Hawaii	3,354	17, 33	0.0014	0.0014	0.0014	0.0014	33
Spinner dolphin	Hawaii Pelagic	3,351	14	0.0008	0.0008	0.0008	0.0008	14
	Kauai/Niihau	601	17	0.0070	0.0070	0.0070	0.0070	14
	Hawaii Island	631	17	0.0070	0.0070	0.0070	0.0070	14
	Oahu/4-Islands	355	17	0.0070	0.0070	0.0070	0.0070	14
	Kure/Midway Atoll	260	17	0.0070	0.0070	0.0070	0.0070	14
	Pearl and Hermes Reef	300	30, 31	0.0070	0.0070	0.0070	0.0070	14
Striped dolphin	Hawaii	20,650	17, 33	0.0084	0.0084	0.0084	0.0084	33
Hawaiian monk seal	Hawaii	1,209	17	0.0001	0.0001	0.0001	0.0001	
Mission Area #11: Hawaii South								
Blue whale	CNP	81	17, 33	0.0001	0.0001		0.0001	33
Bryde's whale	Hawaii	798	17, 33	0.0003	0.0003	0.0003	0.0003	33
Common minke whale	Hawaii	25,049	3	0.0002	0.0002		0.0002	10, 11
Fin whale	Hawaii	58	17, 33	0.0001	0.0001		0.0001	33

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Humpback whale	CNP	10,103	20	0.0009	0.0009		0.0009	19
Sei whale	Hawaii	178	17, 33	0.0001	0.0001		0.0001	33
Blainville's beaked whale	Hawaii	2,338	14	0.0010	0.0010	0.0010	0.0010	33
Common bottlenose dolphin	Hawaii Pelagic	5,950	17, 33	0.0025	0.0025	0.0025	0.0025	33
	Oahu	743	17, 25	0.0003	0.0003	0.0003	0.0003	33, 34
	4-Islands	191	17, 25	0.0001	0.0001	0.0001	0.0001	33, 34
	Hawaii Island	128	17, 25	0.0001	0.0001	0.0001	0.0001	33, 34
	Kauai/Niihau	184	17, 25	0.0001	0.0001	0.0001	0.0001	33, 34
Cuvier's beaked whale	Hawaii	1,941	17, 33	0.0008	0.0008	0.0008	0.0008	33
Deraniyagala beaked whale	NP	22,799	11, 38	0.0009	0.0009	0.0009	0.0009	10, 11
Dwarf sperm whale	Hawaii	17,519	17	0.0071	0.0071	0.0071	0.0071	14
False killer whale	Hawaii Pelagic	1,503	17, 26	0.0006	0.0006	0.0006	0.0006	26
	Main Hawaiian Island Insular	151	17, 27	0.0012	0.0012	0.0012	0.0012	27
Fraser's dolphin	Hawaii	16,992	17, 33	0.0069	0.0069	0.0069	0.0069	33
Killer whale	Hawaii	101	17, 33	0.0001	0.0001	0.0001	0.0001	33
Longman's beaked whale	Hawaii	4,571	17, 33	0.0019	0.0019	0.0019	0.0019	33
Melon-headed whale	Hawaiian Islands	5,794	17, 35, 36	0.0012	0.0012	0.0012	0.0012	33
	Kohala Resident	447	17, 35, 36	0.0373	0.0373	0.0373	0.0373	17
Pantropical spotted dolphin	Hawaii Pelagic	15,917	17, 33	0.0067	0.0067	0.0067	0.0067	33
	Hawaii Island	220	37	0.0067	0.0067	0.0067	0.0067	33
	Oahu	220	37	0.0067	0.0067	0.0067	0.0067	33
	4-Islands	220	37	0.0067	0.0067	0.0067	0.0067	33

Table 7. Species, stocks, abundances, and densities of the marine mammals potentially affected in each of the proposed SURTASS LFA mission areas in the central and western North Pacific Ocean (references at end of table).

Marine Mammal Species Name	Stock Name[8]	Stock / Abundance (animals)	Stock / Abundance Reference(s)	Density (animals per km^2)[9]				Density reference(s)
				Winter	Spring	Summer	Fall	
Pygmy killer whale	Hawaii	3,433	17, 33	0.0014	0.0014	0.0014	0.0014	33
Pygmy sperm whale	Hawaii	7,138	14, 17	0.0029	0.0029	0.0029	0.0029	14
Risso's dolphin	Hawaii	7,256	17, 33	0.0030	0.0030	0.0030	0.0030	33
Rough-toothed dolphin	Hawaii	6,288	17, 33	0.0026	0.0026	0.0026	0.0026	33
Short-finned pilot whale	Hawaii	12,422	17, 33	0.0051	0.0051	0.0051	0.0051	33
Sperm whale	Hawaii	3,354	17, 33	0.0014	0.0014	0.0014	0.0014	33
Spinner dolphin	Hawaii Pelagic	3,351	14	0.0008	0.0008	0.0008	0.0008	14
	Oahu/4-Islands	355	17	0.0070	0.0070	0.0070	0.0070	14
	Hawaii Island	631	17	0.0070	0.0070	0.0070	0.0070	14
	Kauai/Niihau	601	17	0.0070	0.0070	0.0070	0.0070	14
Striped dolphin	Hawaii	20650	17, 33	0.0084	0.0084	0.0084	0.0084	33
Hawaiian monk seal	Hawaii	1,209	17	0.0001	0.0001	0.0001	0.0001	

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43. IWC, 1996 in Reilly et al., 2008

Requirement 4: *Description of the status, distribution, and seasonal distribution of the affected species or stocks of marine mammals likely to be affected by such activities.*

4 STATUS AND DISTRIBUTION OF POTENTIALLY AFFECTED MARINE MAMMAL SPECIES AND STOCKS

In the 2011, 2012, 2013, and 2014 applications for Rulemaking and annual LOAs, the Navy included summaries of the 38 marine mammal species and stocks most likely to be harassed incidental to SURTASS LFA sonar operations (DoN, 2011, 2012a, 2013, and 2014a). The majority of the information on the 38 marine mammal species presented in those documents has not changed, and this 2015 to 2016 LOAs application incorporates by reference the information on status including seasonality and stock definition, distribution, diving, swim speeds, hearing, and vocalizations of those potentially affected species or stocks of marine mammals. Insular stocks of two species potentially occurring in Hawaiian waters have recently been delineated by NMFS (Carretta et al., 2014); this updated information on the melon-headed whale and pantropical spotted dolphin is presented herein. Additionally, summary information on a new, or more accurately, resurrected, species of beaked whale, the Deraniyagala beaked whale (*Mesoplodon hotaula*), which occurs in the Indo-Pacific Ocean, is provided below.

4.1 MELON-HEADED WHALE (*PEPONOCEPHALA ELECTRA*)

Melon-headed whales are classified as a lower risk (least concern) species by the IUCN. This species is not listed as threatened or endangered under the ESA nor is it categorized as depleted under the MMPA. The global population of melon-headed whales is unknown. The population of the Northern Mariana Islands stock of melon-headed whales is estimated as 2,450 individuals (Fulling et al., 2011), while the Western North Pacific stock of melon-headed whales is estimated as 36,770 individuals (based on extrapolation from Ferguson and Barlow, 2001 and 2003 data). NMFS recently recognized two demographically discrete stocks of melon-headed whales in Hawaiian waters: the Hawaiian Islands and Kohala Resident stocks, which together form the Hawaiian Islands Stock Complex of melon-headed whales (Carretta et al., 2014). The larger Hawaiian Islands stock includes melon-headed whales that occur throughout the waters of the U.S. exclusive economic zone (EEZ) of Hawaii, including the area in which the Kohala Resident stock occurs and the adjacent international waters, while the small Kohala Resident stock includes those melon-headed whales found in nearshore waters off the Kohala Peninsula (northwestern Hawaii Island) and the west coast of Hawaii Island (Carretta et al., 2014). Aschettino (2010) used the photo-identification catalog of melon-headed whales in Hawaiian waters to produce mark-recapture abundance estimates of 5,794 and 447 melon-headed whales for the Hawaiian Islands and Kohala Resident stocks, respectively.

The melon-headed whale occurs in pelagic tropical and subtropical waters of the Pacific, Atlantic, and Indian Ocean, but its likely principal distribution is in warm equatorial waters (Perryman et al., 1994; Jefferson and Barros, 1997). Although typically found in oceanic waters, the melon-headed whale does occur in nearshore areas where deep water approaches the coast, such as Hawaii Island waters. In addition to the Hawaiian Islands, the melon-headed whale also occurs in archipelago waters of the western tropical Pacific in areas such as the in the Marquesas and Philippine Islands. Melon-headed whales form large groups, ranging from 150-500 animals (Shallenberger 1981; Wade and Gerrodette 1993). Mass strandings of this species are common, with a mass stranding of 150 to 200 melon-headed whales having occurred in Hanalei Bay, Kauai, Hawaii in 2004; Navy sonar activities associated with the Rim of the Pacific Exercises (RIMPAC) at nearby Pacific Missile Range Facility were judged to be a contributing factor in the stranding (Southall et al., 2006).

Melon-headed whales are deep divers that feed on fish and mesopelagic squid, which occur at depths to 1,500 m (4,920 ft) (Jefferson and Barros, 1997). General swim speeds for this species are not available. No data are available on dive depths and dive times of melon-headed whales.

There is no direct measurement of hearing sensitivity for melon-headed whales (Ketten, 2000; Thewissen, 2002). However, given their vocalization range, it is likely that they hear well in the ranges from 4 to 40 kHz. Melon-headed whales produce sounds between 8 and 40 kHz. Individual click bursts have dominant frequencies between 20 and 40 kHz, with dominant frequencies of whistles ranging from 1 to 23.5 kHz, with both upsweeps and downsweeps in frequency modulation (Frankel and Yin, 2010). Watkins et al. (1997) found that the calls of melon-headed whales were relatively low in amplitude, 155 dB re 1 µPa at 1 m for whistles and 165 dB re 1 µPa at 1 m for click burst sounds. In general, the number and amplitude of clicks increased with the activity level of the whales.

4.2 PANTROPICAL SPOTTED DOLPHIN (*STENELLA ATTENUATA*)

The pantropical spotted dolphin is one of the most abundant dolphin species in the world. This species is listed as a least concern (lower risk) species by the IUCN. The pantropical dolphin is not listed as threatened or endangered under the ESA nor is it categorized as depleted under the MMPA. The global population of pantropical spotted dolphins is unknown, but researchers have totaled the available abundance estimates to arrive at a minimum global population of at least 2.5 million pantropical spotted dolphins (Hammond et al., 2012). An estimated 438,064 pantropical spotted dolphins comprise the Western North Pacific stock of pantropical spotted dolphins (Miyashita, 1993). Dolar et al. (2006) estimated about 14,930 individuals for the eastern Sulu Sea and 640 individuals for the Tañon Strait, Philippines.

In the central North Pacific Ocean, NMFS recognizes four stocks of pantropical spotted dolphins in Hawaiian waters, three insular stocks and one pelagic stock: Oahu, 4-Islands, Hawaii Island, and Hawaii Pelagic Stocks, respectively, which together comprise the Hawaiian Islands Stock Complex. The Oahu stock includes the pantropical spotted dolphins that occur within 20 km (10.8 nmi) of the Oahu shore; the 4-Islands stock includes pantropical spotted dolphins within 20 km (10.8 nmi) of the shores of Maui, Molokai, Lanai, and Kahoolawe, collectively; the Hawaii Island stock includes those pantropical spotted dolphins within 65 km (35 nmi) from the shore of Hawaii Island; and the Hawaiian Pelagic stock includes all pantropical spotted dolphins beyond the insular stock areas to the Hawaiian EEZ and adjacent international waters (Carretta et al., 2014). Due to lack of data from international waters on pelagic pantropical spotted dolphins, NMFS evaluates the status of the Hawaiian Pelagic stock based on information and data from the U.S. EEZ waters surrounding Hawaii. The Hawaii Pelagic stock is estimated to include 15,917 pantropical spotted dolphins, based on data collected during the 2010 line-transect survey of Hawaiian EEZ waters (Bradford et al., 2013). Courbis et al. (2014) estimated the effective population size of the Hawaii Island stock of pantropical spotted dolphins as 220 individuals based on genetic (microsatellite) analysis. Although NMFS estimated no stock abundances for the Oahu and 4-Islands stocks, abundances are needed for the calculation of impacts to the Oahu and 4-Islands stocks. Given the lack of data for these stocks, the Navy estimated the populations of both stocks as 220 individuals, the same estimation used for the Hawaii Island stock.

Pantropical spotted dolphins occur throughout tropical and sub-tropical waters from roughly 40°N to 40°S in the Atlantic, Pacific, and Indian Oceans and enclosed seas, occurring more abundantly in the lower-latitude portions of their overall range (Perrin, 2009). These dolphins typically are oceanic but are found close to shore in areas where deep water approaches the coast, such as in Taiwan, Hawaii, and the western coast of Central America (Jefferson et al., 2008).

Pantropical spotted dolphins have been recorded swimming at speeds of 4 to 19 kilometers per hour (kph) (2.2 to 10.3 knots [kt]), with bursts up to 22 kph (12 kt) (Perrin, 2009). Pantropical spotted dolphins dive to at least 170 m (557.7 ft), with most of their dives to between 50 and 100 m (164 and 328 ft) for 2 to 4 minutes; most foraging dives occur at night (Stewart, 2009). Pantropical spotted dolphins off Hawaii

have been recorded to dive to a maximum water depth of 122 m (400 ft) during the day and 213 m (700 ft) during the night (Baird et al., 2001). The average dive duration for the pantropical spotted dolphins is 1.95 minutes for depths as deep as 100 m (Scott et al., 1993).

Very little is known about hearing in the pantropical spotted dolphin. Greenhow (2013) used audio evoked potential and behavioral methods to collect audiograms of a pantropical spotted dolphin and reported that its greatest hearing sensitivity was at 10 kHz with severe high frequency hearing loss with a cutoff frequency between 14 and 20 kHz. Pantropical spotted dolphins produce whistles and clicks. Richardson et al. (1995) estimated that the whistles of pantropical spotted dolphins range from 3.1 to 21.4 kHz, while Oswald et al. (2003) measured their whistles and reported a range of frequencies from 8.2 to 18.7 kHz. These dolphins also produce click sounds that are typically bimodal in frequency with peaks at 40 to 60 kHz and 120 to 140 kHz with SLs up to 220 dB re 1 μPa (Schotten et al., 2004).

4.3 DERANIYAGALA BEAKED WHALE (*MESOPLODON HOTAULA*)

The Deraniyagala beaked whale, *Mesoplodon hotaula*, was originally described in 1963 by P.E.P. Deraniyagala as a new beaked whale species based on a live stranded animal in Sri Lanka. Since Deraniyagala poorly described the differentiating features of the specimen, two years later, researchers decided the specimen was not unique and *M. hotaula* was made synonymous with *M. ginkgodens*, the ginkgo-toothed beaked whale (Brownell et al., 2013). It wasn't until 2007 when researchers conducting DNA analysis of several beaked whale specimens discovered that some were genetically distinct from any known beaked whale species (Dalebout et al., 2007). Molecular analysis of a specimen from Kiribati Island and two specimens from Palmyra Atoll suggested that these specimens were from an undescribed beaked whale species. At nearly the same time, repeated sightings and acoustic recordings of an unidentified beaked whale species were made in the waters of Palmyra Atoll over a two year period (Baumann-Pickering, 2009). Eventually, genetic and molecular analysis of the original, archived Sri Lankan type specimen of the Deraniyagala beaked whale proved to be the same as specimens from the Republic of Kiribati, Palmyra Atoll, the Maldives, and the Seychelles Islands; Dalebout et al. (2014) published the results of their genetic and molecular analyses, demonstrating conclusively that Deraniyagala's original description had been that of a distinct beaked whale species and resurrected the scientific name, *M. hotaula,* for the Deraniyagala beaked whale.

No abundance or stock information is available for the Deraniyagala beaked whale. Little is known about this beaked whale species. It is known principally from strandings in the Indian Ocean (Malacca, Malaysia; Sri Lanka; Maldives; and the Seychelles) and the central and western Pacific Ocean (Palmyra Atoll, Northern Line Islands; and Gilbert Islands, Kiribati Republic), with suspected sightings and acoustic recordings in the waters of Palmyra Atoll (Baumann-Pickering, 2009; Baumann-Pickering et al., 2010; Brownell et al., 2013). Brownell et al. (2013) reported that acoustic recordings from the waters of Kingman Reef are also thought to be those of the Deraniyagala beaked whale. From the known records of the Deraniyagala beaked whale, its distribution is considered to encompass the equatorial Indo-Pacific (Dalebout et al., 2014). From evidence at Kingman Reef and Palmyra Atoll, Brownell et al. (2013) speculated that the Deraniyagala beaked whales in these waters may represent insular stocks, such as Oleson et al. (2013) suggested for Cuvier's and Blainville's beaked whales in Hawaiian waters. Additionally, Baker et al. (2013) suggest from their investigations of beaked whales in the Republic of Kiribati that the Gilbert Islands, like Palmyra Atoll and likely Kingman Reef, are likely hotspots for the Deraniyagala beaked whale.

Nothing is known about the hearing of the Deraniyagala beaked whale. Vocalizations have been recorded at Palmyra Atoll and Kingman Reef that have been attributed to the Deraniyagala beaked whale. Baumann-Pickering et al. (2010) described upsweep frequency modulated (FM) pulses similar to those produced by beaked whales but with spectral and temporal characteristics different from any other recorded beaked whale species. The recorded signals consisted of echolocation pulses and buzz sequences with regularly spaced FM pulses with a switch to broadband clicks for the buzz, which

probably indicated prey capture; the pulses had a peak frequency of 44 kHz, a 10 dB bandwidth of 26 kHz, and a pulse duration of 355 µsec with the inter-pulse interval of 225 msec while the buzzes had short inter-pulse intervals <20 msec, peak frequency of 37 kHz, and click duration of 155 µsec (Baumann-Pickering et al., 2010).

Requirement 5: *Type of incidental take authorization that is being requested (i.e., takes by harassment only; takes by harassment, injury, and/or death) and the method of incidental taking.*

5 TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

Pursuant to MMPA Section 101(a)(5)(D) and the MMPA Final Rule (NOAA, 2012) for SURTASS LFA sonar operations, the Navy is requesting renewal of LOAs authorizing the unintentional taking by Levels A and B of marine mammals incidental to Navy routine training, testing, and military operation of SURTASS LFA sonar onboard the USNS VICTORIOUS (T-AGOS 19), USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23) for the 12-month period commencing 15 August 2015. This renewal request document has been prepared in accordance with applicable regulations and the MMPA, as amended by the National Defense Authorization Act (NDAA)[11] for Fiscal Year 2004.

The employment of SURTASS LFA sonar onboard four vessels has the potential for incidental harassment of marine mammals due to the underwater noise generated during at-sea training, testing, and military operations. As a result, the Navy is requesting annual LOAs under the MMPA for each of the four SURTASS LFA sonar vessels to take marine mammals by Level A (no lethal taking) and Level B harassment incidental to the employment of SURTASS LFA sonar systems. No lethal taking or serious injury is likely due to the suite of mitigation monitoring measures employed during use of LFA sonar onboard all vessels, the sonar's operational parameters, and the geographic restrictions governing the operation of SURTASS LFA sonar. Throughout the more than 12 years of the Navy's use of SURTASS LFA sonar, no injury or mortality has ever been known or shown to have occurred as a result of LFA sonar transmissions.

11 The NDAA modified the MMPA by removing the ''small numbers'' and ''specified geographical region'' limitations and amended the definition of ''harassment'' as it applies to a ''military readiness activity.''

Requirement 6: *Age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in paragraph (a)(5) of this section, and the number of times such takings by each type of taking are likely to occur.*

6 INCIDENTAL TAKES

For SURTASS LFA sonar operation, potential impacts to marine mammals should be assessed in the context of the basic operational characteristics of the systems:

- A maximum of four operating sonar systems onboard four SURTASS LFA vessels will be deployed in the North Pacific Ocean.
- USNS VICTORIOUS (T-AGOS 19), USNS ABLE (T-AGOS 20), USNS EFFECTIVE (T-AGOS 21), and USNS IMPECCABLE (T-AGOS 23) are U.S. Coast Guard-certified for operations. In addition, these vessels will operate in accordance with all applicable Federal and U.S. Navy regulations and procedures related to environmental concerns. SURTASS LFA sonar vessel movements are not unusual or extraordinary and are part of routine operations of seagoing vessels. Therefore, there should be no unregulated environmental impacts from the operation of the SURTASS LFA sonar vessels.
- At-sea SURTASS LFA sonar missions would be temporary in nature. Of an estimated maximum 294 underway days per year per vessel, the SURTASS LFA sonar would be operated in the active mode a maximum of 240 days. During these 240 days, active transmissions would occur for a maximum of 432 cumulative hours per year per vessel. While the 432 hr are the maximum numbers of hours used in analysis of impact potential and requested for authorization, the actual number of total hours SURTASS LFA sonar has been transmitted historically for all T-AGOS vessels is much lower than this number. For instance, over the 12-year operation period from 2002 through 2014, LFA sonar was transmitted for 969 hr for all operational vessels or an average of 81 hr total per year or about 20 hr per year per vessel.
- Average duty cycle (ratio of the time the sonar is “on” or actively transmitting to total time) of the SURTASS LFA sonar active transmission mode is less than 20%. The typical duty cycle, based on historical LFA operational parameters since 2003, is nominally 7.5% to 10%. That is, only 7.5 to 20% of the time the LFA acoustic sources could be transmitting, while 80% to 92.5% of the time the LFA sources would be off/not transmitting or adding sound into the marine environment. On an annual basis, each SURTASS LFA vessel is limited to transmitting no greater than 4.9% of the time (or 432 hr out of 8,760 possible hr).

6.1 POTENTIAL IMPACTS ON MARINE MAMMALS

SURTASS LFA sonar operations could result in four types of potential impacts to marine mammals including:

- **Non-auditory impacts**: Non-auditory impacts include direct acoustic impact on tissue, indirect acoustic impact on tissue surrounding a structure, and acoustically mediated bubble growth within tissues from supersaturated dissolved nitrogen gas. These types of impacts have the potential for resonance of the lungs/organs, tissue damage, and mortality.
- **Auditory impacts**: Auditory impacts include permanent threshold shift (PTS), which is a severe condition that occurs when sound intensity is very high or of such long duration that the result is a permanent hearing loss for the listener. PTS constitutes Level A “harassment” under the MMPA as it is considered auditory injury caused by irreparable damage (Southall et al., 2007). Temporary

threshold shift (TTS) is a lesser impact to hearing caused by underwater sounds of sufficient loudness to cause a transient condition in which an animal's hearing is impaired for a period of time. With TTS, hearing is not permanently or irrevocably damaged, so TTS is not considered an injury (Richardson et al., 1995; Southall et al., 2007), although during a period of TTS, animals may be at some disadvantage in terms of detecting predators or prey. Albeit not injurious, for the purposes of the SURTASS LFA sonar analyses presented herein, TTS is considered a component of Level A harassment, in that all marine mammals exposed to underwater sound ≥180 dB SPL RL are evaluated as if they are injured (Level A harassment under the MMPA). Even though actual injury would not occur unless animals were exposed to sound at a level greater than this value (Southall et al., 2007), the analysis in this document continues to define LFA's injury level as ≥180 dB SPL RL. This value is conservative and is used to maintain consistency in the analytical methodologies utilized in all previous environmental compliance documentation for SURTASS LFA sonar, including applications for LOAs under the MMPA and in consultations under the ESA.

- **Behavioral change**: Behavioral responses to intense sounds in a marine animal's environment vary from subtle changes in surfacing and breathing patterns to cessation of vocalization or even active avoidance or escape from regions of high sound levels (Wartzok et al., 2004). For military readiness activities such as the employment of SURTASS LFA sonar, Level B "harassment" under the MMPA is defined as any act that disturbs or is likely to disturb a marine mammal by causing disruption of natural behavioral patterns to a point where the patterns are abandoned or significantly altered.
- **Masking**: The presence of intense sounds in the environment can potentially interfere with an animal's ability to hear relevant sounds. This effect, known as "auditory masking", could interfere with the animal's ability to detect biologically-relevant sounds, such as those produced by predators, prey, or reproductively active mates. During auditory masking, an animal may, thus, not be able to escape predacious attack, locate food, or find a reproductive partner.

6.1.1 NON-AUDITORY INJURY

Nowacek et al. (2007) and Southall et al. (2007) reviewed potential types of non-auditory injury to marine mammals from active sonar transmissions. These types of injuries include direct acoustic impact on tissue, indirect acoustic impact on tissue surrounding a structure, and acoustically mediated bubble growth within tissues from supersaturated dissolved nitrogen gas. The detailed descriptions and information on these types of non-auditory impacts provided in previous documentation for SURTASS LFA sonar (DoN, 2012; DoN, 2014a) and related conclusions are incorporated by reference herein except as addressed below.

6.1.1.1 Gas Bubble Formation and Decompression Sickness

Some researchers have concluded strandings of some beaked whales was the result of these species' strong avoidance and flight responses that lead to altered diving behavior upon hearing mid-frequency active (MFA) sonars because the signals sound similar to a predator, the killer whale (Cox et al., 2006; Southall et al., 2007; Zimmer and Tyack, 2007; Baird et al., 2008; Hooker et al., 2009). The diving behavior of stranded beaked whales is thought to have involved rapid ascent and surfacing after exposure to some types of sonar, which resulted in a form of decompression sickness manifested by the formation of gas bubbles in body tissue. Debate continues among researchers regarding the potential for stranded marine mammals to have suffered from decompression sickness and what findings of gas bubble formation indicates.

In humans, experts have noted that the "presence of gas in any organ or vessel after a scuba diving death is not conclusive evidence of decompression sickness or air embolism" (Caruso, 2014 as cited in Ketten, 2014). It is the presence of gas emboli rather than broadly distributed gas bubbles in tissue that is one of the criteria for diagnosing decompression sickness, as well as suite of other symptoms including consistent trauma in the lungs, ears, and brain as well as high oxygen content in arteries and a part of the

heart (Piantadosi and Thalman, 2004; Hooker et al., 2012; Caruso, 2014 as cited in Ketten, 2014). Ketten (2014) noted that no stranded marine mammals have been documented with the critical symptoms of decompression sickness, so that it is not possible to accurately state that the presence of gas bubbles in stranded marine mammals is representative of decompression sickness or physiological alterations caused by responsive diving behavior due to exposure to sonar or other underwater sounds.

6.1.2 AUDITORY EFFECTS OF SOUND ON MARINE MAMMALS

Marine mammals exposed to natural or man-made sound may experience physical and psychological auditory effects, ranging the spectrum of severity (Southall et al., 2007). When exposed to elevated noise levels, marine mammals may experience PTS, TTS, behavioral disturbance, or acoustic masking (Nowacek et al., 2007; Southall et al., 2007; Clark et al., 2009). Underwater sound has also been implicated in strandings of marine mammals. Details and information on these types of auditory impacts and the associated conclusions provided in previous documentation for SURTASS LFA sonar (DoN, 2012; DoN, 2014a) are incorporated by reference herein except as addressed below.

6.1.2.1 Temporary Loss of Hearing

Exposure to sound of high intensity or long duration may cause TTS, a condition considered temporary and resulting in a reversible loss of hearing that may last for minutes to days. The duration of TTS depends on a variety of factors including intensity and duration of the stimulus. Southall et al. (2007) considered that the temporary elevation of a hearing threshold by 6 dB was a sufficient definition for TTS onset. In the SURTASS LFA Sonar MMPA Final Rules (NOAA, 2002, 2007, and 2012), NMFS did not consider TTS to be an injury. Recent studies have provided additional information on TTS.

- In their synthesis of recent TTS experiments and information, Tougaard et al. (2014) report that although TTS by definition is considered a temporary effect, recent experiments with terrestrial mammals suggest that an animal's auditory system may not recover fully from severe TTS and that permanent degeneration of the cochlear nerve system may result from recoverable TTS episodes and possibly repeated severe TTS can cause accumulated damage that could lead to a neurologically-based PTS. In other highlights of this synthesis, the authors reported on the potential for earlier TTS studies to have overestimated the levels for onset of TTS due to high levels of ambient noise in the experimental setting as well as the use of older animals without optimal hearing (Tougaard et al., 2014). While other recent research has shown that harbor and finless porpoises are more sensitive to sound than expected from extrapolations of research results on bottlenose dolphins (Schlundt et al., 2000), Tougaard et al. (2014) caution that it is not known whether these results were due to differences in experimental methodology, masking levels, or the age and health of the subject animals, but the reliability of extrapolating TTS thresholds between species relies on careful examination of such factors. Last, results from TTS experiments and field studies of behavioral reactions to noise suggest that response thresholds and TTS critically depend on stimulus frequency.
- TTS studies on harbor porpoises have indicated a higher susceptibility to noise than other odontocetes and more sensitivity to sound than expected from extrapolations based on results from bottlenose dolphins and belugas (Lucke et al., 2009; Kastelein et al., 2012; Kastelein et al., 2014). Kastelein et al. (2014) induced up to about 30 dB re 1 μPa^2-sec (SEL) of TTS by exposure of an 8-year old harbor porpoise to frequency modulated sweeps between 1 and 2 kHz (without harmonics) in various combinations of duration (1.9 to 240 minutes), intensity (144 to 179 dB re 1 µPa SPL), and duty cycle (5 to 100%), with SEL thresholds for TTS occurring between 188 and 196 dB re 1 μPa^2-sec. Additionally, Kastelein et al. (2014) found that the inter-pulse interval of the experimental sound was an important parameter in determining the magnitude of noise-induced TTS.

  In a separate study, Kastelein et al. (2014a) determined the effects on the hearing of a 7-year old harbor porpoise after exposure to a 6.5 kHz continuous signal for a duration of 60 minutes at received SPLs ranging from 118 to 154 dB re 1 µPa. The authors determined that the hearing frequency at

which the maximum TTS occurred for the harbor porpoise was dependent on the noise level (SPL); the higher the SPL, the higher the TTS induced at frequencies higher than the exposure frequency (below 148 dB re 1 µPa, the maximum TTS was at 6.5 kHz, whereas above 148 dB re 1 µPa, the maximum TTS was at 9.2 kHz) (Kastelein et al., 2014a). Last, Kastelein et al. (2014a) noted that recovery from TTS in the harbor porpoise, after small reductions in hearing sensitivity (threshold shifts <15 dB), is relatively quick (within 60 minutes) and that such a short-term reduction in hearing likely has little impact but repeated hearing reductions over hours or days may become ecologically significant for the harbor porpoise.

These new data and information do not alter the conclusion outlined in previous documentation for SURTASS LFA sonar (DoN, 2001, 2007, 2012, 2015) that the likelihood that SURTASS LFA sonar may cause TTS at a SPL of 180 dB RL in marine mammals is negligible and very few animals are likely at all to be affected by TTS. Additionally, the implementation of the mitigation monitoring that is a condition of SURTASS LFA sonar use would allow little potential for a marine mammal to incur TTS (NOAA, 2007 and 2012).

6.1.2.2 Behavioral Change

The primary potential impact on marine mammals from exposure to SURTASS LFA sonar is change in a biologically significant behavior. The National Research Council (NRC, 2005) noted that an action or activity becomes biologically significant to an individual animal when it affects the ability of the animal to grow, survive, and reproduce, wherein an effect on individuals can lead to population-level consequences and affect the viability of the species. Tougaard et al. (2014) recently noted that while scientists generally agree about the overall mechanisms leading from changes in behavior to population-level effects, there is an increasing realization that overall it is impossible to establish those connections for real world systems solely from studies of behavior.

Details and information on these types of auditory impacts and the associated conclusions provided in previous documentation for SURTASS LFA sonar (DoN, 2012; DoN, 2014a) are incorporated by reference herein except as addressed below. The following provides recent research details on the impacts of underwater sound on marine mammal behavior, principally from sonar sources with higher frequency ranges than that of SURTASS LFA sonar.

- The multi-year southern California behavioral response study (SOCAL BRS) has been conducted to provide direct, controlled measurements of marine mammal's behavioral reactions to underwater sound, including military sonar systems. During 2013, the SOCAL BRS incorporated operational military MFA (53C) sonar as well as surrogate MFA sonar sources during controlled exposure experiments (CEEs). Overall, the SOCAL BRS results indicate that:

  1. beaked whales show consistent and strong avoidance responses to not only low sonar signal RLs but generally to novel sounds, with context likely moderating behavioral responses (De Ruiter et al., 2013);
  2. blue whales respond to simulated military MFA sonar with varying behavioral responses including no response, stopping foraging, increased swim speeds, and movement away from the sound source, with complex contextual and acoustic factors determining whether blue whales responded to mid-frequency sonar (Goldbogen et al., 2013);
  3. avoidance behaviors in some blue whales occurred at relatively low sound levels, suggesting an avoidance response rather physiological trauma (inner or middle ear injury), followed by rapid recovery (Ketten, 2014; Southall et al., 2014);
  4. preliminary results from the 2013 experiments indicate that, even in conditions where RLs were comparable, limited or no clear behavioral responses occurred to military MFA sonar positioned at relatively greater ranges from tagged animals than for experimental scaled sources CEEs

(Southall et al., 2014a). This suggests that physical range of a source from animals, particularly beaked whales, may be a contributing factor to whether behavioral responses occur.

- A recent study focused on the potential impacts of MFA sonar on odontocetes that occur in the waters of the Navy's Pacific Missile Range Facility of Kauai, Hawaii (Baird et al., 2014). Four odontocete species (common bottlenose dolphins, rough-toothed dolphins, short-finned pilot whales, and false killer whales) were tagged prior to scheduled MFA sonar use. Of the tagged animals, data were assessed only for one bottlenose dolphin, one pilot whale, and two rough-toothed dolphins, which all retained satellite tags and recorded data coincident with MFA sonar transmissions. The bottlenose dolphin remained in the same waters before and after sonar transmissions, with no movement away from the ensonified area, despite received levels estimated at 149 to 168 dB re 1 µPa rms (Baird et al., 2014). The tagged short-finned pilot whale actually moved towards the sonar sound source on the third day of transmissions, with increasingly higher RLs as it more closely approached the sonar source, with RLs estimated at the closest proximity to the source as about 130 to 154 dB re 1 µPa rms (Baird et al, 2014). Data for the rough-toothed dolphins were more limited, but indicated that the animals did not move away from the waters more greatly ensonified (Baird et al., 2014). Given the current behavioral response function for MFA sonar, a high probability of a significant behavioral reaction would have been predicted at the estimated RLs (Finneran and Jenkins, 2012), but no such responses were observed.

- Risch et al. (2012) documented reduction in humpback whale vocalization concurrent with transmissions of the low-frequency Ocean Acoustic Waveguide Remote Sensing (OAWRS) system, at distances of 200 km (108 nmi) from the source. The OAWRS source appears to have affected more whales, by producing a greater response with a lower sound source level, than reported from the Phase III of the Low Frequency Sound Scientific Research Program LFS SRP, even though OAWRS had a lower RL (88 to 110 dB re 1 µPa) than the LFA signal. This strongly suggests that other acoustic characteristics may be responsible for the difference in observed behavioral responses. Risch et al. (2012) stated that due to differences in behavioral context, location, and proximity to the source, it is difficult to compare their findings directly to the Phase III of the LFS SRP. These observations are consistent with the importance of considering context in predicting and observing the level and type of behavioral response to anthropogenic signals (Ellison et al., 2012).

  In 2014, Gong et al. (2014) reported on their reassessment of the effects from exposure to the OAWRS source on humpback whales and determined that the constant occurrence rate of humpback whale songs indicated that the LF OAWRS source transmissions had no effect on humpback whale song, contrary to what Risch et al. (2012) reported. Gong et al. (2014) attributed the variation in song occurrence Risch et al. (2012) described as due to natural causes other than sonar since the change in song occurrence began before the OAWRS began transmitting. Risch et al. (2014) responded to the Gong et al. (2014) assessment by stating that both their original and the Gong et al. (2014) findings may be correct, highlighting the multifactorial and context-dependent nature of behavioral responses. Risch et al. (2014) pointed out that the principal point of their original paper had been the importance of behavioral context, ambient noise, and the novelty of received sounds when assessing anthropogenic impacts on marine mammals.

- Stimpert et al. (2014) reported that upon controlled exposure of a tagged Baird's beaked whale to simulated MFA sonar (3.5 to 4 kHz), the whale changed its foraging behavior, increasing its swimming speed and body movements, changing its vocal behavior, and displaying uncommon dive behavior. During exposure to the simulated MFA source, the Baird's beaked whale moved away from the source signals at more than double the swim speed exhibited before the sonar source began transmitting; changed vertical direction, duration, and depths of its dives; and nearly ceased echolocating (Stimpert et al., 2014). The later response was considered indicative that foraging had ceased, and like other researchers, Stimpert et al. (2014) suggested that the change in behavior from

foraging to non-foraging deep dives may be a type of response to disturbance for beaked whales (Minamikawa et al., 2007; Kvadsheim et al., 2014).

- Antunes et al. (2014) conducted exposure-control approach experiments using simulated European LF (1 to 2 kHz) and MF (6 to 7 kHz) naval sonar to determine if transmission frequency had an effect on the behavioral response threshold for long-finned pilot whales. The experiment used a new method to quantify the dose threshold at which free-ranging long-finned pilot whales began to avoid an approaching vessel transmitting sonar, consisting of a statistical analysis of the movements of the whales to indicate changes in behavior and a Bayesian dose-response model using the observed response thresholds (Antunes et al., 2014). Pilot whale movements during the duration of sonar transmissions changed to indicate an avoidance response, with a shorter response duration than reported for other marine mammal species, including Cuvier's and Blainville's beaked whales and killer whales. The observed response thresholds occurred at 50% higher levels (~ 170 dB re 1µPa or 173 dB SEL_{cum}) than described for other cetacean species (Antunes et al., 2014).
- Miller et al. (2014) conducted eight controlled exposure experiments on killer whale groups using the same simulated European LF (1 to 2 kHz) and MF (6 to 7 kHz) naval sonar used in the Atunes et al. (2014) experiments. The SL and distance to the source were increased during each exposure to reveal response thresholds. Changes in movements (swim speed and direction) during exposure to the transmitted sonar signals were evaluated as avoidance responses and animals began to avoid the sonar at RLs SPL (142 +/- 15 dB re 1 µPa) (Miller et al., 2014), which is below the threshold assumed by the U.S. Navy (Finneran and Jenkins, 2012). High levels of between and within individual variability were identified, and the context of exposure was recognized as an important factor, particularly since the sound source changed course to continue moving towards the animals, even after they exhibited avoidance responses.

6.1.2.3 Marine Mammal Strandings

Ketten (2014) recently examined the linkage between mass strandings of marine mammals and exposure to military sonar and other high intensity acoustic sources. Exposure to MFA military sonar transmissions has been implicated as a causative factor in several marine mammal strandings in the Bahamas, Hawaii, the Canary Islands, Madeira, and Greece (Frantzis, 1998; Cox et al., 2006; Southall et al., 2006; D'Amico et al., 2009; Filadelfo et al., 2009; Fernández et al., 2012). Ketten (2014) noted that in the absence of other causative factors, exposure to naval sonar transmissions was assumed to be the probable cause of these strandings, although a documented mass stranding of the same species, melon-headed whales, occurred at the same time as the Hawaii stranding more than 5,000 miles west of Hawaii, and absent of any nearby acoustic events. At least for the Hawaiian stranding of melon-headed whales in 2004, Ketten (2014) suggests that consideration should be given to other causative factors such an underlying, non-acoustic trigger, such as a prey movement or lunar cycles.

As has been reported previously (DoN, 2001, 2007, 2012, 2015), the employment of SURTASS LFA sonar is not expected to result in sonar-induced strandings of marine mammals. For the annual 2013 to 2014 and first two quarters of the 2014 to 2015 LOA effective periods, all available media and known stranding databases were monitored for strandings in the western and central North Pacific Ocean. More information about the details of the marine mammal strandings that occurred during this period can be found in Chapter 13 of this document. During the period from August 2013 to August 2014, 11 and 5 marine mammal stranding events occurred in the western and central North Pacific Ocean, respectively, in or adjacent to mission areas for SURTASS LFA sonar in which LFA sonar may have operated during that period. Correlating the strandings spatially and temporally with active sonar missions of SURTASS LFA sonar vessels, the Navy concluded that none of the 11 western and 5 central (Hawaii) North Pacific stranding events occurred temporally or spatially in conjunction with SURTASS LFA sonar missions.

Given the large number of natural and other anthropogenic factors that can result in marine mammal mortality or live strandings, the high incidence of marine mammal strandings, and the more than 12 years

of LFA sonar operations without any associated stranding events, the likelihood of SURTASS LFA sonar transmissions causing marine mammals to strand is considered to be negligible. From the commencement of SURTASS LFA sonar use from 2002 through the present, neither LFA sonar nor operation of T-AGOS vessels has been associated with any mass or individual strandings of marine mammals.

6.2 RISK ASSESSMENT OF POTENTIAL IMPACTS ON MARINE MAMMALS FROM SURTASS LFA SONAR OPERATIONS

The Navy conducted a risk assessment to analyze and assess potential impacts associated with employing up to four SURTASS LFA sonar systems for routine training, testing, and military operations in the western and central North Pacific Ocean. Under the MMPA, a risk assessment must provide decision-makers and regulators results that demonstrate the least practicable adverse impacts on marine mammals while including consideration of personnel safety, practicability of implementation, and impact on the effectiveness of military readiness activities. The risk analysis assessed the impacts associated with SURTASS LFA sonar operations in nine mission areas of the western North Pacific and two mission areas of the central North Pacific Ocean. The same analytical methodology and process as have been used in previous risk assessment analyses of the potential for impacts from SURTASS LFA sonar and that have been documented in four EISs/SEISs (DoN, 2001, 2007, 2012, 2015) and in the most recent MMPA rulemaking for SURTASS LFA sonar operations (NOAA, 2012) were used in the analysis for this LOAs request and are incorporated by reference herein. Further details on the impact analysis methodology may be found in the 2012 SEIS/SOEIS (Appendix C) for SURTASS LFA sonar (DoN, 2012).

6.2.1 MARINE MAMMAL IMPACT ANALYSIS

To estimate the risk to marine mammals in each of the 11 potential mission areas (Table 4) for SURTASS LFA sonar, a list of marine mammals likely to be encountered in each region was developed (Table 6) and abundance and density estimates derived for each species stock potentially occurring in SURTASS LFA sonar mission areas during all seasons (Table 7; Appendix A). These population data were derived from the most current published literature and documentation available. To determine the likely acoustic exposure, the movement of animals in the area is modeled, along with the acoustic field generated by the sonar system. Acoustic impact modeling of 11 potential SURTASS LFA sonar-mission areas was conducted for this LOAs request, resulting in estimated percent harassment for each marine mammal stock at each mission area as well as the cumulative potential impact on each stock in total (Appendix B).

Potential effects to marine mammal stocks during the 12-month period commencing 15 August 2015 have been estimated based on 16 collective 7-day missions in the western North Pacific and four collective 7-day missions in the central North Pacific mission areas. Analyses to determine the percentage of marine mammal stocks and number of each stock potentially affected for exposures from 120 to 180 dB re 1 µPa (single ping equivalent [SPE]) and $\geq$180 dB re 1 µPa (rms) (with mitigation methods applied) have been conducted on the marine mammal stocks or species groups potentially occurring during all seasons in the western and central North Pacific mission areas for the number of potential SURTASS LFA sonar missions. In the analysis results of the takes estimated at 120 to 180 dB re 1 µPa (SPE) and $\geq$180 dB re 1 µPa (rms) (Tables 8 to 18), the total percentages affected has been rounded up to two decimal places and fractional numbers of animals potentially affected have been rounded upwards to the next whole number.

The results of the Navy's analysis of estimated impacts from exposure to SURTASS LFA sonar transmissions demonstrate that no exposures of marine mammals at sound levels $\geq$180 dB re 1 µPa (rms) are expected as 0.00% or 0 animals of any stock in any mission area would be affected, with the application of mitigation measures; as such, no marine mammals are expected to be harmed, injured, or killed from exposure to SURTASS LFA sonar transmissions during the requested LOAs period from 15 August 2015 through 14 August 2016. At exposures of 120 to 180 dB re 1 µPa (SPE) (MMPA Level B

harassment), the overall percentages of potentially affected marine mammal stocks range from 0.00% to 8.78% during operation of SURTASS LFA sonar for the proposed missions in 11 mission areas (Tables 8 to 18). The highest estimated percentage of any stock of marine mammals potentially affected at

Table 8. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during a summer mission (one total) in the East of Japan mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Mission Area #1—East of Japan—1 Mission			
Marine Mammal Species	**Stock**[12]	**Summer**	
		Percent Affected 120 to 180 dB[13]	**Number Animals Affected 120 to 180 dB**[14]
Bryde's whale	WNP	0.06	13
Common minke whale	WNP "O"	0.21	52
Fin whale	WNP	0.03	3
North Pacific right whale	WNP	—[15]	—
Sei whale	NP	0.15	13
Baird's beaked whale	WNP	0.71	57
Common bottlenose dolphin	WNP	0.11	181
Cuvier's beaked whale	WNP	0.05	50
False killer whale	WNP Pelagic	0.29	48
Ginkgo-toothed beaked whale	NP	0.03	8
Harbor porpoise	WNP	1.15	358
Hubbs' beaked whale	NP	0.03	8
Killer whale	WNP	0.01	2
Kogia spp.	WNP	0.01	50
Pacific white-sided dolphin	WNP	0.01	57
Pantropical spotted dolphin	WNP	0.03	151
Pygmy killer whale	WNP	0.09	28
Risso's dolphin	WNP	0.18	154
Rough-toothed dolphin	WNP	0.06	91
Short-beaked common dolphin	WNP	0.04	1245
Short-finned pilot whale	WNP	0.29	158
Sperm whale	NP	0.01	15
Spinner dolphin	WNP	0.00	5
Striped dolphin	WNP	0.01	65

12 Stock names: WNP=Western North Pacific; NP= North Pacific; CNP=Central North Pacific; ECS=East China Sea. IA=Inshore Archipelago; SOJ= Sea of Japan; NMI=Northern Mariana Islands

13 The total percent affected has been rounded up to two decimal places.

14 Fractional animals potentially affected have been rounded up to the next whole number.

15 "—" indicates that an animal is not expected in the mission area during that season.

Table 9. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter, spring, and summer missions (three total) in the North Philippine Sea mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

North Philippine Sea—Mission Area #2—3 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Spring		Summer		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB14
Blue whale	CNP	0.00	1	0.00	1	--	--	0.01	2
Bryde's whale	WNP	0.07	16	0.07	15	0.07	15	0.21	46
Common minke whale	WNP "O"	0.44	111	0.42	105	0.42	105	1.28	321
Fin whale	WNP	0.05	6	0.05	5	—[16]	—	0.11	11
Humpback whale	WNP	2.02	23	1.91	22	—	—	3.93	45
North Pacific right whale	WNP	0.03	1	0.02	1	—	—	0.05	2
Omura's whale	WNP	0.08	2	0.08	2	0.08	2	0.24	6
Blainville's beaked whale	WNP	0.07	6	0.09	8	0.09	8	0.25	22
Common bottlenose dolphin	WNP	0.14	240	0.13	211	0.13	211	0.39	662
Cuvier's beaked whale	WNP	0.07	63	0.09	79	0.09	79	0.24	221
False killer whale	WNP Pelagic	0.29	49	0.25	43	0.25	43	0.80	135
Fraser's dolphin	WNP	0.05	101	0.05	103	0.05	103	0.14	307
Ginkgo-toothed beaked whale	NP	0.03	6	0.03	8	0.03	8	0.09	22
Killer whale	WNP	0.01	2	0.01	2	0.01	2	0.03	6
Kogia spp.	WNP	0.01	46	0.01	50	0.01	50	0.04	146

16 "—" indicates that an animal is not expected in the mission area during that season.

Table 9. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter, spring, and summer missions (three total) in the North Philippine Sea mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

North Philippine Sea—Mission Area #2—3 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Spring		Summer		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB14
Long-beaked common dolphin	WNP	0.61	1708	0.58	1627	0.58	1627	1.78	4962
Longman's beaked whale	WNP	0.06	3	0.08	4	0.08	4	0.22	11
Melon-headed whale	WNP	0.20	72	0.17	63	0.17	63	0.54	198
Pacific white-sided dolphin	WNP	0.02	196	0.02	162	—[17]	—	0.04	358
Pantropical spotted dolphin	WNP	0.05	223	0.04	173	0.04	173	0.13	569
Pygmy killer whale	WNP	0.12	36	0.10	31	0.10	31	0.32	98
Risso's dolphin	WNP	0.18	153	0.20	169	0.20	169	0.59	491
Rough-toothed dolphin	WNP	0.06	93	0.07	101	0.07	101	0.20	295
Short-beaked common dolphin	WNP	0.03	829	0.02	790	0.02	790	0.07	2409
Short-finned pilot whale	WNP	0.42	228	0.43	232	0.43	232	1.29	692
Sperm whale	NP	0.02	16	0.02	16	0.02	16	0.05	48
Spinner dolphin	WNP	0.00	14	0.00	11	0.00	11	0.00	36
Striped dolphin	WNP	0.09	534	0.07	416	0.07	416	0.24	1366

17 "—" indicates that an animal is not expected in the mission area during that season.

Table 10. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter, summer, and fall missions (three total) in the West Philippine Sea mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

West Philippine Sea—Mission Area #3—3 Missions, One per Season									
Marine Mammal Species	**Stock[12]**	**Winter**		**Summer**		**Fall**		**Total**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**
Blue whale	CNP	0.00	1	—[18]	—	0.00	1	0.00	2
Bryde's whale	WNP	0.07	15	0.07	15	0.07	14	0.21	44
Common minke whale	WNP "O"	0.32	81	0.32	80	0.29	73	0.93	234
Fin whale	WNP	0.05	5	—	—	—	—	0.05	5
Humpback whale	WNP	2.10	24	—	—	1.89	21	3.98	45
Omura's whale	WNP	0.08	2	0.08	2	0.08	2	0.24	6
Blainville's beaked whale	WNP	0.07	6	0.08	7	0.08	7	0.22	20
Common bottlenose dolphin	WNP	0.14	235	0.13	212	0.12	205	0.39	652
Cuvier's beaked whale	WNP	0.00	4	0.00	4	0.00	4	0.01	12
False killer whale	WNP Pelagic	0.26	44	0.26	44	0.25	43	0.78	131
Fraser's dolphin	WNP	0.01	92	0.05	107	0.04	95	0.13	294
Ginkgo-toothed beaked whale	NP	0.02	6	0.03	7	0.03	7	0.08	20
Killer whale	WNP	0.01	2	0.01	2	0.01	2	0.03	6
Kogia spp.	WNP	0.01	26	0.01	29	0.01	28	0.02	83
Long-beaked common dolphin	WNP	0.53	1,482	0.56	1,554	0.55	1,523	1.63	4,559
Longman's beaked whale	WNP	0.06	3	0.07	4	0.07	4	0.20	11

18 "—" indicates that an animal is not expected in the mission area during that season.

Table 10. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter, summer, and fall missions (three total) in the West Philippine Sea mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

West Philippine Sea—Mission Area #3—3 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Summer		Fall		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]
Melon-headed whale	WNP	0.18	65	0.18	65	0.17	63	0.52	193
Pantropical spotted dolphin	WNP	0.04	176	0.04	173	0.03	149	0.11	498
Pygmy killer whale	WNP	0.11	32	0.10	32	0.10	31	0.31	95
Risso's dolphin	WNP	0.19	157	0.22	182	0.20	165	0.60	504
Rough-toothed dolphin	WNP	0.06	82	0.07	97	0.06	90	0.18	269
Short-finned pilot whale	WNP	0.19	104	0.21	115	0.20	110	0.61	329
Sperm whale	NP	0.01	15	0.01	16	0.01	15	0.04	46
Spinner dolphin	WNP	0.00	11	0.00	11	0.00	9	0.00	31
Striped dolphin	WNP	0.04	211	0.04	208	0.03	178	0.10	597

Table 11. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter, spring, and summer missions (three total) in the Offshore Guam mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Offshore Guam—Mission Area #4—3 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Spring		Summer		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]
Blue whale	CNP	0.00	1	0.00	1	—[19]	—	0.00	2
Bryde's whale	WNP	0.02	4	0.02	4	0.02	4	0.05	12
Common minke whale	WNP "O"	0.01	2	0.01	3	0.01	3	0.03	8
Fin whale	WNP	0.00	1	0.00	1	—	—	0.00	2
Humpback whale	WNP	0.39	5	0.48	6	—	—	0.87	11
Omura's whale	WNP	0.02	1	0.02	1	0.02	1	0.06	3
Sei whale	NP	0.03	3	0.03	3	—	—	0.06	6
Blainville's beaked whale	WNP	0.16	13	0.15	13	0.15	13	0.46	39
Common bottlenose dolphin	WNP	0.01	17	0.01	18	0.01	18	0.03	53
Cuvier's beaked whale	WNP	0.01	11	0.01	10	0.01	10	0.03	31
Deraniyagala beaked whale	NP	0.05	13	0.05	12	0.05	12	0.16	37
Dwarf sperm whale	WNP	0.02	72	0.02	77	0.02	77	0.06	226
False killer whale	WNP Pelagic	0.04	7	0.05	9	0.05	9	0.15	25
Fraser's dolphin	CNP	0.31	53	0.33	57	0.33	57	0.97	167
Ginkgo-toothed beaked whale	NP	0.05	13	0.05	12	0.05	12	0.16	37
Killer whale	WNP	0.01	1	0.01	2	0.01	2	0.03	5
Longman's beaked whale	WNP	0.54	25	0.52	24	0.51	6	1.57	55
Melon-headed whale	NMI	1.05	26	1.39	35	1.39	35	3.82	96

19 "—" indicates that an animal is not expected in the mission area during that season.

Table 11. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter, spring, and summer missions (three total) in the Offshore Guam mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Offshore Guam—Mission Area #4—3 Missions, One per Season									
Marine Mammal Species	**Stock[12]**	**Winter**		**Spring**		**Summer**		**Total**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**
Pantropical spotted dolphin	WNP	0.02	81	0.02	104	0.02	104	0.07	289
Pygmy killer whale	WNP	0.00	1	0.00	2	0.00	2	0.01	5
Pygmy sperm whale	WNP	0.01	29	0.01	32	0.01	32	0.03	93
Risso's dolphin	WNP	0.04	32	0.04	34	0.04	34	0.12	100
Rough-toothed dolphin	WNP	0.02	28	0.02	27	0.02	27	0.07	82
Short-finned pilot whale	WNP	0.06	32	0.08	45	0.08	45	0.23	122
Sperm whale	NP	0.01	12	0.01	12	0.01	12	0.03	36
Spinner dolphin	WNP	0.00	3	0.00	4	0.00	4	0.00	11
Striped dolphin	WNP	0.00	22	0.00	29	0.00	29	0.01	80

Table 12. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter and fall missions (two total) in the Sea of Japan mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Sea of Japan—Mission Area #5—2 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Fall		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]
Bryde's whale	WNP	0.01	3	0.01	3	0.02	6
Common minke whale	WNP "O"	0.04	10	0.03	8	0.07	18
	WNP "J"	0.44	4	0.34	4	0.78	8
Fin whale	WNP	0.27	26	0.22	20	0.49	46
North Pacific right whale	WNP	0.02	1	—[20]	—	0.02	1
Omura's whale	WNP	0.02	1	0.01	1	0.03	2
Western North Pacific gray whale	WNP	0.04	1	0.03	1	0.06	2
Baird's beaked whale	WNP	0.07	6	0.06	6	0.14	12
Common bottlenose dolphin	IA	0.01	12	0.01	9	0.02	21
Cuvier's beaked whale	WNP	0.06	59	0.06	54	0.12	113
Dall's porpoise	SOJ	0.64	488	0.36	279	1.00	767
False killer whale	IA	0.46	45	0.34	33	0.79	78
Harbor porpoise	WNP	0.36	113	0.20	63	0.56	176
Killer whale	WNP	0.01	2	0.01	2	0.02	4
Kogia spp.	WNP	0.01	29	0.01	21	0.01	50
Long-beaked common dolphin	WNP	0.69	1936	0.55	1531	1.24	3467
Pacific white-sided dolphin	IA	0.00	29	—	—	0.00	29
Risso's dolphin	IA	0.16	135	0.13	107	0.29	242
Rough-toothed dolphin	WNP	0.01	19	0.01	14	0.02	33

20 "—" indicates that an animal is not expected in the mission area during that season.

Table 12. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter and fall missions (two total) in the Sea of Japan mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Sea of Japan—Mission Area #5—2 Missions, One per Season							
Marine Mammal Species	**Stock[12]**	**Winter**		**Fall**		**Total**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**
Short-beaked common dolphin	WNP	0.04	1438	0.03	1137	0.08	2575
Short-finned pilot whale	WNP	0.04	24	0.03	19	0.08	43
Sperm whale	NP	0.03	32	0.03	31	0.06	63
Spinner dolphin	WNP	—[21]	—	0.00	5	0.00	5
Stejneger's beaked whale	WNP	0.12	10	0.11	9	0.23	19
Striped dolphin	IA	0.01	42	0.01	31	0.01	73

21 "—" indicates that an animal is not expected in the mission area during that season.

Table 13. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during a summer mission (one total) in the East China Sea mission area; 0.00% affected/0 animals affected >180 dB (with mitigation measures applied).

East China Sea—Mission Area #6—1 Mission			
Marine Mammal Species	**Stock[12]**	**Summer**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**
Bryde's whale	ECS	5.60	8
Common minke whale	WNP "O"	0.39	99
	WNP "J"	4.50	41
Fin whale	ECS	0.86	5
North Pacific right whale	WNP	—[22]	—
Omura's whale	WNP	0.09	2
Western North Pacific gray whale	WNP	—	—
Blainville's beaked whale	WNP	0.11	9
Common bottlenose dolphin	IA	0.03	28
Cuvier's beaked whale	WNP	0.01	6
False killer whale	IA	0.20	20
Fraser's dolphin	WNP	0.06	140
Ginkgo-toothed beaked whale	NP	0.04	9
Killer whale	WNP	0.01	2
Kogia spp.	WNP	0.01	31
Long-beaked common dolphin	WNP	0.71	1988
Longman's beaked whale	WNP	0.09	5
Melon-headed whale	WNP	0.21	76
Pacific white-sided dolphin	IA	0.00	43
Pantropical spotted dolphin	IA	0.09	196
Pygmy killer whale	WNP	0.01	3
Risso's dolphin	IA	0.27	228
Rough-toothed dolphin	WNP	0.04	53
Short-beaked common dolphin	WNP	0.02	792
Short-finned pilot whale	WNP	0.06	30
Sperm whale	NP	0.02	18
Spinner dolphin	WNP	0.00	12
Striped dolphin	IA	0.01	84

22 "—" indicates that an animal is not expected in the mission area during that season.

Table 14. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE (with mitigation measures applied) by the operation of SURTASS LFA sonar during a spring mission (one total) in the South China Sea mission; 0.00% affected/0 animals affected ≥180 dB.

South China Sea—Mission Area #7—1 Mission			
Marine Mammal Species	**Stock[12]**	**Spring**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**
Bryde's whale	WNP	0.04	10
Common minke whale	WNP "O"	0.21	53
	WNP "J"	3.21	29
Fin whale	WNP	0.03	4
North Pacific right whale	WNP	0.03	1
Omura's whale	WNP	0.05	1
Western North Pacific gray whale	WNP	0.03	1
Blainville's beaked whale	WNP	0.06	5
Common bottlenose dolphin	IA	0.01	7
Cuvier's beaked whale	WNP	0.00	3
Deraniyagala beaked whale	NP	0.02	5
False killer whale	IA	0.10	11
Fraser's dolphin	WNP	0.03	70
Ginkgo-toothed beaked whale	NP	0.02	5
Killer whale	WNP	0.01	1
Kogia spp.	WNP	0.00	16
Long-beaked common dolphin	WNP	0.41	1135
Longman's beaked whale	WNP	0.05	3
Melon-headed whale	WNP	0.11	39
Pantropical spotted dolphin	IA	0.03	74
Pygmy killer whale	WNP	0.00	2
Risso's dolphin	IA	0.14	116
Rough-toothed dolphin	WNP	0.01	14
Short-finned pilot whale	WNP	0.02	14
Sperm whale	NP	0.01	11
Spinner dolphin	WNP	0.00	5
Striped dolphin	IA	0.01	32

Table 15. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during a summer mission (one total) in the Offshore Japan/Pacific (25° to 40°N) mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Offshore Japan/Pacific (25° to 40°N)—Mission Area #8—1 Mission			
Marine Mammal Species	**Stock[12]**	**Summer**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**
Bryde's whale	WNP	0.06	14
Common minke whale	WNP "O"	0.05	14
Fin whale	WNP	0.06	6
Sei whale	NP	0.11	10
Baird's beaked whale	WNP	0.02	2
Blainville's beaked whale	WNP	0.10	8
Common bottlenose dolphin	WNP	0.01	15
Cuvier's beaked whale	WNP	0.05	42
Dwarf sperm whale	WNP	0.02	88
False killer whale	WNP	0.44	74
Hubbs' beaked whale	NP	0.02	6
Killer whale	WNP	0.01	2
Longman's beaked whale	WNP	0.08	4
Melon-headed whale	WNP	0.15	55
Mesoplodon spp.	WNP	0.02	6
Pacific white-sided dolphin	WNP	0.01	117
Pantropical spotted dolphin	WNP	0.04	175
Pygmy killer whale	WNP	0.00	2
Pygmy sperm whale	WNP	0.01	36
Risso's dolphin	WNP	0.01	9
Rough-toothed dolphin	WNP	0.02	27
Short-beaked common dolphin	WNP	0.06	1,835
Short-finned pilot whale	WNP	0.09	48
Sperm whale	NP	0.02	23
Spinner dolphin	WNP	0.00	29
Striped dolphin	WNP	0.02	91
Hawaiian monk seal	Hawaiian	0.04	1

Table 16. Estimated percentage of stock and number of marine mammals that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during a winter mission (one total) in the Offshore Japan (10° to 25°N) mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Offshore Japan/Pacific (10° to 25°N)—Mission Area #9—1 Mission			
Marine Mammal Species	**Stock[12]**	**Winter**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**
Blue whale	CNP	0.00	1
Bryde's whale	WNP	0.03	8
Fin whale	WNP	0.00	1
Omura's whale	WNP	0.04	1
Sei whale	NP	0.04	4
Blainville's beaked whale	WNP	0.08	7
Common bottlenose dolphin	WNP	0.01	11
Cuvier's beaked whale	WNP	0.04	35
Deraniyagala beaked whale	WNP	0.04	9
Dwarf sperm whale	WNP	0.02	57
False killer whale	WNP	0.05	8
Fraser's dolphin	CNP	0.19	32
Ginkgo-toothed beaked whale	NP	0.04	9
Killer whale	WNP	0.01	2
Longman's beaked whale	WNP	0.05	3
Melon-headed whale	WNP	0.10	36
Pantropical spotted dolphin	WNP	0.03	144
Pygmy killer whale	WNP	0.00	1
Pygmy sperm whale	WNP	0.01	24
Risso's dolphin	WNP	0.01	6
Rough-toothed dolphin	WNP	0.02	24
Short-finned pilot whale	WNP	0.05	27
Sperm whale	NP	0.02	24
Spinner dolphin	WNP	0.00	24
Striped dolphin	WNP	0.01	74

Table 17. Estimated percentage of stock and number of marine mammal species that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter and summer missions (two total) in the Hawaii-North mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Hawaii North—Mission Area #10—2 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Summer		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]
Blue whale	CNP	1.03	1	—[23]	—	1.03	1
Bryde's whale	Hawaii	1.05	9	0.86	7	1.91	16
Common minke whale	Hawaii	0.02	6	—	—	0.02	6
Fin whale	Hawaii	0.96	1	—	—	0.96	1
Humpback whale	CNP	0.24	25	—	—	0.24	25
Sei whale	Hawaii	1.57	3	—	—	1.57	3
Blainville's beaked whale	Hawaii	0.54	13	0.51	12	1.05	25
Common bottlenose dolphin	Hawaii Pelagic	0.67	40	0.49	30	1.16	70
	Kauai/Niihau	0.00	1	0.00	1	0.00	2
	Oahu	0.00	1	0.02	1	0.02	2
	4-Islands	0.00	1	0.04	1	0.04	2
	Hawaii Island	0.00	1	0.00	1	0.00	2
Cuvier's beaked whale	Hawaii	0.52	11	0.49	10	1.01	21
Dwarf sperm whale	Hawaii	0.69	121	0.59	103	1.27	224
False killer whale	Hawaii Pelagic	0.67	11	0.57	9	1.25	20
	Main Hawaiian Islands Insular	0.00	1	1.27	2	1.27	3
	Northwestern Hawaiian Islands	0.00	1	0.38	3	0.38	4
Fraser's dolphin	Hawaii	0.56	96	0.36	62	0.92	158
Killer whale	Hawaii	0.67	1	0.57	1	1.24	2

23 "—" indicates that an animal is not expected in the mission area during that season.

Table 17. Estimated percentage of stock and number of marine mammal species that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during winter and summer missions (two total) in the Hawaii-North mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Hawaii North—Mission Area #10—2 Missions, One per Season

Marine Mammal Species	Stock[12]	Winter		Summer		Total	
		Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]	Percent Affected 120-180 dB[13]	Number Animals Affected 120-180 dB[14]
Longman's beaked whale	Hawaii	0.52	24	0.50	23	1.02	47
Melon-headed whale	Hawaiian Islands	0.35	21	0.30	18	0.65	39
	Kohala Resident	0.01	1	0.21	1	0.22	2
Pantropical spotted dolphin	Hawaii Pelagic	0.58	93	0.38	61	0.96	154
	Hawaii Island	0.13	1	1.78	4	1.91	5
	Oahu	0.11	1	1.96	5	2.07	6
	4-Islands	0.15	1	3.09	7	3.24	8
Pygmy killer whale	Hawaii	0.69	24	0.59	21	1.27	45
Pygmy sperm whale	Hawaii	0.68	49	0.59	42	1.27	91
Risso's dolphin	Hawaii	0.57	42	0.63	46	1.20	88
Rough-toothed dolphin	Hawaii	0.57	36	0.37	24	0.94	60
Short-finned pilot whale	Hawaii	0.59	74	0.58	72	1.17	146
Sperm whale	Hawaii	0.48	17	0.50	17	0.99	34
Spinner dolphin	Hawaii Pelagic	0.33	12	0.21	8	0.54	20
	Hawaii Island	0.00	1	0.03	1	0.03	2
	Oahu/4-Islands	0.17	1	3.37	12	3.55	13
	Kauai/Niihau	0.00	1	0.00	1	0.00	2
	Kure/Midway Atoll	0.00	1	0.00	1	0.00	2
	Pearl and Hermes Reef	0.00	1	0.00	1	0.00	2
Striped dolphin	Hawaii	0.56	116	0.37	76	0.93	192
Hawaiian monk seal	Hawaii	0.12	2	0.11	2	0.23	4

Table 18. Estimated percentage and number of marine mammal species that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during spring and fall missions (two total) in the Hawaii-South mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Hawaii South—Mission Area #11—2 Missions, One per Season							
Marine Mammal Species	**Stock[12]**	**Spring**		**Fall**		**Total**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**
Blue whale	CNP	0.66	1	0.75	1	1.41	2
Bryde's whale	Hawaii	0.61	5	0.71	6	1.32	11
Common minke whale	Hawaii	0.01	4	0.02	5	0.03	9
Fin whale	Hawaii	0.56	1	0.65	1	1.20	2
Humpback whale	CNP	0.14	14	0.14	15	0.27	29
Sei whale	Hawaii	0.91	2	1.06	2	1.97	4
Blainville's beaked whale	Hawaii	0.48	12	0.46	11	0.94	23
Common bottlenose dolphin	Hawaii Pelagic	0.46	28	0.52	31	0.98	59
	Kauai/Niihau	0.00	1	0.00	1	0.00	2
	Oahu	0.00	1	0.00	1	0.00	2
	4-Islands	0.00	1	0.00	1	0.00	2
	Hawaii Island	0.00	1	0.00	1	0.00	2
Cuvier's beaked whale	Hawaii	0.46	9	0.45	9	0.91	18
Deraniyagala beaked whale	NP	0.05	11	0.04	11	0.09	22
Dwarf sperm whale	Hawaii	0.52	92	0.58	102	1.10	194
False killer whale	Hawaii Pelagic	0.49	8	0.53	8	1.02	16
	Main Hawaiian Islands Insular	0.05	1	0.13	1	0.18	2
Fraser's dolphin	Hawaii	0.50	86	0.58	100	1.09	186
Killer whale	Hawaii	0.58	1	0.63	1	1.21	2
Longman's beaked whale	Hawaii	0.47	22	0.45	21	0.92	43

Table 18. Estimated percentage and number of marine mammal species that may be affected at RLs of 120 to 180 dB SPE by the operation of SURTASS LFA sonar during spring and fall missions (two total) in the Hawaii-South mission area; 0.00% affected/0 animals affected ≥180 dB (with mitigation measures applied).

Hawaii South—Mission Area #11—2 Missions, One per Season							
Marine Mammal Species	**Stock[12]**	**Spring**		**Fall**		**Total**	
		Percent Affected 120-180 dB[13]	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**	**Percent Affected 120-180 dB[13]**	**Number Animals Affected 120-180 dB[14]**
Melon-headed whale	Hawaiian Islands	0.25	15	0.27	16	0.53	31
	Kohala Resident	0.01	1	0.02	1	0.03	2
Pantropical spotted dolphin	Hawaii Pelagic	0.43	68	0.45	72	0.87	140
	Hawaii Island	0.13	1	0.18	1	0.31	2
	Oahu	0.11	1	0.20	1	0.31	2
	4-Islands	0.15	1	0.31	1	0.46	2
Pygmy killer whale	Hawaii	0.50	18	0.54	19	1.04	37
Pygmy sperm whale	Hawaii	0.52	38	0.58	42	1.10	80
Risso's dolphin	Hawaii	0.49	36	0.57	42	1.05	78
Rough-toothed dolphin	Hawaii	0.49	31	0.58	37	1.07	68
Short-finned pilot whale	Hawaii	0.46	57	0.52	65	0.97	122
Sperm whale	Hawaii	0.42	15	0.41	14	0.83	29
Spinner dolphin	Hawaii Pelagic	0.24	9	0.25	9	0.49	18
	Hawaii Island	0.00	1	0.00	1	0.00	2
	Oahu/4-Islands	0.17	1	0.34	2	0.51	3
	Kauai/Niihau	0.00	1	0.00	1	0.00	2
Striped dolphin	Hawaii	0.41	85	0.43	90	0.84	175
Hawaiian monk seal	Hawaii	0.11	2	0.11	2	0.22	4

exposures of 120 to 180 dB re 1 µPa (SPE) during operation of SURTASS LFA sonar by all vessels during all proposed missions of the annual LOA 2015 to 2016 period is 8.78% of the Western North Pacific (WNP) stock of humpback whales, or 101 whales, in western North Pacific mission areas (Appendix B, Table B6). The second highest percentage of any stock potentially affected at SURTASS LFA sonar exposures of 120 to 180 dB re 1 µPa (SPE) during the annual 2015 to 2016 period is 8.49% of the WNP "J" stock of common minke whales, or 78 whales (Appendix B, Table B3). All estimated takes of any stock of marine mammals potentially occurring in the oceanic areas in which SURTASS LFA sonar may be operated during the 20 nominal missions of the 2015 to 2016 LOA period are well below the 12% limit that is a condition of the employment of SURTASS LFA sonar.

6.2.2 CONCLUSIONS

The potential effects from SURTASS LFA sonar operations on any stock of marine mammals from injury (non-auditory or permanent loss of hearing) are considered negligible, and the potential effects on any stock of marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Employment of SURTASS LFA sonar will have a negligible impact on marine mammals because:

- Potential effects on marine mammal species or stocks are expected to be limited to MMPA Level B harassment. The Navy does not expect those effects to impact rates of recruitment or survival on the associated marine mammal species and stocks. Thus, effects on recruitment or survival are expected to be negligible.
- Navy's impact analysis does not indicate that any mortality or injury of marine mammals is reasonably expected occur as a result of SURTASS LFA sonar operations, and the potential to cause strandings of marine mammals is negligible.
- Potential non-injurious effects (TTS, masking, modification of biological important behavior) are predicted to be minimal or negligible.
- Cumulative effects are not a reasonably foreseeable adverse impact, as auditory masking potentially resulting from SURTASS LFA sonar's contribution to cumulative effects on oceanic ambient noise levels would only occur over a very small spatial and temporal scale, due in large part to the small number of possible sonar systems operating (no more than four in the western or central North Pacific Ocean) and the small number of hours LFA sonar actually transmits.

Per Condition 8J of the annual LOAs authorizing the operation of SURTASS LFA sonar, no more than 12% of any potentially occurring marine mammal stock can be taken by Level B harassment annually. According to the Navy's analysis for the 2015 to 2016 LOAs effective period, this condition of the LOAs is met as the highest percentage for any potentially occurring stock during the 2015 to 2016 annual LOA reporting period is estimated as 8.78%. Upon completion of the SURTASS LFA sonar missions under the requested LOAs, per additional conditions of the LOAs and Final Rule, these impact estimates will be refined and submitted to NMFS under the reporting requirements pursuant to the MMPA Final Rule (NOAA, 2012) and the conditions of the current LOAs, as issued (NOAA, 2014).

Requirement 7: *Anticipated impact of the activity upon the species or stocks.*

7 IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

MMPA Level A harassment can result from auditoriallly or non-auditorially induced injury. Auditory injury or PTS has been defined for the SURTASS LFA sonar program as the deterioration of hearing due to prolonged or repeated exposure to sounds that accelerate the normal process of gradual hearing loss (Kryter, 1985) and the permanent hearing damage from brief exposure to extremely high sound levels (Richardson et al., 1995). PTS results in a permanent elevation in hearing threshold—an unrecoverable reduction in hearing sensitivity (Southall et al., 2007), which is thus, considered to be an injury. For the employment of SURTASS LFA sonar, NMFS adopted the standard that a 20-dB threshold shift defines the onset of PTS (i.e., a shift of 20 dB in hearing threshold) or injury (MMPA Level A harassment) (NOAA, 2002, 2007, 2012). The injury criterion for all marine mammals in the Navy's risk/impact assessments of exposure to SURTASS LFA sonar is an SPL of 180 dB rms RL, which is noticeably lower and, therefore, more conservative, than the injury criteria proposed by Southall et al. (2007) (218 to 230 dB_{peak} re 1 µPa SPL (203 and 215 dB re 1 μPa^2-sec SEL), Finneran and Jenkins (2012) (172 to 198 dB re 1 μPa^2-sec SEL), and NOAA (2013) (201 to 235 dB_{peak} SPL; 180 to 220 dB SEL_{cum}), for all hearing groups of marine mammals.

The conservative injury criterion for SURTASS LFA sonar was used in the analysis and modeling of SURTASS LFA sonar transmissions at 11 North Pacific mission areas for the annual reporting period 15 August 2015 through 14 August 2016 to assess the potential for auditory injury to marine mammals resulting from use of the sonar. The Navy's analysis showed that the potential for physiological effects from exposure to SURTASS LFA sonar sound levels ≥180 dB SPL rms, including the application of mitigation, during the proposed 20 missions is estimated as 0.0000% or 0 of any marine mammal stock in any of the 11 mission areas (Tables 8 to 18). The results of the current analysis are consistent with those of the Navy's comprehensive modeling and analysis effort undertaken since the beginning of the SURTASS LFA sonar program, which demonstrated with the incorporation of mitigation measures, an estimated 0.0000% of any marine mammal stock would result in Level A harassment under the MMPA.

Non-auditory injury (Level A harassment) may be possible as the result of direct acoustic impact on tissue, indirect acoustic impact on tissue surrounding a structure, and acoustically mediated bubble growth within tissues. Physical effects, such as direct acoustic trauma or acoustically enhanced bubble growth, require relatively intense received energy that would only occur at short distances from high-powered sonar sources (Nowacek et al., 2007; Zimmer and Tyack, 2007). While resonance can occur in marine animals, this resonance does not necessarily cause injury, and any such injury is not expected to occur below a received sound pressure level (RL) of 180 dB re 1 µPa (rms). Damage to the lungs and large sinus cavities of cetaceans from air space resonance is not regarded as a likely significant non-auditory injury because resonance frequencies of marine mammal lungs are below that of the LFA sonar signal (Finneran, 2003). An additional type of non-auditory injury, nitrogen gas bubble formation that results in a form of decompression sickness, is an area of much research and theorization recently. Gas bubble lesions were noted in stranded marine mammals, some of which stranded after acoustic naval exercises. Gas bubble lesions can form with repeated lengthy dives with short to medium surface durations (Zimmer and Tyack, 2007; Fahlman et al., 2009; Moore et al., 2009). Despite the increased scientific research and discussion on gas bubble formation, scientists agree that there is insufficient evidence to support gas bubble formation as the likely cause for certain types of acoustic exposures and marine mammal stranding events (Southall et al., 2007) and that all symptoms of decompression sickness should be present (Ketten, 2014) before such a conclusion of cause is given. However, since LFA sonar signals are lower in frequency (<500 Hz) and not similar in characteristic to the vocalizations of marine mammal predators, there is no evidence that SURTASS LFA sonar has or would cause

behavioral reactions such as avoidance responses, such as altered diving patterns in beaked whales that could potentially lead to a type of decompression sickness and stranding. Thus, SURTASS LFA sonar transmissions are not reasonably expected to cause non-auditory injury.

Indeed, to date, no strandings of marine mammals have been correlated temporally or spatially with the employment of SURTASS LFA sonar since its routine employment began in 2002. Operation of SURTASS LFA sonar, with the comprehensive suite of mitigation measures implemented, have produced no known lethal removal impacts (i.e., Level A takes) to marine mammal stocks or species as reported in the Navy's Annual Reports from 2003 through 2014.

The Navy has concluded that the likelihood of SURTASS LFA sonar transmissions (with mitigation measures implemented) causing injury or Level A harassment in marine mammals is considered negligible and are not reasonably expected from employment of LFA sonar. Thus, for this application, the only impacts anticipated from SURTASS LFA sonar transmission are short-term Level B behavioral harassment that will affect only a relatively small percentage of potentially affected marine mammal stocks. The highest estimated percentage of any stock potentially taken by Level B harassment during the annual effective 2015 to 2016 LOA period is 8.78% (of the WNP stock of humpback whales or 101 whales).

The results of the analysis of SURTASS LFA sonar operations over the 2015 to 2016 annual reporting period show that the impact on marine mammal stocks is not significant when SURTASS LFA sonar is employed in accordance with mitigation measures (geographic restrictions, monitoring/reporting, and sonar shutdown protocols). In summary:

- Based on the Navy's impact analysis results, no mortality nor injury (i.e., Level A harassment) of marine mammals is predicted to occur as a result of LFA sonar operations, and the potential of the sonar to cause strandings of marine mammals is considered negligible.
- Potential for non-injurious effects (TTS, masking, modification of biological important behavior) to marine mammals is estimated to be minimal to negligible.
- Potential effects on marine mammals are reasonably expected to be limited to Level B harassment. The Navy does not estimate the Level B effects to impact rates of recruitment or survival on the associated marine mammal species and stocks. Thus, effects on recruitment or survival are expected to be negligible.
    - Per conditions of the NMFS Final Rule (NOAA, 2012) and annual LOAs, no takes by Level B exceed are estimated to exceed 12% of any marine mammal stock.
- The employment of SURTASS LFA sonar will entail the addition of sound energy to the oceanic ambient noise environment, which in conjunction with the sound produced by other anthropogenic sources may increase the overall oceanic ambient noise level. Increases in ambient noise levels have the potential to affect marine animals by causing masking. However, given the nominal duty cycle of 7.5 to 10%, the narrow bandwidth and fluctuating frequencies of LFA sonar signals, masking by LFA sonar would potentiallyl occur over a very small spatial and temporal scale. Additionally, only four SURTASS LFA sonar vessels operate in the entire central and western North Pacific Ocean. The cumulative effects related to the potential for masking from the potential four SURTASS LFA sonar systems are not a reasonably foreseeable significant adverse impact on marine animals.
- Employment of SURTASS LFA sonar will not impact the habitat of marine mammals nor result in loss or modification of marine habitat.
- Annually, each of the four SURTASS LFA sonar vessels will spend no more than 240 days performing active operations with a maximum of 432 hr of sonar transmissions per vessel per year.

Realistically, the historical use of SURTASS LFA sonar indicates that the maximum duration of LFA sonar transmissions will likely be much less than this total per vessel.

- A comprehensive suite of mitigation measures, including three types of monitoring (passive acoustic, active acoustic, and visual) that are conducted during LFA sonar operations; the coastal standoff range (transmission of an 180 dB SPL sound field restricted to 22 km [12 nmi] from shore); and OBIA restrictions (sound field produced by LFA sonar must be below 180 dB RL SPL within 1 km [0.54 nmi] of OBIA boundary during periods when biologically important activities occur) will be implemented whenever LFA sonar is transmitting to reduce the potential for harassment to marine mammals.

Consideration of negligible impact is required for NMFS to authorize incidental take of marine mammals. By definition, an activity has a “negligible impact” on a species or stock when ‘‘an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival’’ (50 CFR 216.103). The Navy has concluded that the incidental taking of marine mammals by the employment of SURTASS LFA sonar in any of the potential 11 mission areas in the central and western North Pacific Ocean will have a negligible impact on the affected marine mammal stocks or species of marine mammals.

Requirement 8: *Anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses.*

8 IMPACT ON SUBSISTENCE USE

Proposed SURTASS LFA sonar operations will take place in the western and central North Pacific Ocean. No subsistence hunting of marine mammal species by Alaskan Native groups or any other U.S. indigenous groups occurs in or near the 11 potential mission areas of the western and central North Pacific Ocean proposed for employment of SURTASS LFA sonar during the 2015 to 2016 effective period. Thus, the proposed action will have no impact on the availability of marine mammal species or stocks for subsistence uses.

Requirement 9: *Anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat.*

9 IMPACT TO MARINE MAMMAL HABITAT

9.1 PHYSICAL HABITAT

Use of SURTASS LFA sonar entails the periodic deployment of acoustic transducers and receivers into the water column from ocean-going ships. SURTASS LFA sonar is deployed from ocean surveillance ships that are U.S. Coast Guard-certified for operations and operate in accordance with all applicable Federal, international, and U.S. Navy rules and regulations related to environmental stewardship and compliance, especially regarding discharge of potentially hazardous materials. In particular, SURTASS LFA sonar ships comply with all requirements of the Clean Water Act (CWA) and Act to Prevent Pollution from Ships (APPS). SURTASS LFA vessel movements are not unusual or extraordinary and are part of routine operations of seagoing vessels. Therefore, no discharges of pollutants regulated under the APPS or CWA will result from the operation of the sonar systems or vessels nor will unregulated environmental impacts from the operation of the SURTASS LFA sonar vessels occur.

9.2 SOUND IN THE ENVIRONMENT

Deployment and use of the sonar systems results in no physical alterations to the marine environment other than the addition of sound energy to the oceanic ambient noise environment, which may have some effect on marine animals. Anthropogenic sources of ambient noise that are most likely to have contributed to increases in ambient noise levels are commercial shipping, offshore seismic exploration, as well as naval and other sonar (ICES, 2005; MMC, 2007). Hildebrand (2005) concluded that increases in anthropogenic oceanic sound sources most likely to contribute to increased noise in order of importance are: commercial shipping, offshore oil and gas exploration and drilling, and naval and other sonar, with noise from shipping and seismic exploration dominating the low frequency bands of oceanic ambient noise (Hildebrand, 2009).

9.2.1 OCEANIC NOISE LEVELS

Ambient noise is the typical or persistent environmental background noise that is present throughout the ocean; it is generated by both natural and anthropogenic sources. Ambient noise can be generated by natural biotic, which can include marine animals, fish, and invertebrates; natural abiotic, such as seismic disturbances; and anthropogenic, which includes noise from shipping vessels and seismic surveying sources (Bradley and Stern, 2008). Southall et al. (2009) noted that even though naval and geophysical sound sources are currently receiving the greatest attention, other lower-power but more ubiquitous sound sources that add to the ambient noise environment occur in far greater numbers and cover much greater geographical ranges and deployment times.

Andrew et al. (2002) compared ocean ambient sound over three decades and found that ambient noise levels increased approximately 10 dB SPL in the frequency range of 20 to 80 Hz and 200 and 300 Hz and about 3 dB SPL at 100 Hz over a 33-year period. McDonald et al. (2006) found that oceanic ambient noise levels in the northeastern Pacific Ocean at 30 to 50 Hz were 10 to 12 dB SPL higher in 2003 to 2004 than in 1964 to 1966, suggesting an increase in the rate of average noise of 2.5 to 3 dB SPL per decade. Above 50 Hz, the noise level differences between recording periods gradually diminished to a rise of 1 to 3 dB SPL at 100 to 300 Hz (McDonald et al., 2006).

Noise from commercial ship traffic is the dominant component of low-frequency ambient noise in the deep-ocean, while in coastal regions, ship noise may also dominate the low frequency spectra but is more difficult to predict. Chapman and Price (2011) reported on the increasing trend in low-frequency (10

to 400 Hz) ambient noise levels at deep ocean sites in the Northeast Pacific from 1978 to 1986, with about an increase of ~0.55 dB per year until 1980, when the increase per year slowed to a significantly lower level, of only 0.2 dB per year. Over the last several decades, LF noise from shipping has increased by as much as 12 dB, which coincides with a significant increase in the number and size of vessels comprising the world's commercial shipping fleet (Hildebrand, 2009). Tournadre (2014) estimated from satellite altimetry data that ship traffic grew by about 60% from 1992 to 2002, at a nearly constant rate of about 6% per year, but after 2002, the rate at which shipping increased rose steadily to more than 10% by 2011, except in 2008 to 2009, when ship traffic remained steady. Globally, Tournadre (2014) estimates that shipping in two decades (1992 to 2011) grew by a factor of four, with the highest growth in the Indian and western North Pacific Oceans, especially in the continental seas along China; growth in shipping in the Atlantic Ocean and Mediterranean Sea, however, decreased after 2008. Širović et al. (2013) measured ocean noise levels at seven sites in the tropical and subtropical Pacific Ocean, including around Kauai and Hawaii Island. Širović et al. (2013) found a seasonal pattern of increased background noise levels of up to 8 dB from January through April due to humpback whale vocalizations at the Kauai site. At both the Kauai and Hawaii Island sites, distant shipping caused an increase of 7 to 13 dB during months in which shipping was reported (Širović et al., 2013).

Recent scientific papers and research have reported concerns about the increase in ocean surface acidity and the effects that this will have on ocean noise. Increased levels of carbon dioxide in the atmosphere are raising the dissolved carbon dioxide contents in the oceans, which produces carbonic acid (Hester et al., 2008; Brewer and Hester, 2009; Doney et al., 2009; Ilyina et al., 2010). Because the transmission loss of low frequency sound will decrease with increasing acidity, ocean background noise levels could increase. Several long term predictive models have been developed (Joseph and Chiu, 2010; Reeder and Chiu, 2010; Udovydchenkov et al., 2010). Over the next 100 years, predicted increases in LF ocean noise from acidification will be less than the present variability (approximately 1 dB) in background noise levels for LF.

9.2.1.1 Effects of Ambient Noise

As oceanic ambient noise levels increase due to the global escalation in the number of anthropogenic sources, scientific evidence indicates that effects on marine mammals are due to this escalation. Low-frequency noise from large ships (20 to 200 Hz) overlaps the frequency range of acoustic vocalizations of baleen whales, and increased levels of underwater noise have been documented in areas with high shipping traffic, causing responses in baleen whales that have included habitat displacement; changes in behavior; and alterations in the intensity, frequency, and intervals of their calls (Rolland et al., 2012).

Parks et al. (2007) correlated increased underwater ambient noise levels with the change in sound production behavior by North and South Atlantic right whales, which indicated that right whales might shift their call frequency to compensate for the increasing band-limitations caused by background noise. Holt et al. (2009) studied the effects of anthropogenic sound exposure on the endangered Southern Resident killer whales in Puget Sound, reporting that these whales increased their call amplitude by 1 dB SPL for every 1 dB SPL increase in background noise (1 to 40 kHz). Clark et al. (2009) demonstrated that acoustic communications space for the highly endangered North Atlantic right whale is seriously compromised by anthropogenic noise from commercial shipping traffic. Di Iorio and Clark (2010) found that blue whales increase their rate of social calling in the presence of seismic exploration sparkers (plasma sound sources), which presumably represented a compensatory behavior to elevated ambient noise levels from seismic surveys. Individual North Atlantic right whales increased the amplitude of their calls linearly as the background or ambient noise levels increased to moderate levels, which indicated to Parks et al. (2011) that the right whales were able to maintain the signal-to-noise ratio of their call signals in what was considered an immediate short-term response to moderate ambient noise levels. In 2012, Castellote et al. reported that male fin whales from two different subpopulations not only modified their song characteristics during increased ambient noise conditions but during seismic gun activity, the fin whales left the area for an extended period, not returning for 14 days. Castellote et al. (2012)

hypothesized that the fin whales modified their acoustic communications to compensate for the increased background noise and that the animals had a lower tolerance for seismic gun noise than for shipping noise, perhaps having become desensitized to the shipping ambient noise. Last, in response to the terrorist attacks of September 11, 2001, shipping traffic dramatically decreased in the Bay of Fundy, Canada, resulting in 6 dB decrease in the ambient underwater noise level including a significant reduction below 150 Hz, which was associated with decreased baseline levels of stress-related hormone metabolites in North Atlantic right whales (Rolland et al., 2012). This reduction in ambient noise levels associated with shipping was the first evidence that exposure to LF noise from shipping may be associated with chronic stress in whales (Rolland et al., 2012).

Increases in underwater ambient noise levels have the potential to cause masking and decrease the distances that underwater sound can be detected by marine animals. These effects have the potential to cause a long-term decrease in a marine mammal's efficiency at foraging, navigating, or communicating (ICES, 2005). NRC (2003) discussed acoustically-induced stress in marine mammals and stated that sounds resulting from one-time exposure are less likely to have population-level effects than repeated exposures to sounds over extended periods of time. Although the biological significance of behavioral and physiological changes such as those documented herein are not known, the results suggest that that increasing ambient noise from anthropogenic acoustic sources certainly have short-term effects and most likely chronically increase the energetic costs of critical life functions, such as communication and foraging.

9.2.1.2 SURTASS LFA Sonar and Other Anthropogenic Sources of Ocean Noise

SURTASS LFA sonar transmissions solely or in conjunction with those of other anthropogenic sources have the potential for affecting the marine habitat by increasing the overall oceanic ambient noise level, most especially in the LF bands. As noted, the principal impact of increased ambient noise in the marine environment is that of masking communication signals and physiological stress on marine mammals. Broadband, continuous LF ambient noise is more likely to affect marine mammals than narrowband, low duty cycle sound sources, such SURTASS LFA sonar.

Most mysticete vocalizations are in the LF band below 1 kHz, and it is generally believed that their frequency band of best hearing is below 1 kHz, where their calls have the greatest energy (Clark, 1990; Edds-Walton, 2000; Ketten, 2000). However, the bandwidth of any transmitted SURTASS LFA sonar signal is limited (approximately 30 Hz), the average maximum pulse length is 60 sec, signals do not remain at a single frequency for more than 10 sec, and during an operation, the system only is transmitted roughly 7.5 to 10% of the time and is off the majority of time at sea. These factors lead to the conclusion that masking by LFA sonar would only occur over a very small spatial and temporal scale, and thus, any masking effects from SURTASS LFA sonar are expected to be negligible.

Little is known on physiological stress of ambient noise, particularly of in the LF bands, on marine mammals. Available research indicates that the increased ambient noise, especially LF shipping noise, affects stress levels in baleen whales (Rolland et al., 2012). The effect of noise-induced stress effects on marine mammals associated with transmissions of SURTASS LFA sonar is not known.

With only four SURTASS LFA sonar systems operating in the vast ocean area of the western and central North Pacific Ocean and considering that these systems will likely not necessarily transmit concurrently, LFA sonar transmissions will not significantly increase anthropogenic oceanic noise, and the cumulative effects of the proposed four SURTASS LFA sonar systems are not a reasonably foreseeable significant adverse impact on marine animals.

9.3 PROTECTED MARINE HABITATS

Many habitats in the marine environment are protected for a variety of reasons but typically, habitats are designated to conserve and manage natural and cultural resources. Protected marine and aquatic habitats have defined boundaries and are typically enabled under some Federal, State, or international

legal authority. Habitats are protected for a variety of reasons including intrinsic ecological value; biological importance to specific marine species or taxa, which are often also protected by federal or international agreements; management of fisheries; and cultural or historic significance. Due to their importance as marine mammal habitat, two types of marine habitats protected under U.S. legislation or Presidential Executive Order (EO) are considered here. These marine habitats include critical habitat designated under the ESA and marine protected areas (MPAs) designated under the National Marine Sanctuaries Act and EO 13158.

9.3.1 ESA Critical Habitat

The ESA, and its amendments, require the responsible agencies of the Federal government to designate critical habitat for any species that it lists under the ESA. Critical habitat is defined under the ESA as:

1. the specific areas within the geographic area occupied by a listed threatened or endangered species on which the physical or biological features essential to the conservation of the species are found, and that may require special management consideration or protection; and
2. specific areas outside the geographic area occupied by a listed threatened or endangered species that are essential to the conservation of the species (16 U.S.C. §1532(5)(A), 1978).

Critical habitat designations are not required for foreign species or those species listed under the ESA prior to the 1978 ESA amendments that added critical habitat provisions. Under Section 7 of the ESA, all Federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or destroy or adversely modify its designated critical habitat. Of the marine mammal species listed under the ESA, critical habitat has only been designated for six of those species (Table 19). Of the designated critical habitat for marine mammals, only that of one species, the Hawaiian monk seal, is located in regions of the central and western North Pacific Ocean environment that have been requested for operation of SURTASS LFA sonar during the 2015 to 2016 effective LOA period. The currently designated critical habitat of the Hawaiian monk seal is all beach areas, sand spits and islets, including all beach vegetation and lagoon waters out to a depth of 37 m (120 ft) in designated areas of use.

Table 19. ESA-listed marine mammal species for which critical habitat has been designated.

Species	Status Under ESA	Listed Distinct Population Segment (DPS) / Population/Evolutionarily Significant Unit (ESU)	Critical Habitat—Type of Habitat Designated
Beluga whale	Endangered	Cook Inlet	Inshore
Killer whale	Endangered	Southern Resident	Inshore
North Atlantic right whale	Endangered		Marine, nearshore and >12 nmi
North Pacific right whale	Endangered		Marine, nearshore and >12 nmi
Hawaiian monk seal	Endangered		Marine, nearshore <12 nmi
Steller sea lion	Endangered	Western	Marine, nearshore <12 nmi

If any SURTASS LFA sonar transmissions were to enter the shallow, nearshore waters of the Hawaiian monk seal critical habitat, the only potential effect on the habitat would be a potential increase in the ambient noise level, which could cause masking of communication signals. No recordings of underwater vocalizations for the Hawaiian monk seal are available, but the little known about its hearing ability suggests best hearing sensitivity in the narrow range of 12 to 28 kHz (Thomas et al., 1990; Kastak and Schusterman, 1999). Communications are generally in the range of an animal's hearing, so it is unlikely that the Hawaiian monk seal calls would be masked by LFA sonar transmissions in its critical habitat. While LFA sonar signals may increase the ambient noise levels of the Hawaiian monk seal's critical habitat to some unknown degree, given signal attenuation in shallow waters, no adverse effects on the critical habitat are expected.

9.3.2 MARINE PROTECTED AREAS

The term MPA is very generalized and is used to describe specific regions of the marine and aquatic environments that have been set aside for protection, usually by individual nations within their territorial waters, although a small number of internationally recognized MPAs exist. The variety of names and uses of MPAs has led to confusion over what the term really means and where MPAs are used.

9.3.2.1 U.S. Marine Protected Areas

In the U.S., a MPA is defined by EO 13158 as "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." MPAs have conservation or management purposes, defined boundaries, a permanent protection status, and some legal authority to protect marine or aquatic resources. In practice, U.S. MPAs are defined marine and aquatic geographic areas where natural and/or cultural resources are given greater protection than is given in the surrounding waters. In the geographic regions requested for operation of SURTASS LFA sonar during the annual LOA 2015 to 2016 effective period, U.S. Federal and state MPAs are found in the waters of Hawaii, Guam, and the Northern Mariana Islands. Multiple MPAs have been established in Guam (12), the Northern Mariana Islands (10), and Hawaii (60) (NMPAC, 2012).

Many MPAs around the world that were established specifically to protect marine mammals have been considered during the OBIA designation process for SURTASS LFA sonar. Several of the marine mammal MPAs are amongst the 22 global OBIAs where SURTASS LFA sonar use will be restricted to transmissions ≤180 dB re 1 µPa (rms) within 1 km (0.54 nmi) of the OBIA perimeter during biologically important seasons. In the requested mission areas for SURTASS LFA sonar use in 2015 to 2016, Penguin Bank, part of the Hawaiian Islands Humpback Whale National Marine Sanctuary, which is also a designated Federal MPA, has been designated as an OBIA for SURTASS LFA sonar. As part of the Adaptive Management process between the Navy and NMFS, as new information becomes available, MPAs and other potentially important areas to marine mammals are considered for designation as additional OBIAs for SURTASS LFA sonar.

9.3.2.2 Effects of Sonar on Marine Protected Areas

The only potential effects on MPAs would be the potential addition of noise to the ambient noise environment of the MPA. As previously noted, given the small number of SURTASS LFA sonar systems operating in the vast ocean area of the western and central North Pacific Ocean, the transmission characteristics and duty cycle of LFA sonar, and very low likelihood that the systems would transmit concurrently, LFA sonar transmissions will not significantly increase anthropogenic oceanic noise in MPAs.

Requirement 10: *Anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.*

10 IMPACTS TO MARINE MAMMALS FROM HABITAT LOSS OR MODIFICATION

Employment of up to four SURTASS LFA sonar systems in ocean areas of the central and western North Pacific Ocean will not impact the habitat of marine mammals nor result in loss or modification of marine habitat. The only alteration to the marine habitat associated with the use of SURTASS LFA sonar is the transient addition to the oceanic ambient noise environment. The addition to the ambient noise environment from SURTASS LFA sonar operation is limited by the small number of vessels operating in the vast ocean area of the western and central North Pacific Ocean, the low duty cycle at which the sonar is operated, and the equally low duration of sonar transmissions.

Requirement 11: *Availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.*

11 MEANS OF EFFECTING LEAST PRACTICABLE ADVERSE IMPACTS—MITIGATION MEASURES

Regulations for the mitigation and monitoring requirements for the incidental taking of marine mammals by the SURTASS LFA sonar system are detailed in the 2012 Final Rule and annual LOAs (NOAA, 2012; NOAA, 2014).

Mitigation monitoring requirements include:

1. SURTASS LFA sonar-generated sound field below RLs of 180 dB re 1 µPa (rms) (SPL) within 22 km (12 nmi) of any coastline;
2. SURTASS LFA sonar-generated sound field below RLs of 180 dB re 1 µPa (rms) within 1 km (0.54 nmi) of the boundaries of the 22 OBIAs for SURTASS LFA during biologically important seasons;
3. No marine mammals exposed, to the greatest extent practicable, to a SPL greater than 180 dB re 1 µPa (rms) (SPL) or greater;
4. Sound field estimation to predict sound pressure levels of transmitted SURTASS LFA sonar prior to and during operation of the sonar;
5. Maintenance of the mitigation + buffer zone around transmitting SURTASS LFA sonar;
6. Visual (daylight hours), passive acoustic, and active acoustic (HF/M3 sonar) monitoring of the mitigation + buffer zone for marine mammals whenever SURTASS LFA sonar is operating;
7. Visual observers trained in at-sea marine mammal visual monitoring by qualified marine mammal biologist;
8. Suspension or delay of LFA sonar transmissions until 15 minutes after all detected marine mammals have left the mitigation + buffer zone and no further detections of marine mammals are made;
9. Ramp-up procedures for HF/M3 sonar; and
10. Takes by Level B incidental harassment during annual effective LOA period cannot exceed 12% of any marine mammal stock from transmissions of all four SURTASS LFA sonar vessels.

None of these requirements presented in these rulemaking and authorizations for effecting least practicable adverse impacts from the employment of SURTASS LFA sonar have changed. Thus, this 2015 to 2016 application for LOAs renewal incorporates by reference the detailed information from the 2012 Final Rule and annual LOAs on mitigation, monitoring, and reporting requirements for the employment of SURTASS LFA sonar.

Requirement 12: *Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammals for Arctic subsistence uses, the applicant must submit either a "plan of cooperation" or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses.*

12 MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE USES

Pursuant to this application for renewal of LOAs for the operation of SURTASS LFA sonar, only areas in the western and central North Pacific Ocean are being requested for the employment of SURTASS LFA sonar. Thus, no SURTASS LFA sonar activities will take place in or near an Arctic subsistence hunting area. For this reason, the operation of SURTASS LFA sonar will not affect the availability of a species or stock of marine mammals for Arctic subsistence uses.

Requirement 13: *The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens of coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding. Guidelines for developing site-specific monitoring plan may be obtained by writing to the Director, Office of Protected Resources.*

13 MONITORING AND REPORTING

13.1 MONITORING TO INCREASE KNOWLEDGE OF AFFECTED MARINE MAMMAL SPECIES

The Navy is tasked by conditions of the annual LOAs and 2012 Final Rule for SURTASS LFA sonar to conduct monitoring to increase knowledge of the marine mammal species affected during employment of SURTASS LFA sonar.

13.1.1 AMBIENT NOISE DATA MONITORING

The Navy collects ambient noise data on the marine environment when the SURTASS passive towed HLA is deployed. However, because the collected ambient noise data may also contain sensitive acoustic information, the Navy classifies the data, and thus, does not make the data publicly available. These data, especially from parts of the ocean for which marine ambient noise data may be lacking, may be a beneficial addition to the comprehensive ocean noise budget (i.e., an accounting of the relative contributions of various underwater sources to the ocean noise field) that is being developed for the world's oceans. Ocean noise budgets are an important component of varied marine environmental analyses, including studies of masking in marine animals, marine habitat characterization, and marine animal impact analyses.

In acknowledgement of the valuable data the Navy routinely collects, the NMFS has recommended that the Navy continue to explore the feasibility of declassifying and archiving the ambient noise data for incorporation into appropriate ocean noise budget efforts. The Navy continues to consider the future feasibility of declassifying and archiving ambient noise data.

13.1.2 AUGMENTATION OF MARINE MAMMAL DATA COLLECTION

One of the types of mitigation monitoring required during SURTASS LFA sonar transmissions is the use of the SURTASS passive HLA to monitor for marine mammal vocalizations, which are indicative of the presence of marine mammals in the surrounding marine environment. In recognition of the monitoring value of the SURTASS LFA passive towed HLA, NMFS has asked the Navy to explore the feasibility of coordinating with other Navy fleet assets to use the SURTASS passive sonar to augment the collection of marine mammal vocalizations during Navy exercises and/or as an adjunct to Navy range monitoring programs. The Navy's Intelligence, Surveillance and Reconnaissance Capabilities Division (OPNAV N2/N6F24) has requested that the Navy planners consider including the SURTASS passive HLA in the advanced planning of Navy exercises in the western and central North Pacific.

13.1.3 MARINE MAMMAL MONITORING (M3) PROGRAM

The Navy's Integrated Undersea Surveillance System's Marine Mammal Monitoring (M3) program uses the Navy's fixed and mobile passive acoustic monitoring systems to enhance the Navy's collection of

long-term data on individual and population levels of acoustically active marine mammals, principally of baleen whales. At present, the M3 program's data are classified as are the data reports created by M3 analysts. In the past, however, researchers have based unclassified research and resulting scientific papers on information from classified data from the M3 program or other Navy passive acoustic assets.

Monitoring requirements of the NMFS 2012 Final Rule and current LOAs for SURTASS LFA sonar employment necessitate the Navy continue assessing data from the M3 program and work toward making some portion of those data, after appropriate security reviews, available to scientists with appropriate clearances, and any portions of the analyses conducted by these scientists based on the M3 data that are determined to be unclassified after appropriate security reviews should be made publicly available. The Navy (OPNAV N2/N6F24) continues to assess and analyze M3 data collected from Navy passive acoustic monitoring systems and is working toward making some portion of that data, after appropriate security reviews, available to scientists with appropriate clearances and ultimately made publicly available.

13.1.4 BEAKED WHALE AND HARBOR PORPOISE RESEARCH/MONITORING

The impetus for investigating the effect of SURTASS LFA sonar on beaked whales and the harbor porpoise is the result of recent research that indicated these taxa may be particularly sensitive to a range of underwater sound exposures. As a result, the potential sensitivity of beaked whales and the harbor porpoise to LF sonar systems has arisen as an important monitoring and research need. NMFS made increasing the understanding of the potential effects of SURTASS LFA sonar on beaked whales and harbor porpoises a condition of the 2012 MMPA rulemaking and the current LOAs for SURTASS LFA sonar employment. Condition 12a of the SURTASS LFA sonar 2014 to 2015 LOAs requires the Navy to complete its consideration of the recommendations provided in the advisory group's report of possible field and laboratory research and monitoring efforts.

The Navy convened an independent Scientific Advisory Group (SAG), whose purpose was to investigate and assess different types of research and monitoring methods that could increase the understanding of the potential effects to beaked whales and harbor porpoises from exposure to SURTASS LFA sonar transmissions. The SAG was composed of six scientists who are affiliated with two universities, one Federal agency (NMFS), and three private research and consultancy firms. The SAG was responsible for preparing and submitting a report, *Potential Effects of SURTASS LFA Sonar on Beaked Whales and Harbor Porpoises*, which described the SAG's monitoring and research recommendations. The SAG report was submitted to the Navy, NMFS, and the SURTASS LFA sonar Executive Oversight Group (EOG) in August 2013.

The EOG is comprised of representatives from the U.S. Navy OPNAV N2/N6F24 (Chair), Office of the Deputy Assistant Secretary of the Navy for the Environment, Office of Naval Research, Navy Living Marine Research Program, and the NMFS Office of Protected Resources (OPR) (Permits, Conservation, and Education Division). Representatives of the Marine Mammal Commission have also attended EOG meetings as observers. The EOG for SURTASS LFA sonar met twice in 2014 to review and further discuss the research recommendations put forth by the SAG, the feasibility of implementing any of the research efforts, and existing budgetary constraints. In addition to the research and monitoring efforts recommended by the SAG, additional promising research/monitoring suggestions were recommended for consideration by the EOG. The EOG learned that given the greatly reduced Navy research budgets, the earliest likely opportunity to submit a budgetary request for research funding support would be for fiscal year 2017. The EOG is considering which research/monitoring efforts are the most efficacious given existing budgetary constraints and will provide the Navy with a ranked list of research recommendations. The Navy will prepare a research action plan within the year that will be submitted to the NMFS Office of Protected Resources outlining the way forward.

13.2 REPORTING

The Navy has six principal reporting requirements to fulfill annually per the conditions of the 2012 Final Rule and annual LOAs for the employment of SURTASS LFA sonar.

13.2.1 M3 PROGRAM DATA

A condition of the current LOAs and of the 2012 Final Rule for SURTASS LFA sonar requires a status update in the annual LOAs application on efforts to assess the data collected by from the M3 program and the Navy's progress toward making some portion of those data, after appropriate security reviews, available to scientists with appropriate clearances. As detailed in the monitoring section of this chapter, the Navy (OPNAV N2/N6F24) continues to assess and analyze M3 data collected from Navy passive acoustic monitoring systems and is working toward making some portion of that data, after appropriate security reviews, available to scientists with appropriate clearances and ultimately made publicly available.

13.2.2 RESEARCH ON BEAKED WHALES AND HARBOR PORPOISES

Condition 13(b) of the 2014 to 2015 LOAs for SURTASS LFA sonar requires the drafting of an action plan outlining a strategy for implementing recommendations for research on beaked whales and/or harbor porpoises or describing in writing why such research is not feasible/or is unlikely to increase the understanding of the potential effects of SURTASS LFA sonar transmissions on beaked whales and/or harbor porpoises. The Navy is in the process of finalizing an action plan for implementing research that potentially could increase knowledge of the effects of SURTASS LFA sonar transmissions on beaked whales and harbor porpoises. The EOG for the SURTASS LFA sonar program met twice in 2014 and has recommended additional research and monitoring approaches to the Navy. The Navy intends to complete its action plan for submittal to NMFS within the year.

13.2.3 INJURED, DISABLED, OR STRANDED MARINE MAMMALS

Per conditions of the LOAs and rulemaking for SURTASS LFA sonar, the Navy is responsible for systematically observing SURTASS LFA sonar operations for injured or disabled marine mammals and monitoring the principal marine mammal stranding networks and other media to correlate analysis of any whale strandings that could potentially be associated with SURTASS LFA sonar operations. Additionally, the Navy must notify NMFS immediately, or as soon as clearance procedures allow, if an injured, stranded, or dead marine mammal is found during, shortly after, and in the vicinity of any SURTASS LFA operations or anytime an injured, stranded, or dead marine mammal is found.

During the 2013 to 2014 and first two quarters of the 2014 to 2015 LOA effective periods, the ocean environment surrounding SURTASS LFA vessels was monitored for injured or disabled marine mammals, and no injured or disabled marine mammals were observed. Additionally, all available media and known stranding databases were monitored for strandings in the western and central North Pacific Ocean in during the annual 2013 to 2014 and first two quarters of the 2014 to 2015 LOA effective periods. Strandings were monitored by e-news alerts notifying the Navy and NMFS in real-time of stranding events, via social media including Twitter feeds and Facebook postings from domestic and international organizations, and by searching available stranding networks for relevant regional information. All available stranding data were visualized and shared between the Navy and NMFS using the Google Maps interface.

During the period from August 2013 to August 2014, 11 marine mammal stranding events occurred in the western North Pacific Ocean in or adjacent to mission areas for SURTASS LFA sonar in which LFA sonar may have operated during that period (Figure 1). The 11 western North Pacific strandings occurred in China, Taiwan, Vietnam, the Philippines, and Guam. During the January to mid-August 2014 period, 15 whales and dolphins stranded in the Main Hawaiian Islands (West, 2015). No SURTASS LFA sonar operations occurred in Hawaiian waters during the 2013 to 2014 LOAs effective period, so none of the

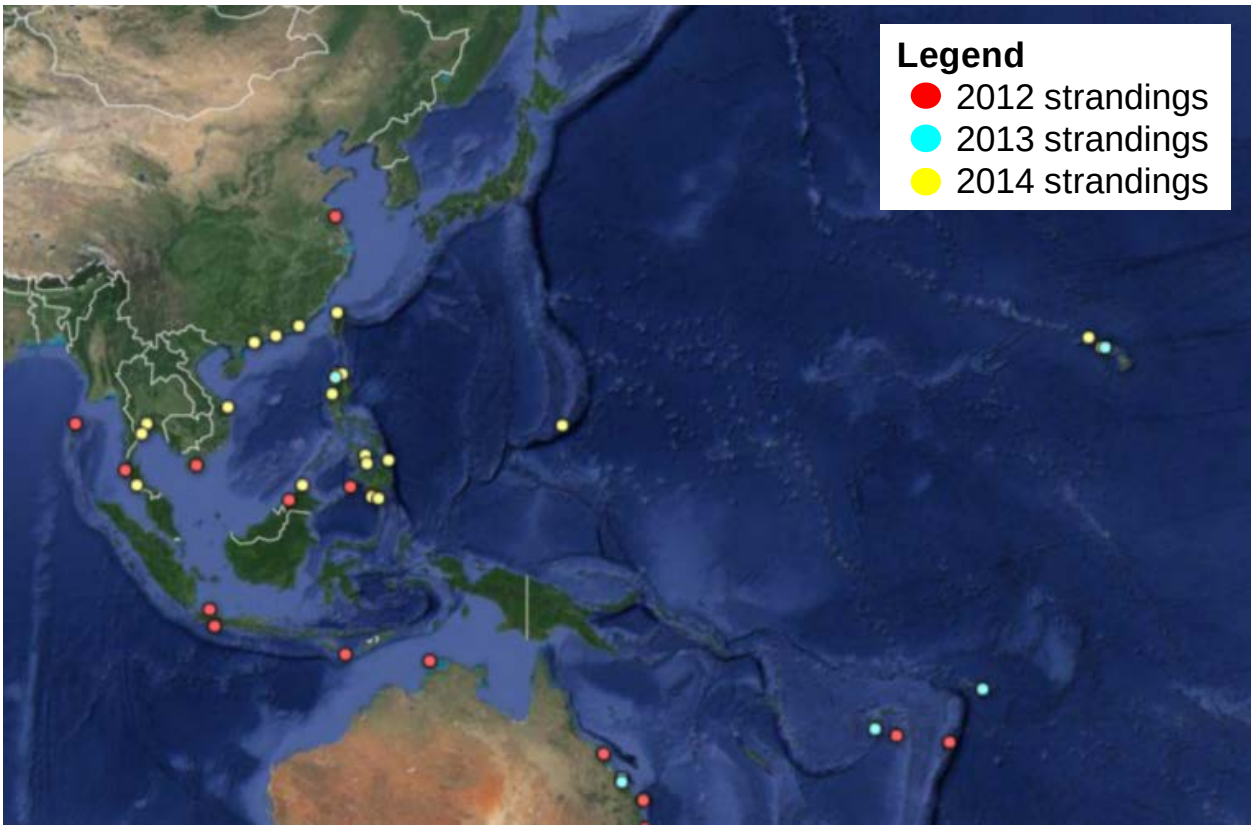

Figure 1. Strandings of marine mammals in the western and central North Pacific Ocean from 2012 through August 2014.

Hawaiian strandings could possibly be related to operation of SURTASS LFA sonar transmissions. After correlating the strandings spatially and temporally with active sonar missions of SURTASS LFA sonar vessels in the western North Pacific Ocean, the Navy concluded that none of the 11 stranding events occurred temporally or spatially in conjunction with SURTASS LFA sonar missions.

From 15 August 2014 through 14 February 2015 (first two quarters of LOAs effective period), 15 marine mammal strandings, including one mass stranding event, occurred in or adjacent to SURTASS LFA sonar mission areas in the western North Pacific Ocean. Nearly all of the strandings to date have occurred in the Philippines, with only two of the 15 strandings having been reported from Korea and China. In January 2015, a mass stranding of about 29 Fraser's and bottlenose dolphins occurred in several locations along the western coast of Luzon Island, Philippines (Philippines Daily Inquirer, 2015); no cause of the mass stranding was reported. No SURTASS LFA sonar operations occurred either temporally or spatially in conjunction with this mass stranding. Five strandings of whales and dolphins, including one sperm whale, occurred in the waters of the Main Hawaiian Islands during the first two quarters of the current LOA period (West, 2015). No SURTASS LFA sonar operations occurred in the Hawaiian missions areas during this period. Correlation of the western North Pacific strandings spatially and temporally with the active LFA sonar operations conducted by SURTASS LFA sonar vessels during the first two quarters (15 August through 15 February) of the 2014 to 2015 LOA effective period resulted in no strandings being associated with the operation of SURTASS LFA sonar.

13.2.4 SHIP STRIKES

The Navy is required to immediately, or as soon as clearance procedures allow, report any ship strikes of marine mammals by one of the SURTASS LFA sonar vessels at any time or place, including all pertinent information on the strike and associated vessel. Impact forces and the probability of injury or death from a ship striking a marine mammal increase with vessel speed (Silber et al., 2010; Wiley et al., 2011). Laist et al. (2001) found that the potential for lethal collisions between whales and ships increase sharply between speeds of 18.5 to 15.9 kph (10 to 14 kt) and are rare at speeds below 18.5 kph (10 kt). Ship strikes by SURTASS LFA sonar vessels are extremely unlikely due to the low speed at which the vessels operate when transmitting LFA sonar (nominally 5.6 kph [3 kt]) and lower transit speed 18.5 to 22 kph (10 to 12 kt). No marine mammals were struck by SURTASS LFA sonar vessels during the 2013 to 2014 LOA period or during the first two quarters of the 2014 to 2015 LOA period.

13.2.5 QUARTERLY MISSION REPORTS

No later than 30 days following the end of each quarter beginning with the LOAs effective date, the Navy must submit unclassified and classified quarterly mission reports to NMFS for each SURTASS LFA sonar vessel. The quarterly mission reports must at least include a summary of all missions during which LFA sonar was transmitted, marine mammal observation/detections during missions, and estimations of the percentages of marine mammals stocks affected by the actual LFA sonar transmissions for the quarter and cumulatively for the annual period. Even if any vessel did not transmit LFA sonar during that quarterly period, a report of negative activity must be submitted to NMFS.

During the annual 2013 to 2014 LOA effective period, the Navy submitted 10 reports of negative activity (no LFA sonar operations by a vessel) to NMFS as well as six sets of classified/unclassified quarterly reports summarizing seven missions during which LFA sonar was transmitted in mission areas of the western North Pacific Ocean. During those missions, LFA sonar was transmitted for a total of 38.6 hours with no visual or passive acoustic detections of marine mammals (Table 1). Active acoustic monitoring made 10 detections during these missions, of which five detections were not judged to be biological signals. Thus, LFA sonar transmissions were suspended / delayed five times.

In the first two quarters of the 2014 to 2015 LOA annual period, the Navy submitted to NMFS five reports of negative activity and three classified/unclassified reports outlining the five active sonar missions conducted by three SURTASS LFA sonar vessels in the western North Pacific Ocean. LFA sonar was transmitted for a total of 21.5 hours thus far in the annual LOA period, with mitigation monitoring having been conducted that resulted in two visual detections of marine animals, no passive acoustic detections, and two active acoustic (HF/M3 sonar) detections of marine mammals (Table 2). These detections of marine mammals resulted in LFA sonar transmissions being suspended four times during missions. LFA sonar transmissions were suspended/delayed another five times due to system/equipment faults. The visual detections of marine mammals during one mission included one detection of dolphins and a second detection of whales; neither of the sightings could be identified to species.

13.2.6 ANNUAL REPORT

The Navy is tasked with submitting an unclassified annual report to the NMFS Office of Protected Resources Director no later than 45 days after the end of the annual LOA effective period. The annual report on SURTASS LFA sonar operations should contain summaries of the unclassified quarterly mission reports, estimations of total percentages of each marine mammal stock affected by SURTASS LFA sonar transmissions, analysis of the effectiveness of mitigation measures, cumulative impacts, and long-term effects from SURTASS LFA sonar operations.

On 26 November 2014, the most recent annual report, which summarized all unclassified quarterly mission reports and LFA sonar operations for the August 15, 2013 through August 14, 2014 LOA reporting period, was submitted to NMFS (DoN, 2014). The annual report summarized the unclassified information from the seven missions conducted in the western North Pacific by SURTASS LFA sonar

vessels as well as estimates of marine mammals potentially affected at RLs of 120 to 180 dB and ≥180 dB as a result of exposure to LFA sonar transmissions from three SURTASS LFA sonar vessels (USNS VICTORIOUS, USNS ABLE, and USNS EFFECTIVE). Post-mission affected stock estimates were based on actual LFA sonar transmission hours and oceanographic conditions. The highest total percentage of marine mammal stocks estimated to be affected by all SURTASS LFA sonar transmissions (RLs 120 to 180 dB) from the three vessels that transmitted LFA sonar during the annual LOA reporting period was 2.16% of the Western North Pacific stock of Longman's beaked whales while the highest percentage of affected ESA-listed marine mammal stocks was estimated at 1.60% for the Western North Pacific stock of humpback whales (DoN, 2014).

The annual report also reported on the Navy's compliance with LOA Condition 9a(i) that requires training of visual observers. A senior marine biologist qualified in conducting at-sea visual monitoring of marine mammals from surface vessels conducted visual training sessions for crew members designated as lookouts aboard three of the SURTASS LFA sonar vessels. Additionally, by direction of the CNO Undersea Capabilities Branch (N2/N6F24), senior marine acousticians and a senior marine biologist conducted passive acoustic training for the military crews of the four SURTASS LFA sonar vessels to increase their ability as sonar operators to distinguish biological sounds from those of mission-directed sounds.

As required, the Navy assessed the effectiveness of the mitigation monitoring protocol for SURTASS LFA sonar. Although no visual or passive acoustic detections were reported during the seven LFA missions in August 2013 to August 2014, detections by the active acoustic sonar system of marine mammals resulted in five suspensions/delays of LFA sonar transmissions (Table 1), per mitigation monitoring protocol and conditions of the Final Rule and LOAs. The employment of the three mitigation monitoring measures at sea results in a predicted effectiveness nearing 100% within the 180-dB LFA mitigation zone (DoN, 2007 and 2011). Together with the other mitigation procedures, the Navy concluded that the mitigation monitoring procedures employed during SURTASS LFA sonar operations achieved the goal of minimizing, to the greatest extent practicable, adverse impacts on marine mammals.

The Navy's assessment of the long-term effects and estimated cumulative impacts from employment of SURTASS LFA sonar over this LOA reporting period has not changed and remains consistent with earlier findings. The four SURTASS LFA sonar systems do not add appreciably to the underwater sounds to which marine mammal stocks are exposed, no evidence exists indicating that SURTASS LFA sonar transmissions have caused mortality or injury to marine mammals, and the cumulative effects from the operation of up to four SURTASS LFA sonar systems are not a reasonably foreseeable significant adverse impact on marine mammals.

13.3 ADAPTIVE MANAGEMENT

Since the understanding of the potential effects of SURTASS LFA sonar on marine mammals is continually evolving, the MMPA Final Rule (NOAA, 2012) provided an adaptive management process that allows NMFS, in consultation with the Navy, to modify or augment existing mitigation or monitoring measures if doing so will have a reasonable likelihood of more effectively accomplishing the mitigation and monitoring objectives of minimizing adverse impacts on marine mammals (50 CFR 218.241). Adaptive management allows the Navy and NMFS to consider, on a case-by-case basis, new peer-reviewed and published scientific data and information or survey data to determine whether consideration, practicability included, should be given to the modification of current SURTASS LFA sonar mitigation monitoring measures or the designation of additional OBIAs for SURTASS LFA sonar, if new scientific data indicate that such modifications would be appropriate. The adaptive management process also allows for updates to marine mammal stock estimates which, in turn, provide for the use of the best available scientific data for predictive models. Under the adaptive management process, the Navy and NMFS would meet annually, if deemed necessary.

The first adaptive management meeting between the Navy and NMFS took place in June 2013. During the August 2013 to August 2014 LOA effective period, the Navy and NMFS participated, along with a representative of the Marine Mammal Commission, in the second adaptive management meeting for SURTASS LFA sonar on 4 December 2014. Representatives from NMFS OPR and General Counsel (GC); Navy CNO (N2/N6 F24 and N45), Navy GC, Deputy Assistant Secretary of the Navy (Environment), Assistant Secretary of the Navy Energy, Installations, and the Environment's GC, Navy Judge Advocate General, and support contractors; and the Marine Mammal Commission participated in the meeting. The planned meeting discussions included overviews of the Navy's quarterly monitoring reports and associated incidental harassment, status of monitoring and reporting requirements, recent relevant scientific literature, possible OBIAs, and pertinent marine mammal stranding events. Evaluation of information on potential OBIAs continues, and, with the analysis scheduled to be completed early in 2015, NMFS suggested a follow-on adaptive management meeting to principally discuss the ranking status of the available information for potential OBIA designation.

Requirement 14: *Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.*

14 RESEARCH

The Navy sponsors significant research and monitoring projects for marine living resources to study the potential effects of its activities on marine mammals. Ongoing Navy-sponsored research on marine mammal includes topics such as hearing and hearing sensitivity, auditory effects, dive and behavioral response models, noise impacts, behavioral responses, tagging of free-ranging marine animals at-sea, and radar-based detection of marine mammals from ships. The Navy, despite waning research budgets, continues to sponsor a high percentage of the research on the effects of human-generated underwater sound on marine mammals.

14.1 SURTASS LFA MARINE MAMMAL MONITORING (M3) PROGRAM

The Navy has and continues to sponsor multi-year research studies using fixed passive acoustic assets. Beginning in 1993, the M3 Program was designed to assess the feasibility of detecting and tracking baleen whales using Navy assets. The M3 Program has evolved into a valuable tool by which the acoustic activity levels of whales can be quantitatively documented and the ambient noise level trends measured over ecologically meaningful ocean scales and time periods under varying ocean noise conditions.

As part of the research component of the SURTASS LFA sonar program, M3 data are collected to: a) document occurrence, distribution, and behaviors of acoustically active whale species over ocean basin and decadal scales; b) objectively assess changes in marine mammal activity levels under normal conditions (e.g., weather, wind, time of year, or time of day) relative to acoustic conditions with varying levels of anthropogenic sources (e.g., seismic profilers[24], naval sonar, shipping, or fishing activity); c) uniquely inform environmental assessments of current and future anti-submarine warfare systems; and d) assemble a long-term database of ocean environmental data to enable scientifically-based evaluations of potential influences on cetaceans or other species.

Acoustic data and information collected and archived by the M3 Program allow program analysts to statistically quantify how baleen whale acoustic behaviors are affected by various factors, such as ocean basin topographic features, hydrographic conditions, seasonality, time, weather conditions, and ambient noise conditions. The compiled acoustic data can be used to estimate the total number of vocalizing whales per unit area, as well as document the seasonal or localized movements of individual animals. In addition, observations over time can also show the interaction and influence of noise sources on large whale behavior.

Besides documenting known sound sources, the M3 analysts use their expertise to expand the Navy's catalog of biological sounds that cannot be identified to species. This collection of unknown biologic sounds includes some signal types that are clearly from large whales, some that are most likely echolocation clicks from diving odontocetes, some that are from fishes, and some that are from invertebrates (e.g., daily vertical migrations). By authenticating that a sound source is of biological origin, the M3 Program has significantly contributed to the proper identification of marine sound sources that are not of biological origin.

24 The term seismic profiler refers to a vessel operating a seismic airgun array or arrays as part of a geological and geophysical survey, usually to explore for sub-bottom oil and gas but also to conduct basic research.

14.2 BEHAVIORAL RESPONSE STUDIES

An important research effort that the Navy continues to fund (Navy's Living Marine Resources [LMR] Program and Office of Naval Research [ONR]) is the independent research program on the behavioral responses of marine mammals to underwater sound. In this multi-year effort (2010 through 2015), the southern California behavioral response study (SOCAL BRS) has been conducted in southern California waters to provide direct, controlled measurements of marine mammal's reactions to underwater sound, including military sonar systems. The recent and planned 2015 BRSs have been conducted on the Navy's Southern California (SOCAL) Range Complex with previous BRSs having been conducted in the Bahamas, on the Navy's Atlantic Undersea Test and Evaluation Center (AUTEC), and in the Mediterranean Sea (BRS 2007 through 2009). The SOCAL-BRS includes collaborations among scientists and researchers from the National Oceanic and Atmospheric Administration (NOAA), private sector, academia, and the Navy. The principal objective of the SOCAL BRS is to collect the data that will provide a better scientific basis for the Navy and Federal regulators to use in estimating risk and minimizing effects associated with exposure to military mid-frequency sonars. The SOCAL BRS is a program of annual or biannual controlled exposure experiments using a scaled underwater sound source that projects simulated military sonar signals and acoustic and movement tags applied to marine mammals that measure calibrated received sound levels and behavioral responses. Recently, SOCAL BRS experiments have coordinated with Navy at-sea training exercises so that behavioral responses to realistic scenarios and full-scale sound sources can be measured. During the SOCAL BRS experiments, 160 tags have been deployed on nine species of marine mammals, with BRS experiments having been conducted on the Baird's beaked whale, blue whale, Cuvier's beaked whale, fin whale, humpback whale, Risso's dolphin, and sperm whale (Southall et al., 2014).

14.3 LIVING MARINE RESOURCE PROGRAM

The purpose of the Navy's LMR Program is to develop, demonstrate, and assess information and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. In addition to the SOCAL BRS, the LMR Program currently is funding marine mammal-related research such as the: integration of an autonomous underwater vehicle with a passive acoustic monitoring system to detect, classify, localize, and track marine mammal vocalizations; creation of a database of marine mammal vocalization detectors and classifiers that will be integrated into existing passive acoustic monitoring (PAM) software; developing automated whistle and click detectors and classifiers for odontocete species' vocalizations; and refining signal detector algorithms to detect specific marine mammal calls.

14.4 ONR MARINE MAMMALS AND BIOLOGY PROGRAM

ONR's Marine Mammals and Biology (MMB) program supports basic and applied research and technology development related to understanding the effects of sound on marine mammals, including physiological, behavioral, ecological effects and population-level effects. The MMB program currently funds over 100 American and international marine mammal-related research projects, in addition to the SOCAL BRS, on specific research areas such as: monitoring and detection; integrated ecosystem, which focuses on sensor and tag development; effects of underwater sound on marine mammals, specifically addressing behavioral responses, diving physiology, physiological stress responses, hearing, and population consequences of acoustic disturbance; and modeling and database development.

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APPENDIX A: MISSION AREA SPECIFIC OCCURRENCE INFORMATION FOR POTENTIALLY AFFECTED MARINE MAMMAL STOCKS IN THE WESTERN AND CENTRAL NORTH PACIFIC OCEAN

The following information describes the estimation approach and scientific literature sources used to derive density and stock abundance estimates in this LOAs request for the marine mammal species potentially occurring in each of the SURTASS LFA sonar mission areas. Information is listed by mission area with marine mammal species occurring in the waters of each mission area listed in alphabetical order within the three general taxonomic groups: mysticetes, odontocetes, and pinnipeds. Literature citations for this appendix may be found in Chapter 15, Literature Cited.

1. MISSION AREA 1—EAST OF JAPAN

A. **Bryde's whale**: Yoshida and Kato (1999) identified three stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. The International Whaling Commission (IWC) provides the best available population estimate for the western North Pacific stock of 20,501 whales (IWC, 2009). The all-season density estimate (0.0006 animals/km^2) for the western North Pacific (WNP) stock is derived from whaling sighting data (Ohsumi, 1977). Bradford et al. (2013) observed Bryde's whales around the Hawaiian Islands, calculating a similar density estimate (0.00033 animals/km^2) to that derived for the WNP stock.

B. **Common minke whale**: Two stocks of minke whales are recognized in the western North Pacific Ocean, the "O" stock, which ranges from the Okhotsk Sea to the waters off eastern Japan, and the "J" stock, which is located in waters around the Korean peninsula and in the Sea of Japan (Pastene et al., 1998). Minke whales potentially occurring in the waters of this mission area are believed to be part of the "O" stock. Buckland et al. (1992) conducted sighting surveys during July and August in the western North Pacific Ocean and Sea of Okhotsk, from which density (0.0022 animals/km^2) and abundance (25,049 individuals) estimates for the WNP "O" stock were derived (Buckland et al., 1992). The density estimates that Ferguson and Barlow (2001; 2003) computed for this species in the offshore areas of the eastern tropical Pacific (ETP) are an order of a magnitude lower than those derived from Buckland et al. (1992).

C. **Fin whale**: Seasonal density, 0.0002 animals/km^2, and abundance, 9,250 individuals, estimates for fin whales in the WNP stock were derived from encounter rates during Japanese whaling in the northwest Pacific Ocean (Tillman, 1977; Mizroch et al., 2009). The seasonal density is comparable to that derived in offshore areas of the ETP (Ferguson and Barlow 2001, 2003) and an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

D. **North Pacific right whale**: The WNP stock of North Pacific right whales is considered distinct from the eastern North Pacific population, arbitrarily separated by the 180° line of longitude (Best et al., 2001). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals for the WNP stock (CV=0.433, 95% CI=404-2,108) (Best et al., 2001). Although no density estimates are available for this very rare marine mammal species, a density estimate is necessary to compute the potential risk to this species associated with exposure to LFA sonar. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis to reflect the very low probability of occurrence in this region during two seasons.

E. **Sei whale**: Tillman (1977) derived an abundance estimate of 8,600 individuals for sei/Bryde's[25] whale in the North Pacific from whaling catch statistics. Initial estimates for a portion of the sei whale population off Japan indicate abundance estimates of similar magnitude (7,744 for May to June and 5,406 for July to September; Hakamada et al., 2009). Whale sighting data obtained from Japanese whaling records were used to derive the density estimate of 0.0006 animals/km^2 for the sei whale's North Pacific (NP) stock (Masaki, 1977; Tillman, 1977). This is an order of magnitude higher than that calculated for around Hawaii (0.00007 animals/km^2; Bradford et al., 2013).

25 Sei and Bryde's whales are difficult to distinguish from one another at sea.

F. **Baird's beaked whale**: Based on Kasuya's (1986) encounter rate and effective search width from 25 years of aerial surveys and shipboard sightings in 1984 off the Pacific coast of Japan, an all-season density estimate of 0.0029 animals/km^2 was derived for this species. Kasuya's (1986) abundance estimate of 4,220 (CV=0.295) covered the region from about 32° to 40°N and seaward of the Pacific Japanese coast out to about 150°E. Since Kasuya's surveys did not include habitat further north, the Kasuya (1986) abundance estimate of 4,220 individuals was increased to 8,000 individuals to account for unsurveyed areas, and is the abundance estimated for the WNP stock of Baird's beaked whales.

G. **Common bottlenose dolphin**: Miyashita (1993) reports an abundance estimate of 168,791 individuals (CV=0.261) and a density estimate (0.0171 animals/km^2) for the WNP stock of common bottlenose dolphins off the Pacific coast of Japan. Miyashita's (1993) density is comparable to that observed for common bottlenose dolphins in nearshore Hawaii waters (0.0103 animals/km^2; Mobley et al., 2000) but is an order of magnitude larger than that derived for this species in the Hawaii exclusive economic zone (EEZ) (0.0025 animals/km^2; Bradford et al., 2013).

H. **Cuvier's beaked whale**: No density or abundance estimate data are available for Cuvier's beaked whales of the WNP stock. Considering habitat preferences (e.g., water temperature and bathymetry), the best population data available to extrapolate for the Cuvier's WNP stock located in this mission area are the Ferguson and Barlow (2001 and 2003) long-time series from the ETP, from which a density of 0.0031 animals/km^2 and an abundance of 90,725 animals were estimated. This density estimate is greater than that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

I. **False killer whale**: Miyashita (1993) estimated the abundance (16,668 animals, CV=0.263) of false killer whales from 34 sighting cruises associated with the Japanese drive fishery and also derived density estimates in 1° latitude by 1° longitude boxes from which an average density, 0.0036 animals/km^2, was derived for the WNP Pelagic stock of false killer whales in this mission area. Miyashita's (1993) density is comparable to the density estimated for the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

J. **Ginkgo-toothed beaked whale**: The ginkgo-toothed whale is only known from strandings in the temperate and tropical waters of the Pacific (Palacios, 1996; Dalebout et al., 2014). Since no data on density or abundance estimates are available for ginkgo-toothed beaked whales in the western North Pacific Ocean, the best population estimations from which to extrapolate for this species in this region are those derived for *Mesoplodon* spp. from the ETP (Ferguson and Barlow, 2001 and 2003). Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density of 0.0005 animals/km^2 and an abundance of 22,799 animals are estimated for the North Pacific (NP) stock of ginkgo-toothed whales. This derived density estimate is comparable to that computed for unidentified *Mesoplodon* whales in the Hawaiian EEZ (0.0021 animals/km^2, Bradford et al., 2013) and the mean predicted density estimate for *Mesoplodon* spp. in the ETP (0.0003 animals/km^2; Ferguson et al., 2006).

K. **Harbor porpoise**: Little is known about the harbor porpoises that are found off the northern coasts of Japan (Gaskin et al., 1993). Off the U.S. east coast and U.S. west coast, animals are found almost exclusively at water depths of less than 100 m (323 ft) (Read and Westgate, 1997; Carretta et al., 2001) and fine-scale stock structure exists (Carretta et al., 2014; Waring et al., 2014). Preliminary analysis of mitrochondrial DNA suggests that Japanese harbor porpoises mix with Alaskan animals to form a genetically distinct group (Taguchi et al., 2010).Therefore, using survey data corrected for

sighting biases, the abundance estimate (31,046 animals) and density estimate (0.19 animals/km^2) of the Gulf of Alaska stock are most appropriate (Hobbs and Waite, 2010; Allen and Angliss, 2014).

L. **Hubbs' beaked whale**: All known occurrences to date of Hubb's beaked whales in the western North Pacific Ocean having been strandings along Japan's shore (MacLeod et al., 2006). Miyazaki et al. (1987) reported five strandings of Hubbs' beaked whales along the Pacific coast of northern Honshu. Since no data on density or stock estimates are available for the Hubb's beaked whale in the waters of this mission area, *Mesoplodon* spp. data from the ETP (Ferguson and Barlow, 2001 and 2003) are considered to be the most appropriate population estimates available from which to extrapolate population estimates for this beaked whale in this mission area. Using the northernmost strata from Ferguson and Barlow's (2001, 2003) data, a density of 0.0005 animals/km^2 and an abundance of 22,799 animals are estimated for the NP stock of Hubb's beaked whales. Ferguson and Barlow's (2001, 2003) density is comparable to that estimated for unidentified *Mesoplodon* whales in the Hawaii EEZ (0.0021 animals/km^2; Bradford et al., 2013) and the mean predicted density estimated for the ETP *Mesoplodon* spp. (0.0003 animals/km^2; Ferguson et al., 2006).

M. **Killer whale**: Killer whales have been observed off the southeast coast of Honshu but none were taken in Japanese drive fisheries (Miyashita, 1993). With no population data for killer whales to estimate the WNP stock, the best available data from which to extrapolate abundance estimate is the ETP time series data, where Ferguson and Barlow (2001, 2003) derived an abundance estimate of 12,256 animals. A density of 0.0001 animals/km^2 was estimated from LGL (2011) data. The LGL (2011) density estimated for the WNP stock is comparable to the density, 0.00004 animals/km^2, estimated for killer whales in the Hawaii EEZ (Bradford et al., 2013).

N. ***Kogia* spp.**: Few occurrence data are available for *Kogia* spp. in the western North Pacific. In the ETP, Ferguson and Barlow (2001; 2003) summed the abundances of *Kogia breviceps, Kogia sima,* and *Kogia* spp. for an estimated overall abundance of 350,553 animals. Although only *Kogia breviceps* (pygmy sperm whale) is expected at the northern latitude of this area, the abundance from the ETP remains the best estimate for the WNP stock of *Kogia* spp. The density estimate of 0.0031 animals/km^2 calculated for *Kogia* spp. from the ETP at about 30° N is considered the best estimate (Ferguson and Barlow, 2001; 2003) from which to extrapolate a density of undifferentiated *Kogia* in the WNP stock. Ferguson and Barlow's (2001, 2003) density is comparable to the density estimates for pygmy sperm whale (0.00291 animals/km^2 [CV=1.12]) and dwarf sperm whale (0.00714 animals/km^2 [CV=0.74]) estimated within the Hawaii EEZ (Barlow, 2006).

O. **Pacific white-sided dolphin**: No data on density or abundance estimates are available for this gregarious, pelagic species in this mission area (Miyashita, 1993). Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different Pacific white-sided dolphin population than animals found in offshore North Pacific waters (Hayano et al., 2004). Data from sighting surveys in the North Pacific were analyzed to estimate an abundance of 931,000 individuals in the WNP stock of Pacific white-sided dolphins (Buckland et al., 1993). This estimate is over an order of magnitude larger than the abundance estimated for this species in waters of the eastern North Pacific (Ferguson and Barlow, 2001, 2003). Ferguson and Barlow's (2001, 2003) density estimates of 0.0082 animals/km^2 from the ETP is appropriate to extrapolate as a density for the WNP stock in this mission area. No sightings of Pacific white-sided dolphins were reported in Hawaiian surveys (Mobley et al., 2000; Barlow, 2006; Bradford et al., 2013).

P. **Pantropical spotted dolphin**: Gilpatrick et al. (1987) described a known distribution of pantropical spotted dolphins occurring east of Japan. Miyashita (1993) reports an abundance estimate of 438,064 individuals (CV=0.174) and a seasonal density estimate, 0.0259 animals/km^2, for pantropical spotted dolphins occurring east of Japan. In the high latitude waters of this mission area, pantropical spotted dolphins are not expected to occur during winter or spring. Miyashita's (1993) density for the WNP

stock of pantropical spotted dolphins can be compared to that observed in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000), although it is an order of magnitude higher than that estimated for pantropical spotted dolphins in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013).

Q. **Pygmy killer whale:** Kishiro and Kasuya (1993) reported that no pygmy killer whales were taken in Japanese drive fisheries, but Leatherwood and Reeves (1983) reported that pygmy killer whales were seen relatively frequently in the waters of the tropical Pacific off Japan. However, since no population data are available for pygmy killer whales in the western North Pacific Ocean, density (0.0021 animals/km^2) and abundance (30,214 individuals) estimates were extrapolated from the ETP data (Ferguson and Barlow, 2001 and 2003) and used to reflect the population levels of the WNP stock of pygmy killer whales. Ferguson and Barlow's (2001 and 2003) density is comparable to that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013).

R. **Risso's dolphin**: Miyashita (1993) reports an abundance for the WNP stock of 83,289 individuals (CV=0.179) and a density estimate of 0.0097 animals/km^2 derived for Risso's dolphins in waters off the Pacific coast of Japan. Miyashita's (1993) density is comparable to that observed for this species in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013).

S. **Rough-toothed dolphin**: No data on abundance or density estimates for the WNP stock of rough-toothed dolphins are available. Therefore, density (0.0059 animals/km^2) and abundance (145,729 individuals) estimates from the waters of the ETP (Ferguson and Barlow, 2001 and 2003) were used to represent rough-toothed dolphins in the WNP stock. While the density estimated for rough-toothed dolphins in the waters of the Hawaii EEZ (0.0026 animals/km^2; Bradford et al., 2013) is comparable, the density estimated for nearshore Hawaii waters is slightly lower (0.0017 animals/km^2; Mobley et al., 2000).

T. **Short-beaked common dolphin**: No data on density or abundance estimates of short-beaked common dolphins are available for the waters of the western North Pacific (Miyashita, 1993). Due to this lack of information, population data derived from ETP surveys of 3,286,163 animals and 0.0761 animals/km^2 (Ferguson and Barlow, 2001, 2003) are the most appropriate to represent the WNP stock of short-beaked common dolphins.

U. **Short-finned pilot whale**: The stock delineation of the short-finned pilot whale in the western North Pacific is not fully resolved. Kasuya et al. (1988) suggested two stocks of short-finned pilot whales occurred in the western North Pacific Ocean off Japan and Taiwan, with the southern stock found south of the Kuroshio Current front (south of 35° N) while the northern stock occurs between the frontal boundaries of the Kuroshio and Oyashio Currents (~35° to 43°N). Miyashita (1993) questioned the stock delineation of short-finned pilot whales in this region but had no way of defining stock boundaries. Miyashita (1993), however, estimated an abundance (53,608 animals, CV=0.224) of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery and also derived density estimates in 1° latitude by 1° longitude boxes, from which an average density estimate (0.0128 animals/km^2) was derived to represent the WNP stock. This density estimate is higher than that found in pelagic waters of the Hawaii EEZ (0.0051 animals/km^2; Bradford et al., 2013).

V. **Sperm whale**: Sperm whale stock structure in the western North Pacific Ocean is not well defined. Kasuya and Miyashita's (1988) data suggest that there are two stocks of sperm whales in the western North Pacific: a northwestern stock whose females summer off the Kuril Islands (~50°N) and winter off Hokkaido and Sanriku (~40°N) and a southwestern stock whose females summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of both stocks are thought to occur north of the corresponding female's ranges, i.e., in the Bering Sea (~55°N) and off Hokkaido and Sanriku (~40°N), respectively, during the summer (Kasuya and Miyashita, 1988). Since population level data are not available to quantify two North Pacific stocks, abundance can be

estimated for only the North Pacific (NP) stock as a whole. The best available population estimate for sperm whales occurring in the NP stock is Kato and Miyashita's (1998) estimate of 102,112 animals (CV=0.155). The density estimate of sperm whales, 0.0012 animals/km^2, calculated from the winter/spring survey around Guam and the Mariana Islands, is the best representative estimate for the NP stock of sperm whales in this mission area (Fulling et al., 2011). This is comparable to the density estimate of sperm whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013).

W. **Spinner dolphin**: The spinner dolphin is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or abundance estimates are available for this species in the western North Pacific Ocean (Miyashita, 1993). Due to this lack of information, the abundance for the WNP stock, 1,015,059 animals, is estimated from the ETP population data (Ferguson and Barlow, 2001 and 2003) while the density, 0.0008 animals/km^2, is estimated from offshore stratum of the Hawaii EEZ survey data (Barlow, 2006); no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013). Due to the high latitude at which this mission area occurs, spinner dolphins are only expected to occur in these waters during summer and fall.

X. **Striped dolphin**: Although two stocks of striped dolphins may be present in the waters of the western North Pacific Ocean, boundaries between the stocks have not been fully resolved (Miyashita, 1993). Therefore, for striped dolphins, Miyashita (1993) derived a total WNP population estimate of 570,038 individuals (CV=0.186) and a density estimate of 0.0111 animals/km^2 was used for this mission area to represent the WNP striped dolphin stock. This is slightly higher than the density estimate of striped dolphins in the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013).

2. MISSION AREA 2—NORTH PHILIPPINE SEA

A. **Blue whale**: Due to the lack of occurrence data, stock structure of the blue whale in the North Pacific Ocean remains uncertain[26]. Stafford et al. (2001) studied the geographic variation of blue whale calls in the North Pacific Ocean using hydrophones off the Kamchatka Peninsula and along the western Aleutian Islands chain and found that all recorded blue whale calls were of north-central and north-west Pacific blue whales. Based on this acoustic information from Stafford et al. (2001), the best available occurrence data for blue whales in the northwestern Pacific Ocean are the sighting survey data associated with Japanese whaling (Tillman, 1977). Blue whales of the central North Pacific (CNP) stock, found at this mission area (Stafford et al., 2001; Carretta et al., 2014), winter in western North Pacific waters and less frequently, in the central North Pacific but summer off southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska. Although the blue whale was the initial focus of Japanese whaling effort in the North Pacific, limited data were reported on blue whales. Therefore, whaling data on fin whales were judged to be the most appropriate proxy for blue whale occurrence estimates. From the fin whale estimates from Japanese whaling data, an abundance of 9,250 individuals (Tillman, 1977) was used for blue whales in mission area #2. A density of 0.0001 whales/km^2 was estimated for all seasons but summer (Tillman, 1977; Ferguson and Barlow, 2001 and 2003; LGL, 2008). This density for blue whales occurring in winter, spring, and fall seasons in the north Philippine Sea is comparable to density estimates of the blue whale in offshore areas of the ETP (Ferguson and Barlow, 2003) and to the waters surrounding Guam (Fulling et al., 2011).

B. **Bryde's whale**: Yoshida and Kato (1999) identified three stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore WNP. The IWC (2009) provides the best available population estimate, 20,501 whales, for the WNP stock of Bryde's whales. The density estimate (0.0006 animals/km^2) for the WNP stock is derived from scouting vessel sighting

26 The IWC recognizes only one stock of blue whales in the North Pacific Ocean (Donovan, 1991), and Reeves et al. (1998) estimated that up to five populations existed in the entire North Pacific basin. NMFS delineates two stocks in U.S. EEZ waters (eastern and central North Pacific stocks) while acoustic data suggest two populations (Stafford et al., 2001).

data (Ohsumi, 1977). Bradford et al. (2013) observed Bryde's whales around the Hawaiian Islands, calculating a similar density estimate (0.00033 animals/km^2) to that derived for the WNP stock.

C. **Common minke whale**: 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). Minke whales in this region are 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. The density estimate, 0.0044 animals/km^2, for minke whales in this area was derived from the encounter rates and effective search widths for the offshore population (standard error (SE) = 0.17), while the stock estimate for the WNP "O" stock is estimated as 25,049 individuals by Buckland et al. (1992). Ferguson and Barlow (2001; 2003) computed density estimates in offshore areas of the ETP that are an order of magnitude lower

D. **Fin whale**: Fin whales of the WNP stock are not expected to occur in summer and fall in LFA mission area #2. Density, 0.0002 animals/km^2 for winter and spring, and abundance, 9,250 individuals, estimates of the WNP stock were derived from encounter rates of scouting boats during Japanese whaling in the northwest Pacific (Tillman, 1977; Mizroch et al., 2009). The 0.0002 animals/km^2 density estimate is comparable to those of fin whales in offshore areas of the ETP (Ferguson and Barlow, 2001 and 2003) and an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

E. **Humpback whale**: Recent research conducted by the Structure of Populations, Levels of Abundance, and Status of Humpbacks (SPLASH) consortium of scientists throughout the North Pacific Ocean has shown that humpback whale movement patterns between feeding areas in high latitudes and wintering grounds in lower latitudes are extremely complex but indicate a high level of population structure (Calambokidis et al., 2008). In the western North Pacific during winter and early spring, humpback whale distribution is centered along the Ogasawara Islands, Ryukyu Islands, Taiwan, the Philippines, and the Mariana Islands (Calambokidis et al., 2008). The remainder of the year, humpback whales are largely absent from these regions as they move northward to other regions of the North Pacific to feed, principally off Russia but also to the Bering Sea and the Gulf of Alaska (Calambokidis et al., 2008). Thus, humpback whales are only expected to occur in the north Philippine Sea mission area during winter, spring, and fall. The SPLASH consortium derived an average abundance for the Asian wintering grounds of 1,107 humpback whales (Calambokidis et al., 2008). A density of 0.0009 animals/km^2 was estimated for the WNP stock of humpback whales (Acebes et al., 2007; LGL, 2008).

F. **North Pacific right whale**: The WNP right whale population is considered distinct from the eastern north Pacific population, arbitrarily separated by the 180° line of longitude (Best et al., 2001). 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 WNP stock of North Pacific right whales. The WNP population may occur in the waters of the North Philippine Sea only in winter and spring. Although no density estimates are available for this very rare marine mammal species, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis to reflect the very low probability of occurrence in this region.

G. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP

stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

H. **Blainville's beaked whale**: Without any data on abundance or density estimates of the Blainville's beaked whale for the western North Pacific, extrapolation from ETP data is appropriate (Ferguson and Barlow, 2001, 2003). A density estimate of 0.0005 animals/km^2 represents the WNP stock of Blainville's beaked whales in mission area 2. The abundance estimate of 8,032 individuals was derived by adding the *Mesoplodon densirostris* abundance estimate to one-fifth of the *Mesoplodon* spp. abundance estimate (Ferguson and Barlow, 2001, 2003). The ETP density estimate is lower than the density of Blainville's beaked whales estimated in the Hawaii EEZ (0.0010 animals/km^2; Bradford et al., 2013) and the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), although the mean predicted density estimate (0.000296 animals/km^2; Ferguson et al., 2006) for the ETP *Mesoplodon* spp. is comparable.

I. **Common bottlenose dolphin**: Miyashita (1993) abundance (168,791 animals CV=0.261) and density (0.0146 animals/km^2) estimates for common bottlenose dolphins off southern Japan were used to represent the WNP stock, which occurs in this mission area. Miyashita's (1993) density is comparable to that derived for the bottlenose dolphins in nearshore Hawaii waters (0.0103 animals/km^2; Mobley et al., 2000) but is an order of magnitude larger than that derived for the species in the waters of the Hawaii EEZ (0.0025 animals/km^2; Bradford et al., 2013).

J. **Cuvier's beaked whale**: No density or abundance estimate data are available for the Cuvier's beaked whale in this region. Considering the Cuvier's habitat preferences (e.g., water temperature, bathymetry), the best data available to represent the WNP stock of Cuvier's beaked whales is the density (0.0054 animals/km^2) and abundance (90,725 animals) estimated for the Cuvier's in the ETP (Ferguson and Barlow, 2001 and 2003). This density estimate is greater than that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

K. **False killer whale**: Miyashita (1993) estimated an abundance of 16,668 (CV=0.263) individuals from 34 sighting cruises associated with the Japanese drive fishery and derived a density estimate of 0.0029 animals/km^2 for the WNP Pelagic stock of false killer whales. Miyashita's (1993) estimated density is much higher than the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) but comparable to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

L. **Fraser's dolphin**: Without data on abundance or density estimates for the western North Pacific, Ferguson and Barlow's (2001, 2003) abundance estimate of 220,789 animals is extrapolated to represent the WNP stock of Fraser's dolphins, which occurs in this mission area. However, the density estimate derived for Hawaiian waters, 0.0069 animals/km^2 (Bradford et al., 2013), is most appropriate and representative of the stock.

M. **Ginkgo-toothed beaked whale**: The ginkgo-toothed whale is only known from strandings in the temperate and tropical waters of the Pacific (Palacios, 1996; Dalebout et al., 2014). With no data available on density or abundances of the NP stock of ginkgo-toothed beaked whales, the best population estimations are those extrapolated from the ETP derivations of Ferguson and Barlow (2001 and 2003) for *Mesoplodon* spp. Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density of 0.0005 animals/km^2 and an abundance of 22,799 animals are estimated. Ferguson and Barlow's density estimate is an order of magnitude less than that for unidentified beaked whales in the Hawaii EEZ (0.0.0021 animals/km^2; Bradford et al., 2013) but comparable to the

mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al. 2006).

N. **Killer whale**: Killer whales have been observed off the southeast coast of Honshu, Japan, but no killer whales were taken in Japanese drive fisheries (Miyashita, 1993). Without any population or occurrence data on killer whales for the western North Pacific, the best available data to use as a proxy for the WNP stock of killer whales are from the long time-series in the ETP, where Ferguson and Barlow (2001, 2003) derived an abundance estimate of 12,256 animals. The most appropriate density, 0.0001 animals/km^2, is derived by LGL (2011). LGL's (2011) density can be compared to the density estimate of 0.00004 animals/km^2 estimated for killer whales in the Hawaii EEZ (Bradford et al., 2013).

O. ***Kogia* spp.**: Few occurrence data are available for *Kogia* spp. in the western North Pacific. In the ETP, Ferguson and Barlow (2001; 2003) summed the abundances of *Kogia breviceps, Kogia sima,* and *Kogia* spp. for an estimated overall abundance of 350,553 animals. Although only *Kogia breviceps* (pygmy sperm whale) is expected at the northern latitude of this mission area, the abundance from the ETP remains the best population estimate for the WNP stock of *Kogia* spp. The density estimate of 0.0031 animals/km^2 calculated for *Kogia* spp. from the ETP at about 30°N is considered the best estimate for *Kogia* spp. in this western region of the North Pacific (Ferguson and Barlow, 2001, 2003). Ferguson and Barlow's (2001, 2003) density is comparable to the density estimates for pygmy sperm whale (0.00291 animals/km^2, CV=1.12) and dwarf sperm whale (0.00714 animals/km^2, CV=0.74) observed within the Hawaii EEZ (Barlow, 2006).

P. **Long-beaked common dolphin**: The overall distribution of this species is difficult to determine because until 1994, all common dolphins around the world were classified as a single species, *Delphinus delphis.* Long-beaked common dolphins generally occur within about 180 km of the coast in tropical and warm-temperate waters (Jefferson and Van Waerebeek 2002). The best density estimate (0.1158 animals/km^2) and abundance estimate (279,182 animals) are from a line-transect survey off the North American west coast, specifically designed to target this species (Carretta et al., 2011a).

Q. **Longman's beaked whale**: Longman's beaked whales are known from tropical waters of the Pacific and Indian Oceans (Pitman et al., 1999; Dalebout et al., 2003). Ferguson and Barlow (2001) reported that all Longman's beaked whale sightings in their surveys were south of 25ºN. Considering the lack of occurrence or population data for the WNP stock of Longman's beaked whales, the abundance of 4,571 animals estimated for Longman's beaked whales in offshore Hawaiian waters (Bradford et al., 2013) and the density of 0.0003 animals per km^2 (LGL, 2011) derived from the Marianas region are considered most appropriate to represent the WNP stock of Longman's beaked whale.

R. **Melon-headed whale**: An abundance estimated by Ferguson and Barlow (2001, 2003) from the ETP of 36,770 animals and a density estimated by Fulling et al. (2011) of 0.0043 animals/km^2 from the Marianas Islands region were the best available data to use to represent the WNP stock of melon-headed whales. The density of Fulling et al. (2011) is higher than the density (0.0021 animals/km^2) estimated by Mobley et al. (2000) for melon-headed whales near the Main Hawaiian Islands.

S. **Pacific white-sided dolphin**: No data on density or abundance estimates are available on the Pacific white-sided dolphin in the western North Pacific (Miyashita, 1993). Recent research on genetic differentiation suggests that Pacific white-sided dolphins found in coastal Japanese waters and the Sea of Japan belong to a different population than Pacific white-sided dolphins 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 in the WNP stock as 931,000 individuals (Buckland et al., 1993). This estimate is over an order of magnitude larger than the abundance estimated for this species in the eastern North Pacific by Ferguson and Barlow (2001, 2003). Without any data on density estimates for the western North Pacific (Miyashita, 1993), the density estimate of

0.0119 animals/km^2 from the ETP (Ferguson and Barlow, 2001, 2003) are most appropriate as a proxy to represent the WNP stock of Pacific white-sided dolphins occurring in this mission area during winter and spring. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al., 2000; Barlow, 2006).

T. **Pantropical spotted dolphin**: Miyashita's (1993) abundance, 438,064 animals, (CV=0.174) and density, 0.0137 animals/km^2, estimated for waters off southern Japan/east Taiwan are the best available data to represent the WNP stock of pantropical spotted dolphins. Miyashita's density is comparable to the density derived for the species in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000) but is higher than that derived for these dolphins in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013).

U. **Pygmy killer whale**: Kishiro and Kasuya (1993) reported that no pygmy killer whales were taken in Japanese drive fisheries, but Leatherwood and Reeves (1983) reported that pygmy killer whales were seen relatively frequently in the tropical Pacific off Japan. With no population data available for the WNP stock of pygmy killer whales, a density of 0.0021 animals/km^2 and abundance of 30,214 animals estimated from eastern Pacific by Ferguson and Barlow (2001, 2003) were used to represent the WNP stock. Ferguson and Barlow's (2001, 2003) density estimate is comparable to that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013). No pygmy killer whales were sighted in nearshore Hawaii waters (Mobley et al., 2000).

V. **Risso's dolphin**: Miyashita (1993) reported an abundance estimate of 83,289 animals (CV=0.179) and density estimate of 0.0106 animals/km^2 for Risso's dolphins in the WNP stock off southern Japan/east Taiwan. Miyashita's (1993) density is an order of magnitude larger than that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013); no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al. 2000).

W. **Rough-toothed dolphin**: Rough-toothed dolphins are reportedly rare off Japan and in the heavily studied ETP. Since there are no data on abundance or density estimates for the WNP stock of rough-toothed dolphins, a density estimate of 0.0059 animals/km^2 and an abundance estimate of 145,729 animals from eastern Pacific waters (Ferguson and Barlow, 2001, 2003) was used to represent the WNP stock. Ferguson and Barlow's (2001, 2003) density is comparable to those observed for this species in the Hawaii EEZ (0.0026 animals/km^2; Bradford et al., 2013) but was higher than those estimated in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

X. **Short-beaked common dolphin**: No data on density or abundance estimates are available for the short-beaked common dolphin in the western Pacific Ocean (Miyashita, 1993). With no data on the WNP stock, the abundance and density data derived by Ferguson and Barlow (2001, 2003) from ETP surveys of 3,286,163 animals and 0.0562 animals/km^2, respectively, are most appropriate to represent the WNP stock of short-beaked common dolphins.

Y. **Short-finned pilot whale**: The stock delineation of the short-finned pilot whale in the western North Pacific is not fully resolved. Kasuya et al. (1988) suggested that two stocks of short-finned pilot whales occurred in the western North Pacific Ocean off Japan and Taiwan, with a southern stock located south of the Kuroshio Current front (south of 35° N) and a northern stock found between the frontal boundaries of the Kuroshio and Oyashio Currents (~35° to 43°N). Although Miyashita (1993) questioned the stock delineation of short-finned pilot whales in this region, he had no way of defining stock boundaries. Miyashita (1993) estimated the abundance of short-finned pilot whales in the WNP stock from 34 sighting cruises associated with the Japanese drive fishery as 53,608 individuals (CV=0.224), while the average density estimated in 1° blocks was 0.0153 animals/km^2 derived. This density estimate is higher than that found in pelagic waters of the Hawaii EEZ (0.0051 animals/km^2; Bradford et al., 2013).

Z. **Sperm whale**: Stock structure of this species has not been completely delineated for sperm whales in the North Pacific. NMFS considers historical and current abundance estimates to be unreliable (Allen

and Angliss, 2013). Sightings collected by Kasuya and Miyashita (1988) suggest that two stocks of sperm whales occur 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 a 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. Since the stock structure has not been well delineated, an abundance is estimated for the NP stock of sperm whales as 102,112 individuals (CV=0.155) (Kato and Miyashita, 1998). The density estimate of sperm whales, 0.0012 animals/km^2, calculated from the winter/spring survey around Guam and the Mariana Islands is the best representative estimate for sperm whales in this mission area (Fulling et al., 2011). This is comparable to the density estimate of sperm whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013).

AA. **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 for spinner dolphins in this region (Miyashita, 1993). Lacking density or abundance data on the WNP stock of spinner dolphins, the abundance estimate, 1,015,059 animals, derived for spinner dolphins in waters of the ETP (Ferguson and Barlow, 2001, 2003) at a similar latitude is appropriate to characterize this stock in this region. Barlow's (2006) density estimate, 0.0008 animals/km^2, derived for spinner dolphins in the waters of the outer Hawaii EEZ, is the best available; no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013).

BB. **Striped dolphin**: As many as three stocks of striped dolphins (one south of 30°N, one inshore north of 30°N, and one offshore north of 30°N and east of 145°E) may be present in the waters of the western North Pacific Ocean, but boundaries between the stocks have not been fully resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a population estimate for the total WNP stock as 570,038 animals (CV=0.186) and estimated a density of striped dolphins off southern Japan/east Taiwan as 0.0329 animals/km^2. This is higher than the density estimate of striped dolphins in the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013).

3. MISSION AREA 3—WEST PHILIPPINE SEA

A. **Blue whale**: Few data are available on blue whale occurrence in the North Pacific Ocean, especially in the Philippine Sea, and the stock structure in the North Pacific remains uncertain[26]. Stafford et al. (2001) studied the geographic variation of blue whale calls in the North Pacific Ocean using hydrophones off the Kamchatka Peninsula and along the western Aleutian Islands chain, and found that all recorded blue whale calls were of north-central and north-west Pacific blue whales. Based on Stafford et al. (2001) acoustic information, the best available occurrence data for blue whales in the northwestern Pacific Ocean are the sighting survey data associated with Japanese whaling (Tillman, 1977). Blue whales of the central North Pacific stock, found at this mission area (Stafford et al., 2001; Carretta et al., 2014), winter in western North Pacific waters and less frequently, in the central North Pacific, but summer off southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska. Although the blue whale was the initial focus of Japanese whaling effort in the North Pacific, limited data were reported on blue whales. Therefore, whaling data on fin whales were judged to be the most appropriate proxy for blue whale occurrence estimates. From the fin whale estimates from Japanese whaling data, an abundance of 9,250 individuals was used for blue whales in mission area #2 (Tillman, 1977; Stafford et al., 2001; Carretta et al., 2014). A density of 0.0001 whales/km^2 was estimated for winter, spring, and fall seasons (Tillman, 1977, Ferguson and Barlow, 2001 and 2003; LGL, 2008). This density for blue whales is comparable to density estimates of the blue whale in offshore areas of the ETP (Ferguson and Barlow, 2003).

B. **Bryde's whale**: Three stocks of Bryde's whales are currently recognized in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific (Yoshida and Kato, 1999). Ohsumi's (1977) density estimate (0.0006 animals/km^2) and the IWC (2009) abundance estimate of 20,501 whales provide the best available estimates for the WNP stock Bryde's whales. Bradford et al. (2013) observed Bryde's whales around the Hawaiian Islands, calculating a similar density estimate (0.00033 animals/km^2) to that derived for the WNP stock.

C. **Common minke whale**: 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). Minke whales occurring in mission area #3 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 and derived density estimates from encounter rates and effective search widths for the offshore population. Buckland et al. (1992) estimated the abundance of the WNP O stock as 25,049 individuals and the density was estimated as 0.0033 animals/km^2 (Buckland et al., 1992). The density computed by Ferguson and Barlow (2001; 2003) for common minke whales in offshore areas of the ETP is an order of magnitude lower.

D. **Fin whale**: Since fin whales migrate south from offshore waters of the northwest Pacific Ocean, the density of 0.0002 animals/km^2 for winter and spring and the abundance of 9,250 animals for the WNP stock occurring in mission area #3 were estimated from encounter rates of Japanese scouting boats in the northwest Pacific Ocean (Tillman, 1977; Mizroch, 2009). This density estimated for fin whales in the WNP stock are comparable to the density estimated for this species in offshore areas of the ETP (Ferguson and Barlow, 2001 and 2003) and an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

E. **Humpback whale**: Recent research conducted by the SLASH consortium of scientists in the North Pacific Ocean has shown that humpback whale movement patterns between feeding areas in high latitudes and wintering grounds in lower latitudes are extremely complex but are indicative of a high level of population structure (Calambokidis et al., 2008). In the western North Pacific during winter and early spring, humpback whale distribution is centered along the Ogasawara Islands, Ryukyu Islands, Taiwan, the Philippines, and the Mariana Islands (Calambokidis et al., 2008). The remainder of the year, humpback whales are largely absent from these regions as they move northward to other regions of the North Pacific to feed, principally off Russia but also to the Bering Sea and the Gulf of Alaska (Calambokidis et al., 2008). The WNP stock of humpback whales are only expected in the western Philippine Sea mission area during winter, spring, and part of fall as they reside in or transit through the waters of this area. The SPLASH consortium derived an average abundance for the Asian wintering grounds of 1,107 humpback whales (Calambokidis et al., 2008), while a density of 0.0009 animals/km^2 was estimated for the WNP stock in mission area #3 (Acebes et al., 2007; LGL, 2008).

F. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

G. **Blainville's beaked whale**: Lacking data on population estimates for the Blainville's beaked whale in the western North Pacific, the data derived for this species in waters of the ETP (Ferguson and

Barlow, 2001, 2003) are deemed most appropriate to represent the species in the WNP stock. Ferguson and Barlow's (2001, 2003) abundance derived for *Mesoplodon densirostris* added to one-fifth of the *Mesoplodon* spp. abundance provides an estimate of 8,032 animals to represent this stock. The density estimate for *Mesoplodon* spp. at the same latitudes in the eastern Pacific, 0.0005 animals/km^2; is most appropriate (Ferguson and Barlow, 2001 and 2003). This density estimate is lower than that derived for Blainville's beaked whales in the Hawaii EEZ (0.0010 animals/km^2; Bradford et al., 2013) and in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), but is comparable to the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

H. **Common bottlenose dolphin**: Miyashita's (1993) abundance estimate of 168,791 (CV=0.261) and density estimate off southern Japan of 0.0146/km^2 represent the stock of Western North Pacific common bottlenose dolphins. Miyashita's (1993) density is similar to that observed in the nearshore Hawaii waters (0.0103/km^2; Mobley et al., 2000) but is an order of magnitude larger than that observed in the Hawaii EEZ (0.0025 animals/km^2; Bradford et al., 2013).

I. **Cuvier's beaked whale**: No data are available for Cuvier's beaked whales in this region. Considering Cuvier's habitat preferences (e.g., water temperature, bathymetry), the best data available to use as a proxy for the WNP stock of Cuvier's beaked whales that occur in mission area #3 are Ferguson and Barlow's (2001 and 2003) density estimate of 0.0003 animals/km^2 and abundance estimate of 90,725 animals derived for the species in waters at the same latitudes in the eastern Pacific. This eastern Pacific density is comparable to that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) and less than the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

J. **False killer whale**: From 34 sighting cruises associated with the Japanese drive fishery, Miyashita (1993) estimated an abundance of 16,668 (CV=0.263) and an average density of 0.0029 animals/km^2 of false killer whales in the WNP stock. Miyashita's (1993) average density is higher than the density estimated for the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) but comparable to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

K. **Fraser's dolphin**: Lacking occurrence or population data on the Fraser's dolphins in the western North Pacific, the abundance estimated at 220,789 animals for the species in the waters of the ETP by Ferguson and Barlow (2001, 2003) and the density of 0.0069 animals/km^2 estimated for Fraser's dolphins in the waters of the Hawaii EEZ by Bradford et al. (2013) best represented the WNP stock of Fraser's dolphins.

L. **Ginkgo-toothed beaked whale**: Since no data on density or stock estimates are available for the Ginkgo-toothed beaked whale in this region, the density of 0.0005 animals/km^2 and abundance of 22,799 animals was estimated for *Mesoplodon* spp. at the same latitudes in the eastern Pacific (Ferguson and Barlow, 2001, 2003) are most appropriate to represent the North Pacific stock of ginkgo-toothed beaked whales in this region. The ETP density estimate is an order of magnitude less than that for unidentified beaked whales in the Hawaii EEZ (0.0.0021 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

M. **Killer whale**: Killer whales have been observed off the southeast coast of Honshu, Japan, but no killer whales were taken in Japanese drive fisheries (Miyashita, 1993). Without any population or occurrence data on killer whales for the western North Pacific, the best available abundance estimate of 12,256 animals is from Ferguson and Barlow's (2001, 2003) long time series in the ETP while the best available density estimate of 0.0001 animals/km^2 is from LGL (2011) compilation of data for the

Marianas area. LGL's (2011) density is comparable to the density, 0.00004 animals/km^2, estimated for killer whales in the Hawaii EEZ (Bradford et al., 2013).

N. ***Kogia* spp.**: 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 sima, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001, 2003), an overall abundance of 350,553 animals was computed in the ETP. Considering the lack of data for the western North Pacific, Ferguson and Barlow's (2001, 2003) data are the most appropriate to represent *Kogia* spp. in this mission area. At this latitude, *Kogia breviceps* and *Kogia sima* are both expected to occur. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N (Ferguson and Barlow, 2001, 2003), a density estimate of 0.0017 animals/km^2 was derived, which is considered the best available for the WNP stock of *Kogia* spp. Ferguson and Barlow's (2001, 2003) density is slightly lower than the densities for pygmy sperm whale (0.00291 animals/km^2, CV=1.12) and dwarf sperm whale (0.00714 animals/km^2, CV=0.74) estimated within the Hawaii EEZ (Barlow, 2006).

O. **Long-beaked common dolphin**: The overall distribution of this species is difficult to determine because until 1994, all common dolphins around the world were classified as a single species, *Delphinus delphis.* Long-beaked common dolphins generally occur within about 180 km of the coast in tropical and warm-temperate waters (Jefferson and Van Waerebeek, 2002). The best density estimate (0.1158 animals/km^2) and abundance estimate (279,182 animals) are from a line-transect survey off the North American west coast, specifically designed to target this species (Carretta et al., 2011a).

P. **Longman's beaked whale:** Longman's beaked whales are known from tropical waters of the Pacific Ocean (Pitman et al., 1999; Dalebout et al., 2003). Ferguson and Barlow (2001) reported that all Longman's beaked whale sightings in their ETP surveys were south of 25ºN. Considering the lack of occurrence or population data for the WNP stock of Longman's beaked whales, the abundance of 4,571 animals estimated for Longman's beaked whales in offshore Hawaiian waters (Bradford et al., 2013) and the density of 0.0003 animals per km^2 (LGL, 2011) derived from the Marianas regions are considered most appropriate to represent the WNP stock.

Q. **Melon-headed whale:** With a lack of population data on melon-headed whales in the western North Pacific, the abundance estimated from the eastern Pacific of 36,770 animals (Ferguson and Barlow, 2001, 2003) and the density estimate of 0.0043 animals/km^2 (Fulling et al., 2011) derived for the Marianas region are the best available estimations for the WNP stock. The Fulling et al. (2011) density value is comparable to the estimate from Mobley et al. (2000) for near the Main Hawaiian Islands: 0.0021 animals/km^2.

R. **Pantropical spotted dolphin**: The Miyashita (1993) abundance estimate of 438,064 (CV=0.174) and density estimate, 0.0137 animals/km^2, derived for waters off southern Japan/east Taiwan were used to represent the WNP stock of pantropical spotted dolphins in this mission area. Miyashita's (1993) density is higher than that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013) but is comparable to that derived for nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

S. **Pygmy killer whale**: Lacking data on the pygmy killer whale in the western North Pacific, density, 0.0021 animals/km^2, and abundance, 30,214 animals, estimates from eastern Pacific (Ferguson and Barlow, 2001 and 2003) were considered the best available to use as a proxy to represent the WNP stock of pygmy killer whales in this mission area. The Ferguson and Barlow density is comparable to that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013), while no pygmy killer whales were sighted in nearshore Hawaii waters (Mobley et al., 2000).

T. **Risso's dolphin**: Miyashita's (1993) abundance estimate of 83,289 animals (CV=0.179) and density estimate of 0.0106 animals/km^2 derived for Risso's dolphins off southern Japan/east Taiwan were used to represent the WNP stock of Risso's dolphin in this region. Miyashita's (1993) density is an

order of magnitude larger than that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013); no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al., 2000).

U. **Rough-toothed dolphin:** Since no data on abundance or density estimates are available for the WNP stock of rough-toothed dolphins, a density estimate, 0.0059 animals/km^2, and an abundance estimate, 145,729 animals, from the ETP were used to characterize this stock in this mission area (Ferguson and Barlow, 2001, 2003). This density is comparable to those observed in the Hawaii EEZ (0.0026 animals/km^2; Bradford et al., 2013) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

V. **Short-finned pilot whale**: 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 form found south of the Kuroshio Current front (south of 35°N) and a different form found between the fronts of the Kuroshio Current and the Oyashio Current (from approximately 35° to 43°N). However, since the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya, 1993), it was, thus, not included in Miyashita's (1993) study. From 34 sighting cruises associated with the Japanese drive fishery, Miyashita (1993) estimated an abundance of short-finned pilot whales of 53,608 (CV=0.224) and a density estimate of 0.0076 animals/km^2 that are appropriate for this species in the West Philippine Sea. This density estimate is higher than that found in pelagic waters of the Hawaii EEZ (0.0051 animals/km^2; Bradford et al., 2013).

W. **Sperm whale**: Stock structure of this species has not been completely delineated in the North Pacific Ocean. Even though sightings collected by Kasuya and Miyashita (1988) were interpreted to indicate that two stocks of sperm whales exists in the western North Pacific Ocean, insufficient population-level data exist to adequately define a fine-scale population structure, except for the populations of sperm whales in U.S. EEZ waters (Allen and Angliss, 2013). For this reason, the number of sperm whales in the entire North Pacific stock is taken from Kato and Miyashita's (1998) estimate of 102,112 animals (CV=0.155). Since no densities of sperm whales have been estimated for this region, the density of 0.0012 animals/km^2 (Fulling et al., 2011), calculated from the winter/spring survey around Guam and the Mariana Islands, is the best representative estimate for this mission area. This is comparable to the density estimate of sperm whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013).

X. **Spinner dolphin**: Records of spinner dolphins are not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or abundance estimates for this species are available (Miyashita, 1993). Lacking data on abundance or density estimates for the WNP stock of spinner dolphins, Ferguson and Barlow's (2001, 2003) abundance of 1,015,059 animals derived from the ETP, while the density estimated by Barlow (2006) of 0.0008 animals/km^2 from the offshore stratum of the outer Hawaiian EEZ are considered most appropriate to represent this stock in this mission area; no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013).

Y. **Striped dolphin**: Though two stocks of striped dolphins may exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N, the boundaries between these populations have not been resolved (Miyashita 1993). Therefore, Miyashita's (1993) derived a total stock estimate, 570,038 animals (CV=0.186) for the WNP stock, while the density, 0.0164 animals/km^2, was estimated as one-half of Miyashita's (1993) density estimate from off southern Japan/east Taiwan. This is higher than the density estimate of striped dolphins in the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013).

4. MISSION AREA 4—GUAM

Eldredge (1991) compiled the first list of published and unpublished records or marine mammals in the waters of the Guam and the lower Marianas Islands, reporting 19 species. The waters in the vicinity of

Guam and nearby Marianas Islands were most recently surveyed for marine mammals from January to April 2007 (Fulling et al., 2011), in August 2007 (Mobley, 2007), and from February to March 2010, when waters around Guam and Saipan were surveyed by small-boat (Ligon et al., 2011).

A. **Blue whale**: Although Stafford et al. (2001) showed that recordings made near Kaneohe, Hawaii from August 1992 through April 1993 consisted of approximately 30% of the northwest Pacific blue whale call type and 70% of northeast Pacific call type, stock structure of blue whales in the North Pacific Ocean remains uncertain. Due to the uncertainty in the blue whale stock structure throughout the North Pacific Ocean[26] and limited occurrence data for this species, blue whales found in waters near Guam are considered part of the CNP stock (Stafford et al., 2001; Carretta et al., 2014), and proxy data are used for the estimated abundance of this stock in mission area #4. The estimated abundance of 9,250 whales is derived from fin whale data recording by Japanese whalers (Tillman, 1977). Due to the sparse occurrence data for blue whales in the region, a density of 0.0001 whales/km^2 was estimated for the winter, spring, and fall seasons of occurrence (Tillman, 1977, Ferguson and Barlow, 2001 and 2003; LGL, 2008; Fulling et al., 2011). This density for blue whales occurring in winter, spring, and fall seasons in the west Philippine Sea is comparable to the density estimate of the blue whale in offshore areas of the eastern tropical Pacific (ETP) (Ferguson and Barlow, 2003).

B. **Bryde's whale**: The IWC provides the best available population estimate for the WNP stock at 20,501 whales (IWC, 2009). Sightings from the Fulling et al. (2011) 2007 surveys in the Marianas region produced an abundance of 233 Bryde's whales. The best available density estimate (0.00041 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (Fulling et al., 2011). The Fulling et al. (2011) density is comparable to density estimates from the ETP (0.0009/km^2) (Ferguson and Barlow, 2001, 2003) and the Hawaii EEZ (0.00033 animals/km^2; Bradford et al., 2013).

C. **Common minke whale**: Minke whales were heard but not sighted during recent surveys in Guam and the Mariana Islands waters (Fulling et al., 2011). Two stocks of common 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). Minke whales occurring in mission area #4 are believed to be part of the "O" stock. Buckland et al. (1992) estimated the abundance of the WNP O stock as 25,049 individuals. The best available density for common minke whales is 0.0003 animals/km^2, the highest density reported for minke whales in the ETP (Ferguson and Barlow, 2001, 2003).

D. **Fin whale**: Fin whales are not typically expected to occur south of 20°N (Mizroch et al., 2009), and during recent surveys, no fin whales were detected (Fulling et al., 2011). Due to the lack of data available for fin whales in this region, any rare fin whales potentially occurring in this region are considered part of the WNP stock, with an abundance estimated as 9,250 whales (Tillman, 1977; Mizroch, 2009). The density estimate of 0.0001 for the waters of mission area #4 was derived from data from the eastern North Pacific stock (Ferguson and Barlow, 2001 and 2003). It is conservative to use the eastern North Pacific data especially because McDonald and Fox (1999) derived an average calling fin whale density estimate of 0.000027 animals/km^2 based on recordings made north of Oahu, Hawaii, which is similar to that estimated from a shipboard line-transect survey around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

E. **Humpback whale**: Humpback whales are only expected in waters of this mission area during the winter, spring, and fall seasons, when they typically occur in water depths less than 183 m (100 fm) (Mobley et al., 2001). Humpbacks in the Guam region are part of the WNP stock, with an estimated abundance of 1,107 animals, from mark-recapture model estimates for North Pacific data from 2004 to 2006 (Calambokidis et al., 2008). A density of 0.0009 animals/km^2 for humpbacks occurring in the

waters of mission area 4 has been estimated based on data from Acebes et al. (2007) and LGL (2008).

F. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

G. **Sei whale**: The IWC recognizes one stock of sei whales in the North Pacific (Donovan, 1991), although some evidence exists for several populations (Carretta et al., 2014). Very few sightings of sei whales have occurred in any region of the North Pacific. Until the recent survey conducted in the waters of the Mariana Islands (Fulling et al., 2011), during which a total of 16 sei whale sightings were observed, sei whales were considered rare in the Marianas region. The best density estimate is 0.0003 animals animals/km^2 is derived from the 2007 surveys (Fulling et al., 2011). This is an order of magnitude higher than that calculated for around Hawaii (0.00007 animals/km^2; Bradford et al., 2013). The Marianas 2007 surveys derived an abundance estimate of 177 animals, which is similar to other site-specific estimates in the eastern North Pacific where limited sightings have occurred (Carretta et al., 2014). Therefore, the best available estimate for the entire NP stock, of which sei whales found in the waters of mission area #4 belong, is 8,600 animals based on very old whaling data (Tillman, 1977). Initial estimates for a portion of the sei whale stock off Japan indicate abundance estimates of similar magnitude (7,744 for May to June and 5,406 for July to September [Hakamada et al., 2009]).

H. **Blainville's beaked whale**: The density estimate of 0.0010 animals/km^2 derived from the Hawaii EEZ (Bradford et al., 2013) is the most appropriate for this species in this mission area. Lacking abundance data for this region, Ferguson and Barlow's (2001 and 2003) abundance estimate from the eastern Pacific that included the *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate, resulting in a total of 8,032 animals, was considered best to represent the WNP stock. Bradford et al.'s (20013) density estimate is comparable to that for Blainville's beaked whales in the eastern Pacific (0.0013 animals/km^2; Ferguson and Barlow, 2003), in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), and the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296/km^2; Ferguson et al., 2006).

I. **Common bottlenose dolphin:** Miyashita (1993) reports an abundance estimate of 168,791 animals (CV=0.261). The best available density estimate, 0.0025 animals/km^2, is calculated from the Hawaii EEZ survey data (Bradford et al., 2013). This density is comparable to that derived for this species in the eastern North Pacific at similar latitudes (0.0025 animals/km^2) (Ferguson and Barlow, 2003).

J. **Cuvier's beaked whale:** With few population data available for the western North Pacific Ocean, the best data available density and abundance estimates for the WNP stock of Cuvier's beaked whales are 0.0008 animals/km^2 for the Hawaii EEZ (Bradford et al., 2013) and 90,725 animals from the ETP (Ferguson and Barlow, 2003). The Hawaii density is less than the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

K. **Deraniyagala beaked whale**: Dalebout et al. (2014) conducted genetic and molecular analyses to demonstrate that *Mesoplodon hotaula* was genetically distinct from the ginkgo-toothed beaked whale (*M. ginkgodens*). Little is known about this beaked whale species, and no abundance or stock information is available for the Deraniyagala beaked whale. Given that this species was synonymous with the ginkgo-toothed beaked whale, which is part of the *Mesoplodon* spp. complex, the best

available density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the ETP are most appropriate for this region (Ferguson and Barlow, 2001, 2003). Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density estimate of 0.0009 animals/km^2 and abundance estimate of 22,799 animals were used for analyses for the Deraniyagala beaked whale in this mission area.

L. **Dwarf sperm whale**: Ferguson and Barlow's (2001 and 2003) derived an abundance estimate for *Kogia* spp. of 350,553 in the ETP, which is the most appropriate to use as an abundance proxy for the dwarf sperm whale in the Guam area. The 0.0071 animals/km^2 (CV=0.74) for dwarf sperm whales derived for the Hawaii EEZ (Barlow, 2006) is the best available density for the dwarf sperm whale in the Guam region.

M. **False killer whale**: Miyashita (1993) estimated the abundance of false killer whales as 16,668 animals (CV=0.263) from 34 sighting cruises associated with the Japanese drive fishery. The best available density estimate (0.0011 animals/km^2) for the WNP Pelagic stock is calculated from the winter/spring surveys in the waters of Guam and the Mariana Islands (Fulling et al., 2011). This is an order of magnitude larger than the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) but comparable to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

N. **Fraser's dolphin**: With few population data available for the WNP stock, Bradford et al.'s (2013) estimated density of 0.0069 animals/km^2 and abundance of 16,992 for Fraser's dolphins in Hawaiian waters during summer/fall surveys is the most appropriate density for this species in this mission area. Although Fraser's dolphins are estimated to occur regularly and year-round in the Mariana region's waters of the Guam mission area, no Fraser's dolphins were observed during the 2007 surveys of this area (Fulling et al., 2011).

O. **Ginkgo-toothed beaked whale**: Since no data on density or stock estimates are available for this species, the best available density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the ETP are most appropriate for this region (Ferguson and Barlow, 2001, 2003). Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density estimate of 0.0009 animals/km^2 and abundance estimate of 22,799 animals were used for analyses for the Ginkgo-toothed beaked whale in this mission area.

P. **Killer whale**: Killer whales are considered rare with limited sightings reported, and during the 2007 surveys of this area, no killer whales were observed (Fulling et al., 2011; Carretta et al., 2014). The best available density estimate, 0.00004 animals/km^2, is for killer whales in the Hawaii EEZ (Bradford et al., 2013). An abundance of 12,256 animals was estimated by Ferguson and Barlow (2001 and 20003) and is the most appropriate for this region. Mobley et al. (2000) did not report any sightings in their surveys of waters within 25 nm of the Main Hawaiian Islands.

Q. **Longman's beaked whale:** Few population data are available for this rarely observed beaked whale. No density estimates for Longman's beaked whales are available from the Mariana Islands area (Fulling et al., 2011), so the best available data are a density estimate of 0.00187 animals/km^2 (CV = 0.65) and an abundance estimate of 4,571 animals estimated for offshore Hawaiian waters (Bradford et al., 2013).

R. **Melon-headed whale**: The best available density (0.0043 animals/km^2) and abundance (2,455 animals) estimates for the melon-headed whale's Northern Mariana Island stock found in this mission area are derived from the winter/spring 2007 surveys around Guam and the Mariana Islands (Fulling et al., 2011). This is comparable to the density estimate (0.0012 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013) and in nearshore Hawaii waters (0.0021 animals/km^2) during the spring, summer and fall (Mobley et al., 2000).

S. **Pantropical spotted dolphin**: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. Miyashita (1993) reports an abundance estimate of 438,064 animals, (CV=0.174). The best available density estimate, 0.0226 animals/km^2, is calculated from the winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011). This density is greater than that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013) and comparable to that observed in nearshore waters of Hawaii (0.0407 animals/km^2; Mobley et al., 2000).

T. **Pygmy killer whale**: One sighting of six animals was observed during the 2007 surveys around the Mariana Islands, from which a density estimate (0.0001 animals/km^2) was derived (Fulling et al., 2011). Data from the eastern North Pacific was used to derive a stock-wide abundance estimate (30,214 animals) (Ferguson and Barlow, 2001 and 2003) for the WNP stock of pygmy killer whales. The density for this mission area for this species is an order of magnitude less than that observed in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013), but no pygmy killers were sighted in nearshore Hawaii waters (Mobley et al., 2000).

U. **Pygmy sperm whale**: Ferguson and Barlow's (2001 and 2003) derived an abundance estimate for *Kogia* spp. of 350,553 for in the ETP, which is the best estimate available for the WNP stock in the Guam mission area. The combined densities of 0.0029 animals/km^2 (CV=1.12) for pygmy sperm whales was derived for the Hawaii EEZ (Barlow, 2006) and was used for this species in the Guam mission area. Mobley et al. (2000) observe two pods of five individuals during the 1993 to 1998 surveys in Hawaii, but no density or abundance estimates were derived.

V. **Risso's dolphin:** Neither Fulling et al. (2011) or Mobley et al. (2000) collected sufficient sighting data to derive density or abundance estimates for this species. Miyashita (1993) reports a WNP stock estimate of 83,289 animals (CV=0.179). The density estimate of 0.0067 animals/km^2 was used for the WNP stock in this mission area and was derived from surveys in the Hawaii EEZ (Bradford et al., 2013). This density is comparable to the density estimate calculate for the eastern North Pacific (0.0007 animals/km^2; Ferguson and Barlow, 2003).

W. **Rough-toothed dolphin**: Fulling et al. (2011) did not collect sufficient sighting data to derive density or abundance estimates for this species during the 2007 surveys of this region. Thus, the best available density estimate (0.0026 animals/km^2) is calculated from Hawaii EEZ data (Bradford et al., 2013), while the best available data for abundance is estimated from the eastern North Pacific (145,729 individuals) (Ferguson and Barlow, 2001 and 2003).

X. **Short-finned pilot whale:** Insufficient sighting data were collected on this species during the 2007 surveys of this mission area's waters to derive density or abundance estimates for this species (Fulling et al., 2011). Therefore, Miyashita's (1993) estimated abundance of short-finned pilot whales as 53,608 animals (CV=0.224) from 34 sighting cruises associated with the Japanese drive fishery is most appropriate to represent the WNP stock in this mission area. The best available density estimate (0.0051 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density is an order of magnitude less than in nearshore Hawaii waters (0.0237 animals/km^2) during the spring, summer and fall (Mobley et al., 2000).

Y. **Sperm whale**: Insufficient population-level data exist to currently adequately define the stock structure of sperm whales in the North Pacific, except in U.S. EEZ waters, where for management purposes, three stocks have been defined: 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 (Allen and Angliss, 2014). Further, the NMFS considers both currently available and historical population estimates for the North Pacific stock to be unreliable (Allen and Angliss, 2014). The IWC recognizes two stocks in the North Pacific Ocean (eastern and western stocks), but stock boundaries delineation and review by the IWC are woefully out of date (Donovan, 1991). Sperm whales in the Guam mission area are part the NP stock.

Since an abundance estimate is needed for the calculation of impacts, the best available abundance estimate for the NP stock is the estimate of 102,112 individuals (Kato and Miyashita, 1998). In the 2007 surveys of the southern Mariana Islands, including Guam, Fulling et al. (2011) reported that the sperm whale was the most frequently encountered marine mammal. The density estimated for sperm whales in waters of the southern Marianas Islands, 0.0012 animals/km^2, was calculated from the 2007 winter/spring surveys reported in Fulling et al. (2011). This is comparable to the density estimate of sperm whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013).

Z. **Spinner dolphin:** Although a stock structure incorporating an inshore (insular) and pelagic stock of spinner dolphins has been suggested for the Marianas region following the stock delineation for the species in the Hawaiian archipelago (i.e., DoN, 2013a), currently sufficient population level abundance data are not available to designate insular and pelagic stocks of spinner dolphins, as are needed for computation of the percentage of the stocks affected by SURTASS LFA sonar. Similarly, in the American Samoan Islands, NMFS currently is only able to define one stock of spinner dolphins, and no stocks are designated in the Marianas Islands (Carretta et al., 2014). Thus, for the purposes of this LOAs application, spinner dolphins in the Marianas region are estimated to be part of the WNP stock, with an estimated abundance of 1,015,059 animals, as derived from Ferguson and Barlow (2001, 2003) ETP data estimates. Further, the best available density estimate for the WNP stock of spinner dolphins, 0.0008 animals/km^2, is derived from the Hawaiian pelagic survey data (Barlow, 2006); no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013). The density of Barlow (2006) is an two orders of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000).

AA. **Striped dolphin**: Two concentrations of striped dolphins exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 (CV=0.186). The best available density estimate (0.0062 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013) and in nearshore waters of Hawaii (0.0016 animals/km^2; Mobley et al., 2000).

5. MISSION AREA 5—SEA OF JAPAN

A. **Bryde's whale**: Omura (1977) refers to four major whaling grounds on the coast of Japan: waters off Bonin Islands, Sanriku, Wakayama (Taiji), and West Kyushu, although none of these are located in the Sea of Japan. However, Evans (1987) described the Bryde's whale range from northern Japan to the equator in the western North Pacific. Considering habitat preferences (e.g., water temperature, bathymetry), the best density data available are the long-term time series from the ETP (Ferguson and Barlow, 2001 and 2003), with an appropriate density estimate (0.0001 animals/km^2) to represent the WNP stock in this area. The IWC population estimate of 20,501 whales for the WNP stock was used for in analyses for this mission area (IWC, 2009). Bradford et al. (2013) observed Bryde's whales around the Hawaiian Islands, calculating a similar density estimate (0.00033 animals/km^2) to that derived for the WNP stock.

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

from ETP surveys was deemed most appropriate to represent the "O" stock animals (Ferguson and Barlow, 2001, 2003). An abundance estimate of 25,049 individuals was used to represent the O stock (Buckland et al., 1992). The Pastene and Goto (1998) abundance of 893 animals and Ferguson and Barlow's (2001 and 2003) density of 0.0002 animals/km^2 estimated from the ETP best represent the J stock of common minke whales in this mission area.

C. **Fin whale**: Fin whales migrate south in the winter to about 10°N and are found in the summer from a line near Japan north to the Chukchi Sea and Aleutian Islands (Evans, 1987). Fin whales are known to winter in the Sea of Japan and are probably found there throughout the year (Mizroch et al., 2009). An historic stock estimate for the WNP stock of fin whales, 9,250 animals, was derived from encounter rates of Japanese scouting boats in the northwest Pacific (Tillman, 1977). The current density estimate (0.0009 animals/km^2) for the WNP stock is roughly estimated from data of the ETP (Ferguson and Barlow, 2001, 2003), which is an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

D. **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 to 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 to April) and south in fall (peak months September to 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 to 2,108) (Best et al., 2001) for the WNP population. The western population may be affected by proposed LFA operations in the spring, fall, and winter in the Sea of Japan. Although no density estimates are available for this very rare marine mammal species, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis to reflect the very low probability of occurrence in this region.

E. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

F. **Western North Pacific gray whale**: Gray whales in the western North Pacific Ocean are genetically distinct from those gray whales occurring in the eastern North Pacific Ocean (LeDuc et al., 2002). New data photographing western North Pacific gray whales off the U.S. west coast has prompted NMFS to draft the first ever stock assessment report for this population (Carretta et al., 2015). The present day distribution of the WNP gray whale stock appears to range from summering grounds in west central Okhotsk Sea off the northeast coast of Sakhalin Island to wintering grounds in the South China Sea (Meier et al., 2007; Weller et al., 2002). However, some individuals that summer off Sakhalin Island have also been documented off the west coast of North America (Carretta et al.,

2015). The WNP stock of gray whales migrates through the Sea of Japan in November to December. The exact migration route is not known, and Omura (1988) indicated that gray whales were caught along the Chinese and North Korea coasts in the Sea of Japan. Gray whales presumably maintain a shallow water/nearshore affinity throughout the southern portion of their range. Photo-identification studies off Sakhalin Island estimate a population size of 140 (CV=0.043) animals in the WNP stock (Cooke et al., 2013; Carretta et al., 2015). With no density estimate for this rare species available, a minimal density of 0.0001 animals/km^2 was used in risk computation for this mission area to reflect the extremely low potential for this species occurring.

G. **Baird's beaked whale**: Kasuya (1986) reported catches of Baird's in the Sea of Japan around approximately 37°N (Toyama Bay) and off southern Hokkaido (41°-42°N). From Kasuya's (1986) encounter rate and effective search widths, an abundance estimate of 4,200 animals and a density of 0.0003 animals/km^2 were derived for a region from about 32° to 40°N and seaward of the Pacific Japanese coast out to about 150°E. However, since Kasuya's surveys did not include habitat further north, the stock estimate is increased to 8,000 to account for un-surveyed areas. This density estimate is comparable to that derived from the ETP by Ferguson and Barlow, 2001 and 2003.

H. **Common bottlenose dolphin**: Kishiro and Kasuya (1993) reported that bottlenose dolphins were caught at Ohmishima in Yamaguchi Prefecture in the Sea of Japan. Miyashita (1993) reported that reproductive differences suggest that animals from the Sea of Japan and East China Sea are members of an inshore Archipelago stock that are separate from animals in the WNP stock found in the waters of the western North Pacific Ocean. 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 tripled to derive an abundance for the inshore Archipelago stock estimate as 105,138 animals. No density estimates are available for the inshore Archipelago stock; therefore the density estimate (0.0008 animals/km^2) was calculated from LGL (2011) data.

I. **Cuvier's beaked whale:** No density or stock estimate data are available for this region, but Leatherwood and Reeves (1983) state that Cuvier's beaked whales are relatively common in the Sea of Japan. Considering habitat preferences (e.g., water temperature, bathymetry), the best available density and abundance data are derived from Ferguson and Barlow (2001, 2003) ETP survey estimates, with a representative density for the WNP stock in this area estimated as 0.0031 animals/km^2 and an abundance estimated as 90,725 animals. This density estimate is greater than that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

J. **Dall's porpoise**: Dall's porpoise are found only in the North Pacific, primarily north of 36°N in the western North Pacific Ocean. This species has two distinct color morphs: one with a white flank patch that extends forward to the dorsal fin (*dalli* type) and one with a flank patch extending all the way to the front flippers (*truei* type). These morphological differences have been noted between animals from the Pacific coast of Japan (the *truei*-type), the Sea of Japan, and Sea of Okhotsk (the *dalli*-type), and the offshore northwestern Pacific and western Bering Sea (the *dalli*-type) (Hayano et al., 2003). Hayano et al. (2003) conducted genetic studies on the three populations and found a low, but significant, difference between the Sea of Japan-Okhotsk population and the other two populations. Based on surveys of the eastern North Pacific, a density estimate of 0.0520 animals/km^2 and an abundance estimate of 76,720 animals were derived and best represent the Sea of Japan stock in this mission area (Ferguson and Barlow, 2001, 2003). This density estimates a concentration of Dall's porpoises probably larger than what would be encountered by LFA operations in the Sea of Japan since it includes survey effort in nearshore waters where animals are more often found.

K. **False killer whale**: Kishiro and Kasuya (1993) reviewed the history of Japanese coastal whaling, reporting that false killer whales were caught in the Sea of Japan along the Noto coast of Japan.

Miyashita (1993) suggested that animals summering in the Sea of Japan were probably from a separate, inshore Archipelago stock, by analogy from Pacific white-sided dolphins, than animals found in the western North Pacific. Kishiro and Kasuya (1993) cited Miyashita (1986) as estimating the population wintering in Iki Island waters (in the Korea Strait) and part of the East China Sea at 3,259 animals. Since these data represent only about one-third of the habitat of false killer whales in the East China Sea, the population estimate is tripled for the inshore Archipelago stock estimate of 9,777 animals. This is smaller than the estimated abundance of false killer whales off the Pacific coast of Japan (16,668 animals CV=0.263) (Miyashita, 1993). Since no sightings of false killer whales were made during the survey effort in the Sea of Japan and East China Sea (Miyashita, 1993), the density estimate (0.0027 animals/km^2) for this inshore Archipelago stock is derived from the northernmost region of eastern North Pacific (Ferguson and Barlow, 2001 and 2003). This is an order of magnitude larger than the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) but comparable to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

L. **Harbor porpoise:** Little is known about the harbor porpoises that are found off the northern coasts of Japan (Gaskin et al., 1993). Off the U.S. east coast and U.S. west coast, animals are found almost exclusively at water depths of less than 100 m (323 ft) (Read and Westgate, 1997; Carretta et al., 2001) and fine-scale stock structure exists (Carretta et al., 2014; Waring et al., 2014). Preliminary analysis of mitrochondrial DNA suggests that Japanese harbor porpoise group with Alaskan animals to form a genetically distinct group (Taguchi et al., 2010).Therefore, using survey data corrected for sighting biases, the abundance estimate (31,046 animals) and density estimate (0.19 animals/km^2) of the Gulf of Alaska stock are most appropriate (Hobbs and Waite, 2010; Allen and Angliss, 2014).

M. **Killer whale**: Killer whales are considered rare with limited sightings reported (Carretta et al., 2014). The best available density estimate (0.0001 animals/km^2) was derived from LGL (2011) data. The most representative abundance estimate of 12,256 animals for the WNP stock was calculated from the Ferguson and Barlow's (2001 and 2003) eastern North Pacific data. Mobley et al. (2000) did not report any sightings in their surveys of waters within 25 nm of the Main Hawaiian Islands, nor did the Fulling et al. (2011) surveys around the Mariana Islands.

N. ***Kogia* spp.:** With no available population data available for the WNP stock in the Sea of Japan, Ferguson and Barlow's (2001, 2003) abundance estimated for *Kogia* spp. of 350,553 in the ETP and their density of 0.0017 animals/km^2 were deemed the best estimate available for the Sea of Japan area. Mobley et al. (2000) observe two pods of five individuals during the 1993 to 1998 surveys in Hawaii, but no density or abundance estimates were derived.

O. **Long-beaked common dolphin**: The overall distribution of this species is difficult to determine because until 1994, all common dolphins around the world were classified as a single species, *Delphinus delphis.* Long-beaked common dolphins generally occur within about 180 km of the coast in tropical and warm-temperate waters (Jefferson and Van Waerebeek, 2002). The best density estimate (0.1158 animals/km^2) and abundance estimate (279,182 animals) are from a line-transect survey off the North American west coast, specifically designed to target this species (Carretta et al., 2011a).

P. **Pacific white-sided dolphin**: Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a separate, inshore Archipelago stock than animals found in offshore North Pacific waters (Miyashita, 1993; Hayano et al., 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al. 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow, 2001, 2003). Without any

data for the inshore Archipelago stock, it is roughly estimated that the abundance estimate from the WNP (931,000 animals) and the density estimate (0.0030 animals/km^2) from the ETP (Ferguson and Barlow, 2001, 2003) are most appropriate to represent the inshore Archipelago stock. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Barlow, 2006; Mobley et al., 2000).

Q. **Risso's dolphin**: Kishiro and Kasuya (1993) reported that Risso's dolphins were caught on islands in the Korea Strait. Miyashita (1993) reported sightings in the Sea of Japan during June surveys (no effort during other months) and suggested by analogy to bottlenose dolphins and Pacific white-sided dolphins that Risso's summering in the Sea of Japan represent a separate, inshore Archipelago stock separate from the WNP stock. There are no separate data reported for the Sea of Japan or East China Sea, however. Therefore, the WNP stock estimate (83,289 animals, CV=0.179) and density estimate (0.0073 animals/km^2) derived from the Pacific coast of Japan (Miyashita, 1993) are most appropriate to represent the inshore Archipelago stock that occurs in the Sea of Japan. This stock density is comparable to that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013), and no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al., 2000), or around Guam and the Mariana Islands (Fulling et al., 2011).

R. **Rough-toothed dolphin**: With the absence of population data for this dolphin in the Sea of Japan, the best available density estimate (0.0026 animals/km^2) to represent the WNP stock that occurs in the Sea of Japan is calculated from the survey data in the Hawaii EEZ (Bradford et al., 2013), while the best available data on for an abundance estimate is from the eastern North Pacific (145,729 individuals) (Ferguson and Barlow, 2001, 2003). The density is comparable to that in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

S. **Short-beaked common dolphin:** Common dolphins have been caught on the Tsushima Islands in the Korea Strait (Kishiro and Kasuya, 1993). However, no data on density or stock estimates are available (Miyashita, 1993). The density estimate (0.0860 animals/km^2) and abundance estimate of 3,286,163 animals were calculated from Ferguson and Barlow (2001, 2003) in the eastern North Pacific at similar latitudes are the most appropriate to represent the WNP stock of short-beaked common dolphins in the Sea of Japan.

T. **Short-finned pilot whale**: Kishiro and Kasuya (1993) reported that short-finned pilot whales are uncommon in the Sea of Japan and that insufficient information exists from which to determine whether the southern or northern form occurs in the region. Due to limited data specific to this region, data from the Pacific coast of Japan and Taiwan and the eastern North Pacific were used to represent this stock in this area. Miyashita (1993) estimated a short-finned pilot whale abundance of 53,608 animals (CV=0.224) from 34 sighting cruises associated with the Japanese drive fishery and also derived density estimates in 1° latitude by 1° longitude boxes as 0.0014 animals/km^2. This estimate was similar to a density estimate derived from analogous latitudes in the eastern North Pacific (Ferguson and Barlow, 2003), but less than that found in pelagic waters of the Hawaii EEZ (0.0051 animals/km^2; Bradford et al., 2013).

U. **Sperm whale**: Stock structure of sperm whales in the North Pacific Ocean remains unclear except in U.S. EEZ waters (Allen and Angliss, 2014). Kasuya and Miyashita (1988) reported no Japanese whaling stations processing sperm whales in the Sea of Japan (Leatherwood and Reeves, 1983). Gregr and Trites (2001) reviewed sperm whale catch data off the coast of British Columbia to determine habitat preferences, and it is possible that the Sea of Japan provides adequate habitat conditions for sperm whales. The density, 0.0012 animals/km^2, estimated for sperm whales from the dedicated surveys in the waters around the Mariana Islands (Fulling et al., 2011) represents the best available density for this mission area. Kato and Miyashita's (1998) sperm whale abundance estimate of 102,112 animals for the NP stock that migrates between Alaska and the western North Pacific is the best currently available for the overall stock. The Sea of Japan density is comparable to that (0.0014 animals/km^2) estimated for the main Hawaiian Islands (Bradford et al., 2013) and the density

estimate (0.00123 animals/km^2) calculated from the winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011) for this species.

V. **Spinner dolphin:** Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait and adjacent waters to the north but no spinner dolphin sightings were reported from the Sea of Japan. This species is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and there are no data on density or stock estimates (Miyashita, 1993). Thus, the best available density estimate (0.0008 animals/km^2) for possible occurrence in summer and fall is derived from the Hawaii EEZ (Barlow, 2006), which is an order of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000); no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013). The best data available abundance estimate (1,015,059 animals) for spinner dolphins in the WNP stock is that derived from ETP surveys (Ferguson and Barlow, 2001, 2003).

W. **Stejneger's beaked whale**: Miyazaki et al. (1987) reported four Stejneger's beaked whales stranded in the Sea of Japan at about 37°N, 135°E. Density or stock estimate data are not available for the WNP stock in this region. Considering habitat preferences (e.g., water temperature, bathymetry), the most appropriate Stejneger's density estimate of 0.0005 animals/km^2 is derived from ETP data of Ferguson and Barlow (2001, 2003), with the most appropriate abundance (8,000 animals) approximated from that derived for the WNP stock of Baird's beaked whales (Kasuya, 1986).

X. **Striped dolphin**: Recent research on genetic differentiation suggests that dolphins found in coastal Japanese waters and the Sea of Japan belong to a separate, inshore Archipelago stock than animals found in offshore North Pacific waters (Miyashita, 1993; Hayano et al., 2004). However, with no specific data on this inshore stock, Miyashita's (1993) total population estimate of 570,038 (CV=0.186) for the WNP stock is roughly considered most appropriate to represent the inshore Archipelago stock, as is the best available density estimate of 0.0058 animals/km^2 derived from LGL (2011) data. This density is comparable to that observed in the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013).) and in nearshore waters of Hawaii (0.0016 animals/km^2; Mobley et al., 2000).

6. MISSION AREA 6—EAST CHINA SEA

A. **Bryde's whale:** Yoshida and Kato (1999) identified three 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 within this mission area belong to the East China Sea (ECS) stock. The best available population estimate for the ECS stock is estimated by the IWC as 137 whales (IWC, 1996). Without survey information for the region, the best available density estimate is from the 2010 Hawaii EEZ survey (0003 animals/km^2; Bradford et al., 2013), which is comparable to the ETP (0.0009 animals/km^2; Ferguson and Barlow, 2001, 2003) and Guam and the Mariana Islands (0.00041 animals/km^2) (Fulling et al., 2011).

B. **Common minke whale**: Minke whales have been reported from the East China Sea and the Yellow Sea. Although minke whales in the East China Sea are believed to be from the J-stock (Butterworth et al., 1996; Gong, 1988), migrating into the region in the winter, conservatively however, estimates are included for both the O stock and the J stock, given the limited amount of data on either stock. Therefore, an estimate for the WNP O stock of 25,049 animals with the density of 0.0044 animals/km^2 were derived based on encounter rates in the favored whaling grounds of the western North Pacific (Buckland et al., 1992). The density, 0.0018 animals/km^2, estimated by Buckland et al. (1992) for the J stock was used to represent this stock in this mission area but the abundance of 893 animals is estimated by Pastene and Goto (1998). These estimates are an order of magnitude higher than any calculated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003).

C. **Fin whale**: Fin whales winter in the East China Sea and Yellow Sea. The East China Sea population of fin whales is thought to be resident and is considered to represent a distinct population (Evans,

1987). There are limited data on distribution and abundance, however, for fin whales in this region (Mizroch et al., 2009). Density and stock estimates for the East China Sea stock of fin whales were thus derived from encounter rates of Japanese scouting boats in the northwest Pacific (Tillman, 1977; Mizroch et al., 2009), resulting in an abundance estimated as 500 fin whales and a density estimated as 0.0002 animals/km^2. This density is comparable to density estimates in the ETP (Ferguson and Barlow, 2001, 2003) and an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

D. **North Pacific right whale**: The WNP 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 to February) makes a definitive assessment impossible (Brownell et al., 2001). Clapham et al. (2004) noted the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February to April) and south in fall (peak months September to 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 WNP population. Although no density estimates are available for this very rare marine mammal species, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis to reflect the very low probability of occurrence in this region during winter and spring.

E. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

F. **Western North Pacific gray whale**: Gray whales in the western North Pacific Ocean are genetically distinct from those gray whales occurring in the eastern North Pacific Ocean (LeDuc et al., 2002). New data photographing western North Pacific gray whales off the U.S. west coast has prompted NMFS to draft the first ever stock assessment report for this population (Carretta et al., 2015). The exact location of winter breeding grounds for this species is not known, though it is hypothesized that western Pacific gray whales overwinter in the East and South China Seas, in the vicinity of Korea and China (Evans, 1987, Omura, 1988). The exact migration route is not known, but western North Pacific gray whales 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 migration, WNP gray whales may be found up to 741 km (400 nmi) offshore (Weller et al., 2002). In addition, some individuals that summer off Sakhalin Island have also been documented off the west coast of North America (Carretta et al., 2015). Photo-identification studies off Sakhalin Island estimate a population size of 140 (CV=0.043) animals in the WNP stock (Cooke et al., 2013; Carretta et al., 2015). With no density estimate for this rare species available, a minimal density of 0.0001 animals/km^2 was used in risk computation for this mission area to reflect the extremely low potential for this species occurring.

G. **Blainville's beaked whale:** With no population data available for this species in the East China Sea, the best available data are the density estimate (0.0005 animals/km^2) and abundance estimate of 8,032 animals derived from the eastern Pacific survey data (Ferguson and Barlow, 2001, 2003). The *Mesoplodon densirostris* estimate was added to one-fifth of the *Mesoplodon* spp. abundance estimate for an estimate of 8,032 animals. The density estimate is comparable to that for Blainville's beaked whales in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), and the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296/km^2; Ferguson et al., 2006).

H. **Common bottlenose dolphin**: Kishiro and Kasuya (1993) reported that bottlenose dolphins were caught in the Korea Strait and off Goto Island in the East China Sea. Miyashita (1993) reported that reproductive differences suggest that animals from the Sea of Japan and East China Sea are a separate, inshore Archipelago stock from animals in the western North Pacific. Kishiro and Kasuya (1993) cited 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, this population estimate is tripled to represent the inshore Archipelago stock estimate (105,138 animals). No density estimates were available for this stock; therefore, a density estimate of 0.0008 animals/km^2 was derived from LGL (2011). This is appropriate since bottlenose dolphins were sighted in the East China Sea survey effort (Miyashita, 1993). This density estimate is lower than that of Mobley et al. (2000) estimate around Hawaii (0.0103 animals/km^2) but is more comparable to that derived for offshore waters around Hawaii (0.0025 animals/km^2; Bradford et al., 2013).

I. **Cuvier's beaked whale:** No density or stock estimate data are available for this region for Cuvier's beaked whales. Considering habitat preferences (e.g., water temperature, bathymetry) of this species elsewhere in the North Pacific Ocean, the best data available to represent the WNP stock are those derived for the ETP with a density estimate 0.0003 animals/km^2 and an abundance estimate of 90,725 animals (Ferguson and Barlow, 2001, 2003). This density estimate is comparable to that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013).

J. **False killer whale**: Miyashita (1993) suggested that animals summering in the eastern Asian continental seas are probably from a separate, inshore Archipelago stock than animals offshore in the western North Pacific (i.e., WNP stock) by analogy from Pacific white-sided dolphins. Kishiro and Kasuya (1993) cited Miyashita (1986) as estimating the population wintering in the East China Sea at 3,259 animals. Since these data represent only about one-third of the habitat of false killer whales in the East China Sea, the population estimate of 3,259 animals was tripled to represent the inshore Archipelago stock estimate (9,777 animals). There are no data on density estimates for the East China Sea. Thus, the best available density estimate (0.0011 animals/km^2) to represent the inshore Archipelago stock is derived from the winter/spring survey around Guam and the Mariana Islands (Fulling et al., 2011). This density is comparable to the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

K. **Fraser's dolphin:** Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. With no data available on stock or density estimates for the western North Pacific or the East China Sea, the population estimate (220,789 animals) from the ETP (Ferguson and Barlow, 2001, 2003) is most appropriate for application to this area, while Bradford et al.'s (2013) density estimate (0.0069 animals/km^2) derived for the Hawaiian EEZ is the most appropriate density for this mission area.

L. **Ginkgo-toothed beaked whale:** Miyazaki et al. (1987) reported no strandings of ginkgo-toothed beaked whales in the East China Sea. Although the ginkgo-toothed beaked whales in the East China

Sea probably represent a separate population from that of the offshore western North Pacific, no data are available for a distinct stock. With no data on density or stock estimates available for this species, density was roughly estimated as 0.0005 animals/km^2 and abundance estimated at 22,799 animals for *Mesoplodon* spp. at the same latitude from the eastern Pacific survey data (Ferguson and Barlow, 2001, 2003). This density estimate is an order of magnitude less than that for unidentified beaked whales in the Hawaii EEZ (0.0.0021 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

M. **Killer whale**: Killer whales are considered rare with limited sightings reported (Carretta et al., 2014). The best available density estimate (0.0001 animals/km^2) is estimated from LGL (2011) data for the WNP stock while the best abundance estimate (12,256 animals) are derived from the eastern North Pacific by Ferguson and Barlow (2001, 2003). Mobley et al. (2000) did not report any sightings in their surveys of waters within 25 nmi of the Main Hawaiian Islands, nor did the Fulling et al. (2011) surveys around the Mariana Islands.

N. ***Kogia* spp.:** At the latitude of this mission area, *Kogia breviceps* and *Kogia sima* are both expected to occur. However, no density or abundance estimates are available for these species in this region. Summing the abundances of *Kogia breviceps, Kogia sima, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001, 2003), an overall abundance of 350,553 animals is computed in the ETP, and this abundance is thus deemed most appropriate to represent the WNP stock of *Kogia* spp. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N (Ferguson and Barlow, 2001, 2003), a density estimate of 0.0017 animals/km^2 was considered the best available for this stock in this region. This density estimate is comparable to that derived for pygmy sperm whale (0.00291 animals/km^2 (CV=1.12) and dwarf sperm whale (0.00714 animals/km^2 (CV=0.74) observed within the Hawaii EEZ (Barlow, 2006).

O. **Long-beaked common dolphin:** The overall distribution of this species is difficult to determine because until 1994, all common dolphins around the world were classified as a single species, *Delphinus delphis.* Long-beaked common dolphins generally occur within about 180 km of the coast in tropical and warm-temperate waters (Jefferson and Van Waerebeek, 2002). The best density estimate (0.1158 animals/km^2) and abundance estimate (279,182 animals) are from a line-transect survey off the North American west coast, specifically designed to target this species (Carretta et al., 2011a).

P. **Longman's beaked whale:** Ferguson and Barlow (2001) reported that all Longman's beaked whale sightings were south of 25ºN. No population estimates are available for this beaked whale in this mission area. Therefore, the density estimate of 0.0003 animals/km^2 derived from LGL (2011) data and the abundance estimate of 4,571 animals in offshore Hawaiian waters (Bradford et al., 2013) were considered best to represent the WNP stock, animals of which potentially occur in the East China Sea.

Q. **Melon-headed whale:** Very few records of melon-headed whales are available for this region. The first record of melon-headed whales in Korean waters occurred in January 2009 with the stranding of an adult male reported from the southeast corner of the country (Kim et al., 2010). Melon-headed whales are probably uncommon in the colder waters of the East China Sea. The best available density estimate (0.0043 animals/km^2) to represent the WNP stock is calculated from the winter/spring survey around Guam and the Mariana Islands (Fulling et al., 2011). This is comparable to the density estimate (0.0012 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013) and in nearshore Hawaii waters (0.0021 animals/km^2) during the spring, summer and fall (Mobley et al., 2000). An abundance estimate of 36,770 animals derived from the survey data of eastern North Pacific best represents the WNP stock (Ferguson and Barlow, 2001, 2003).

R. **Pacific white-sided dolphin:** Recent research on genetic differentiation suggests that animals found in continental eastern Asian seas belong to a separate, inshore Archipelago (IA) stock than animals found in offshore North Pacific waters (Miyashita, 1993; 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). However, with no other data available to represent the IA population, the abundance of 931,000 animals was roughly estimated from the western North Pacific, and the density estimate (0.0028 animals/km^2) from the ETP (Ferguson and Barlow, 2001, 2003) was most appropriate to represent the occurrences of this dolphin in this area during winter and spring. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Barlow, 2006; Mobley et al., 2000).

S. **Pantropical spotted dolphin:** Gilpatrick et al. (1987) reported some animals from along the chain of the Ryukyu Islands. Miyashita (1993) summarized data from 34 sighting cruises conducted as part of the Japanese drive fishery; the data showed no discontinuity in sightings to suggest different stocks, but based on data from the ETP, it is possible that multiple populations exist in the western North Pacific (Miyashita, 1993). Following the division of stocks for other dolphins in the eastern Asian continental seas, pantropical dolphins in the East China Sea are considered to belong to an IA stock (after Miyashita, 1993). Although Miyashita (1993) computed a total WNP population size of pantropical spotted dolphins as 438,064 animals (CV=0.174), this stock abundance was halved (219,032 individuals) to best represent the IA stock of this species. Miyashita's (1993) density estimated at 0.0137 animals/km^2 for the WNP stock is the best available to represent the IA stock. This density is comparable to those observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

T. **Pygmy killer whale**: There was no mention of pygmy killer whale sightings in Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or stock estimates off Japan or Taiwan have been reported (Miyashita, 1993). The best available density estimate (0.0001 animals/km^2) is calculated from the winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011). This is an order of magnitude less than that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013). No pygmy killer whales were seen in nearshore aerial during the spring, summer and fall (Mobley et al., 2000). An abundance of 30,214 animals was estimated from Ferguson and Barlow's (2001, 2003) eastern North Pacific data and is considered the best available to represent the WNP stock of pygmy killer whales.

U. **Risso's dolphin:** Kishiro and Kasuya (1993) reported that Risso's dolphin inhabit the East China Sea. Miyashita (1993) reported sightings in the East China Sea during June and September surveys (no effort during other months) and suggested, by analogy to bottlenose dolphins and Pacific white-sided dolphins, that animals summering in this area represent a separate, IA stock from the WNP stock. However, no population data have been reported for the Sea of Japan or East China Sea. Consequently, abundance estimated for the WNP stock as 83,289 animals (CV=0.179) and density estimated as 0.0106 animals/km^2, both derived for the southeast Pacific coast of Japan/east of Taiwan by Miyashita (1993) were used to represent the IA stock in this mission area. For comparison, no density estimates were available from Mobley et al. (Mobley et al., 2000) and Fulling et al. (2011), and an estimate of 0.0067 animals/km^2 was reported in the offshore waters of Hawaii (Bradford et al., 2013).

V. **Rough-toothed dolphin:** There are no data on stock or density estimates for the rough-toothed dolphin in the western North Pacific Ocean. Therefore, a density estimated for this species in waters of the Hawaii EEZ (0.0026 animals/km^2; Bradford et al., 2013) was deemed most appropriate to characterize the WNP stock. An abundance of 145,729 animals was estimated from Ferguson and Barlow's (2001, 2003) ETP data to represent the WNP stock, which occurs in this mission area. The density is comparable to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000) and an

order of magnitude larger than that observed around Guam and the Mariana Islands (0.00029 animals/km^2; Fulling et al., 2011).

W. **Short-beaked common dolphin**: Common dolphins have been caught off Goto Island in the East China Sea (Kishiro and Kasuya, 1993). Common dolphins have not been sighted by Barlow (2006) or Mobley et al. (2000) in Hawaii surveys or by the Fulling et al. (2011) during surveys around Guam and the Mariana Islands. Miyashita (1993) reported no data on density or stock estimates for this species. Lacking data on stock or population estimates for the central or western North Pacific for the short-beaked common dolphin, the abundance, 3,286,163 animals, and density, 0.0461 animals/km^2, derived from the same latitude in the ETP (Ferguson and Barlow, 2001, 2003) were considered most appropriate for the WNP stock in this mission area.

X. **Short-finned pilot whale:** Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35 to 43°N). However, Kishiro and Kasuya (1993) reported that short-finned pilot whales are uncommon in the East China Sea and that information is insufficient to ascertain whether the southern or northern form occurs in this region. Further, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya, 1993) and was not, thus, included in the Miyashita (1993) analyses, in which he estimated an abundance (53,608 animals, CV=0.224) of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery. Miyashita's (1993) abundance was considered the best available to represent the WNP stock. The best available density estimate (0.0016 animals/km^2) is calculated from the winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011). This density estimate is lower than that found in pelagic waters of the Hawaii EEZ (0.0051 animals/km^2; Bradford et al., 2013)) and an order of magnitude less than in nearshore Hawaii waters (0.0237 animals/km^2) during the spring, summer and fall (Mobley et al., 2000).

Y. **Sperm whale**: Stock structure of sperm whales in the North Pacific Ocean remains unclear except in U.S. EEZ waters (Allen and Angliss, 2014), and all sperm whales occurring in the North Pacific are currently classified as one stock, the NP stock. De Boer (2000) sighted sperm whales in the South China Sea and suggested that whales seen west of the Balabac Strait might be migrating between the South China and Sulu Seas. Based on such movements, sperm whales might also be found in the East China Sea, where habitat characteristics suggest that conditions are conducive for sperm whale occurrence. The best available abundance estimate for the sperm whales potentially occurring in the East China Sea mission area is that of the NP population of sperm whales, 102,112 individuals (CV=0.155), which was derived by Kato and Miyashita (1998). The most appropriate density estimate (0.00123 animals/km^2) is derived from recent survey data collected in the southern Mariana Islands (Fulling et al., 2011). This density estimate is comparable to the Bradford et al. (2013) Hawaii estimate (0.0014 animals/km^2).

Z. **Spinner dolphin**: Gilpatrick et al. (1987) reported a high density of spinner dolphin sightings in the Korea Strait and adjacent waters to the north, but no spinner dolphin sightings were reported from the East China Sea. Neither is this species mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or stock estimates are available (Miyashita, 1993). Given this lack of available data, the best available density estimate (0.0008 animals/km^2) is calculated from the Hawaii EEZ survey data (Barlow, 2006), which is an order of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000); no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013). The best data available abundance estimate for spinner dolphins is (1,015,059 animals) is derived from surveys of the ETP (Ferguson and Barlow, 2001, 2003).

AA. **Striped dolphin**: Two concentrations of striped dolphins exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. The boundaries between these populations, however, have not yet been resolved, and it is possible that the inshore population is connected to the Sea of Japan/East China Sea as an IA stock, as analogy from bottlenose dolphins (Miyashita, 1993). Miyashita's (1993) total population estimate of 570,038 animals (CV=0.186) best represents the IA stock of striped dolphins, while LGL's (2011) density of 0.0058 animals/km^2 is most appropriate for this stock in this region. This density is comparable to the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013)), from nearshore Hawaii (0.0016 animals/km^2; Mobley et al., 2000), and from Guam and the Mariana Islands (0.00616 animals/km^2; Fulling et al., 2011).

7. MISSION AREA 7—SOUTH CHINA SEA

A. **Bryde's whale:** Yoshida and Kato (1999) identified three 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. Bryde's found in this mission area are considered part of the WNP stock. De Boer (2000) sighted Bryde's whales in this region but reported no stock data; therefore, the IWC (2009) population estimate of 20,501 whales is considered the most appropriate. Ohsumi's (1977) western North Pacific density estimate is most appropriate (0.0006 animals/km^2) and is comparable to that derived by Fulling et al. (2007) (0.00041 animals/km^2) in Mariana waters, Bradford et al. (2013) (0.00033 animals/km^2) in Hawaiian waters, and Ferguson and Barlow (2001, 2003) for the ETP.

B. **Common 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, Smith et al. (1997) did not document them during their cruises, nor were they reported from historical "whale temples." Whaling data from the East China Sea suggest that animals do not migrate through the Taiwan Strait, though other studies (Butterworth et al., 1996; Gong, 1988) indicate that individuals in the South China Sea might be from the J-stock, migrating into the region in the winter. To be conservative, estimates are included for both the O stock and the J stock for the South China Sea, given the limited amount of data on either stock. Therefore, an estimate for the WNP O stock of 25,049 animals with the density of 0.0044 animals/km^2 were derived based on encounter rates in the favored whaling grounds of the western North Pacific (Buckland et al., 1992). The density, 0.0018 animals/km^2, estimated by Buckland et al. (1992) for the J stock was used to represent this stock in this mission area but the abundance of 893 animals is estimated by Pastene and Goto (1998). These estimates are an order of magnitude higher than any calculated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003)

C. **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, during which fin whales and a sperm whale were sighted west of the Balabac Strait, suggesting 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 (De Boer, 2000). A population of fin whales is thought to be resident and may represent a distinct East China Sea population (Evans, 1987). Without any population data for fin whales in the South China Sea, data from the WNP stock are estimated to be most appropriate to represent fin whales in this mission area (Mizroch et al., 2009). Density (0.0002 animals/km^2) and abundance (9,250 animals) estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Tillman, 1977). This density is comparable to density estimates in other areas of the ETP (Ferguson and Barlow, 2001, 2003) and an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

D. **North Pacific right whale**: During limited survey effort in the South China Sea, no observations of right whales have ever been reported in the area (Clapham et al., 2004). In addition, right whales migrate further north to feed during summer, and are thus not expected in this mission at that time of

year. Right whales are likely to occur in the South China Sea primarily during winter but also may be found in these waters as they migrate north and south in spring and fall. Due to the lack of population level data for the North Pacific right whale in this region, an abundance estimate of 922 animals derived from Japanese sighting cruises in the Okhotsk Sea (Best et al., 2001) was used for this mission area. Although no density estimates are available for this very rare marine mammal species, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis to reflect the very low probability of occurrence in this region.

E. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

F. **Western North Pacific gray whale**: Gray whales found in the western and eastern North Pacific are genetically and distributionally distinct (LeDuc et al., 2002). New data photographing western North Pacific gray whales off the U.S. west coast has prompted NMFS to draft the first ever stock assessment report for this population (Carretta et al., 2015). Gray whales are expected to occur principally in this mission area during the winter season but also may occur in these waters as they migrate north and south during spring and fall. Exact wintering grounds of this species are not known but are believed to be located in the South China Sea, in the vicinity of Korea, and China (Evans, 1987; Omura, 1988). Presumably gray whales maintain a shallow water/nearshore affinity throughout this southern portion of their range. The exact migration route of gray whales in the western North Pacific 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 741 km (400 nmi) offshore (Weller et al., 2002). In addition, some individuals that summer off Sakhalin Island have also been documented off the west coast of North America (Carretta et al., 2015). Photo-identification studies off Sakhalin Island estimate a population size of 140 (CV=0.043) animals in the WNP stock (Cooke et al., 2013; Carretta et al., 2015). With no density estimate for this rare species available, a minimal density of 0.0001 animals/km^2 was used in risk computation for this mission area to reflect the extremely low potential for this species occurring.

G. **Blainville's beaked whale:** Miyazaki et al. (1987) did not report any strandings of *M. densirostris* from the South China Sea. Neither De Boer (2000) nor Miyashita et al. (1996) observed any *M. densirostris* during their research cruises. Lacking data on stock or density estimates for the western North Pacific for this species, data from the ETP surveys (Ferguson and Barlow, 2001, 2003) are most appropriate to represent this species in this mission area. The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate in the ETP data results in an abundance estimate of 8,032 animals while the *Mesoplodon* spp. density estimate, 0.0005 animals/km^2, is best for use at this area (Ferguson and Barlow, 2001, 2003). This density estimate can be compared to that for Blainville's beaked whales in the Hawaii EEZ (0.0010 animals/km^2; Bradford et al., 2013), in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), and the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

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

suggest that animals from the Sea of Japan and East China Sea are a separate, IA stock than animals in the western North Pacific. It is highly likely that bottlenose dolphins found in the Sea of Japan, East China Sea, and South China Sea belong to the same IA stock. For this reason, the stock of bottlenose dolphins in the South China Sea is classified as part of the IA stock. Kishiro and Kasuya (1993) cite Miyashita (1986) as estimating the abundance of the stock in the East China Sea as 35,046 animals. Since these data represent only about one-third of the habitat of bottlenose dolphins in the East China Sea, the population estimate was tripled (105,138 animals) to represent the IA stock, and that abundance represents the IA stock in this sea. No density estimates are available for this stock; therefore, a density estimate was derived 0.0008 animals/km^2 estimated by LGL (2011) was most appropriate. This is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003) and lower than those around Hawaii, 0.0103 animals/km^2 (Mobley et al. 2000), 0.0025 animals/km^2 (Bradford et al., 2013), and around Guam and the Mariana Islands, 0.00021 animals/km^2 (Fulling et al., 2011).

I. **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, however. Considering habitat preferences (e.g., water temperature, bathymetry), the best available data to characterize the WNP stock found in this mission area are the density estimate (0.0003 animals/km^2) and the abundance estimate of 90,725 animals from the same latitude in the eastern Pacific (Ferguson and Barlow, 2001, 2003). This density is comparable to that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) but less than the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

J. Deraniyagala beaked whale: Dalebout et al. (2014) conducted genetic and molecular analyses to demonstrate that *Mesoplodon hotaula* was genetic distinct from the ginkgo-toothed beaked whale (*M. ginkgodens*). Little is known about this beaked whale species. No abundance or stock information is available for the Deraniyagala beaked whale. Given that this species was synonymous with the ginkgo-toothed beaked whale, which is part of the *Mesoplodon* spp. complex, the best available density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the ETP are most appropriate for this region (Ferguson and Barlow, 2001, 2003). Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density estimate of 0.0005 animals/km^2 and abundance estimate of 22,799 animals were used for analyses for the Deraniyagala beaked whale in this mission area.

K. **False killer whale:** False killer whales are sighted infrequently in the South China Sea (De Boer, 2000; Miyashita et al., 1996; Smith et al., 1997). Miyashita (1993) suggested that animals summering in the Sea of Japan are probably from a separate, IA stock, by analogy of Pacific white-sided dolphins, than animals from the WNP stock. It is reasonable to assume that false killer whales occurring in the Sea of Japan, East China Sea, and South China Sea are all part of same, IA stock. Kishiro and Kasuya (1993) cited Miyashita (1986) as estimating the population wintering in the East China Sea at 3,259 animals. Since these data represent only about one-third of the habitat of false killer whales in the area, the population estimate was tripled (9,777 individuals) to represent the IA stock estimate. With no data available on density estimates for this species in the South China Sea, the best available density estimate (0.0011 animals/km^2) calculated from the winter/spring survey around Guam and the Mariana Islands (Fulling et al., 2011) was used for this species in this mission area. This density is comparable to the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

L. **Fraser's dolphin**: Kishiro and Kasuya (1993) report catches of Fraser's dolphins off the Pacific coast of Japan in drive fisheries. No population data are available on this species in the western North Pacific Ocean or in the South China Sea. Lacking stock or density data, an abundance most appropriate to represent the WNP stock of Fraser's dolphins of 220,789 animals is derived from the

ETP (Ferguson and Barlow, 2001, 2003) while the best available density estimate of 0.0069 animals/km^2 is derived from the Hawaii EEZ survey (Bradford et al., 2013).

M. **Ginkgo-toothed beaked whale:** Miyazaki et al. (1987) report no strandings of *M. ginkgodens* from the South China Sea. Neither De Boer (2000) nor Miyashita et al. (1996) observed ginkgo-toothed beaked whales during their research cruises. Since no data on density or stock estimates are available for this species in the North Pacific Ocean, a density (0.0005 animals/km^2) and abundance (22,799 animals) estimated for *Mesoplodon* spp. at the same latitude in the eastern Pacific (Ferguson and Barlow, 2001, 2003) was considered most appropriate to characterize this species' population in this mission area. This density estimate is an order of magnitude less than that for unidentified beaked whales in the Hawaii EEZ (0.0.0021 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

N. **Killer whale**: Killer whales are considered rare with limited sightings reported (Carretta et al., 2014), especially in the western North Pacific Ocean. The best available density estimate (0.0001 animals/km^2) derived by LGL (2011) and abundance estimate (12,256 animals) calculated from ETP survey data (Ferguson and Barlow, 2001 and 2003) are used to characterize the WNP stock of killer whales found in this mission area. Mobley et al. (2000) did not report any sightings in their surveys of waters within 25 nmi of the Main Hawaiian Islands, nor did the 2007 surveys around the Mariana Islands (Fulling et al., 2011).

O. ***Kogia* spp.**: Both *Kogia breviceps* and *Kogia sima* potentially may occur in this region. Smith et al. (1997) reported that *Kogia* were found in "whale temples" in nations surrounding the South China Sea. No sightings of *Kogia* spp. were made by De Boer (2000) during his survey. No density or abundance estimates are available for this species in this region. Summing the abundances of *Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001, 2003), an overall abundance of 350,553 animals is computed in the ETP and best represents the WNP stock of *Kogia* spp. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N, the derived density estimate of 0.0017 animals/km^2 from that area best represents the WNP stock (Ferguson and Barlow, 2001 and 2003). This density is comparable to the density estimates for pygmy sperm whale (0.00291 animals/km^2 CV=1.12) and dwarf sperm whale (0.00714 animals/km^2 CV=0.74) observed within the Hawaii EEZ (Barlow, 2006).

P. **Long-beaked common dolphin:** The overall distribution of this species is difficult to determine because until 1994, all common dolphins around the world were classified as a single species, *Delphinus delphis.* Long-beaked common dolphins generally occur within about 180 km of the coast in tropical and warm-temperate waters (Jefferson and Van Waerebeek, 2002). The best density estimate (0.1158 animals/km^2) and abundance estimate (279,182 animals) are from a line-transect survey off the North American west coast, specifically designed to target this species (Carretta et al., 2011a).

Q. **Longman's beaked whale:** Ferguson and Barlow (2001) reported that all Longman's beaked whale sightings occurred south of 25ºN. No population data are available for this species in this mission area or for the WNP stock. Lacking data, the best available density estimate for Longman's beaked whales in the WNP stock is that estimated of by LGL (2011) as 0.0003 animals/km^2, while the best available abundance for this stock is that estimated as 4,571 animals in offshore Hawaiian waters (Bradford et al., 2013).

R. **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, melon-headed whales have been observed in the South China Sea (De Boer, 2000) and are reported from "whale temples" on islands surrounding the South China Sea (Smith et al., 1997). However, they were not observed by Miyashita et al. (1996). With no specific population data for this mission area, the best available

density estimate (0.0043 animals/km^2) is calculated from the winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011). This density is comparable to the density estimate (0.0012 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013) and in nearshore Hawaii waters (0.0021 animals/km^2) during the spring, summer and fall (Mobley et al., 2000). An abundance estimate (36,770 animals) derived from the eastern North Pacific survey data (Ferguson and Barlow, 2001, 2003) was considered most appropriate to represent the WNP stock of these whales.

S. **Pantropical spotted dolphin**: These animals have been reported during the De Boer (2000) research cruise, were observed in winter (January to February) in the South China Sea by Miyashita et al. (1996), were reported from historical "whale temples" (Smith et al., 1997), and also summarized by Gilpatrick et al. (1987) from one record west of Taiwan in the northern portion of the South China Sea. It is reasonable to assume that false killer whales occurring in the Sea of Japan, East China Sea, and South China Sea are all part of same, IA stock, which reflects data fro this species from the ETP, where multiple populations exist (Miyashita, 1993). Miyashita (1993) summarized data from 34 sighting cruises conducted as part of the Japanese drive fishery and derived a population estimate for the western North Pacific as 438,064 animals (CV=0.174) and a density estimate as 0.0137 animals/km^2. Based on these Miyashita (1993) data, the IA population in the South China Sea of 219,032 animals was estimated by halving the abundance of the WNP stock (with the same density estimate of 0.0137 animals/km^2). This density is comparable to those observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

T. **Pygmy killer whale:** 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). Therefore, the best available density estimate to represent the WNP stock in this mission area was judged to be 0.0001 animals/km^2 derived from the winter/spring 2007 surveys around Guam and the Mariana Islands (Fulling et al., 2011). This density is an order of magnitude less than that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013). The best available abundance estimate of 30,214 animals from the eastern Pacific (Ferguson and Barlow, 2001, 2003) was considered to best represent the WNP stock of pygmy killer whales.

U. **Risso's dolphin**: Smith et al. (1997) reported that Risso's dolphin bones were found in "whale temples" in nations along the South China Sea, but this species was not seen by Miyashita et al. (1996) or De Boer (2000) during their surveys. Miyashita (1993) suggested by analogy to bottlenose dolphins and Pacific white-sided dolphins that Risso's dolphins summering in the Sea of Japan are part of a separate, IA stock different from the WNP stock. Since it is reasonable to assume that Risso's dolphins occurring in the Sea of Japan, East China Sea, and South China Sea are all part of same, IA stock, Risso's in this mission area are considered to be part of the IA stock. Since population data are lacking for the IA stock region, the WNP stock estimate (83,289 animals, CV=0.179) and the density estimate (0.0106 animals/km^2 derived for southeast Pacific coast of Japan/east of Taiwan; Miyashita, 1993) were used to represent the IA stock. Miyashita's density is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003) and higher than those around Hawaii (0.0067 animals/km^2, Bradford et al., 2013).

V. **Rough-toothed dolphin:** Rough-toothed dolphins have been reported from "whale temples" in South China Sea nations (Smith et al., 1997). Few other population data, however, are available for this dolphin species in this region. Given that lack of data, the best available density (0.0026 animals/km^2) is estimated from the Hawaiian EEZ surveys (Bradford et al., 2013) and the best available abundance estimate of 145,729 animals derived from the eastern Pacific (Ferguson and Barlow, 2001, 2003)

best represent the WNP stock of rough-toothed dolphins found in this mission area. Although this density is comparable to those observed in the Hawaii EEZ (0.00355 animals/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), it is an order of magnitude larger than that observed around Guam and the Mariana Islands (0.00029 animals/km^2; Fulling et al., 2011).

W. **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. 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). With limited data for this particular region, data from the Pacific coast of Japan were used to estimate population data for the WNP stock of pilot whales in this region. Miyashita's (1993) estimated abundance of 53,608 (CV=0.224) short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery is considered the best available to characterize the WNP stock. The best available density estimate (0.0016 animals/km^2) was calculated from the winter/spring 2007 surveys around Guam and the Mariana Islands (Fulling et al., 2011). This density is comparable to the density estimate (0.0051 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al. 2013) and an order of magnitude less than in nearshore Hawaii waters (0.0237 animals/km^2) during the spring, summer and fall (Mobley et al., 2000).

X. **Sperm whale**: The population structure of sperm whales throughout the North Pacific Ocean remains largely unresolved. De Boer (2000) sighted sperm whales in the South China Sea (March through April) and suggested that animals seen west of the Balabac Strait might be migrating between the South China and Sulu Seas. Miyashita et al. (1996) also observed sperm whales in the winter in the South China Sea, very close to the Philippines. No data on density or stock estimates were derived from either the De Boer (2000) or Miyashita et al. (1996) studies. The only available abundance estimate for the NP population of sperm whales is 102,112 animals (CV=0.155) (Kato and Miyashita, 1998). The best available density estimate, 0.00123 animals/km^2, for use in this region was derived from recent survey in waters of Guam and the Mariana Islands (Fulling et al., 2011). This is comparable to the density estimate of sperm whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013).

Y. **Spinner dolphin:** Gilpatrick et al. (1987) reported a high density of spinner dolphin 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 were not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), nor were they reported during the De Boer (2000) research cruise, nor encountered in historical "whale temples" (Smith et al., 1997). No data on density or stock estimates are available (Miyashita, 1993). Given that lack of regional data, the best available density estimate for the WNP stock found in this mission area is that derived (0.0008 animals/km^2) from the Hawaii EEZ (Barlow, 2006); no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013). This density is orders of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000). The best available abundance estimate for spinner dolphins (1,015,059 animals) in the WNP stock is derived from the ETP surveys (Ferguson and Barlow, 2001, 003).

Z. **Striped dolphin:** These dolphins were not reported during the De Boer (2000) research cruise in March to April but were sighted by Miyashita et al. (1996) in the South China Sea during the January to February cruise. No data on density or abundance estimates for the South China Sea are available

on striped dolphins. Based on stock differentiation among other small odontocetes in the eastern Asian continental seas, the striped dolphins ranging throughout the Sea of Japan, East China Sea, and South China Sea are part of the IA stock, as suggested by Miyashita (1993). Miyashita (1993) derived a total population estimate of 570,038 striped dolphins (CV=0.186). LGL's (2011) density of 0.0058 animals/km^2 was considered best for this species in this region. This density is comparable to the density estimates from the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013)), from nearshore Hawaii (0.0016 animals/km^2; Mobley et al., 2000), and from Guam and the Mariana Islands (0.00616 animals/km^2; Fulling et al., 2011).

8. MISSION AREA 8—OFFSHORE JAPAN/WESTERN NORTH PACIFIC 25º TO 40ºN

A. **Bryde's whale**: Yoshida and Kato (1999) identified three stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. 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. The best available density estimate to represent the WNP stock in this mission area is 0.0004 animals/km^2 derived from the 2007 winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011). This density is comparable to density estimates from offshore areas of the ETP (0.00003 animals/km^2; Ferguson and Barlow, 2001, 2003) and the Hawaii EEZ (0.00033 animals/km^2; Bradford et al., 2013). The IWC provides the best available population estimate, at 20,501 whales, for the WNP Bryde's whale stock (IWC, 2009).

B. **Common minke whale:** Historically, the waters along the south coast of Honshu and Shikoku were whaling grounds for this species (Ohsumi, 1978). Minke whales occurring in these waters are thought to be migratory from the offshore western North Pacific waters. Minke whales in the waters of this mission area belong to the WNP "O" stock. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk and derived a density estimate of 0.0003 animals/km^2 (SE = 0.17) from encounter rates and effective search widths for the offshore population (Buckland et al., 1992). Ferguson and Barlow (2001; 2003) computed density estimates in offshore areas of the ETP that were of the same magnitude. Minke whales were heard but not seen during the 2007 surveys around Guam and the Mariana Islands (Fulling et al., 2011). An abundance of 25,049 minke whales is most appropriate to represent the WNP O stock (Buckland et al., 1992).

C. **Fin whale**: Fin whales have been reported migrating south in the winter to about 20°N (Mizroch et al., 2009), have been observed in summer from near Japan north to the Chukchi Sea and Aleutian Islands, and may occur in the waters of this mission area seasonally (Evans, 1987). Density and stock estimates, 0.0001 animals/km^2 and 9,250 animals, respectively, for the WNP stock of fin whales, which include fin whales occurring in mission #8, were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Tillman, 1977). This density is comparable to density estimates in offshore areas of the ETP (Ferguson and Barlow, 2001, 2003) and an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

D. **Sei whale**: Sei whales are present throughout the temperate waters of the North Pacific Ocean but have been observed as far south as 20°N (Horwood, 1987). The IWC recognizes one stock of sei whales in the North Pacific (Donovan, 1991), although some evidence exists for several populations (Carretta et al., 2010). Very few sightings of sei whales have occurred in any region of the North Pacific, and adding to the difficulty, sei whales are extremely difficult to differentiate from Bryde's whales at sea. Therefore, the best available estimate for the entire NP stock, of which sei whales found in the waters of mission area #8 belong, is 8,600 animals based on very old whaling data (Tillman, 1977). With no specific densities derived for these waters, the best available density estimate (0.00029 animals/km^2 CV=48.7) for the sei whales in this mission area is calculated from the winter/spring surveys around Guam and the Mariana Islands (Fulling et al., 2011). This is an order of magnitude higher than that calculated for around Hawaii (0.00007 animals/km^2; Bradford et al., 2013).

E. **Baird's beaked whale**: Kasuya (1986) reported the presence of Baird's beaked whales off the east coast of Japan, as did Leatherwood and Reeves (1983). Miyazaki et al. (1987) did not report any Baird's beaked whale strandings along the Pacific coast of Japan. Ohizumi et al. (2003) examined the stomach content of Baird's whales caught off the east coast of Japan and reported that the observed prey species were demersal fish that were identical to those caught in bottom-trawl nets at depths greater than 1,000 m (3,281 ft). Kasuya (1986) collected sighting data from 25 years of aerial survey records and 1984 shipboard sightings off the Pacific coast of Japan; based on Kasuya's (1986) encounter rate and effective search width, a density estimate of 0.0001 animals/km^2 was derived for the Baird's beaked whale stock in this mission area. Kasuya's (1986) abundance estimate of 4,220 animals (CV=0.295) covered the region from about 32° to 40°N and seaward of the Pacific Japanese coast out to about 150°E. Since Kasuya's (1986) surveys did not include habitat further north or east, the Kasuya stock estimate is increased to 8,000 to account for unsurveyed areas. Since the density Kasuya (1986) computed already represents the lowest density used in modeling, Kasuya's density estimate of 0.0001 animals/km^2 was not reduced further to reflect less occupation of areas further offshore. The density estimate is comparable to the most western strata density estimates in the eastern Pacific (Ferguson and Barlow, 2003).

F. **Blainville's beaked whale**: Lacking data on population estimates for the Blainville's beaked whale in the western North Pacific, the data derived for this species in waters of the ETP (Ferguson and Barlow, 2001, 2003) are deemed most appropriate to represent the species in the WNP stock. Ferguson and Barlow's (2001, 2003) abundance derived for *Mesoplodon densirostris* added to one-fifth of the *Mesoplodon* spp. abundance provides an estimate of 8,032 animals to represent this stock. The density estimate of 0.0007 animals/km^2 is most appropriate (LGL, 2011). This density estimate is lower than that derived for Blainville's beaked whales in the Hawaii EEZ (0.0010 animals/km^2; Bradford et al., 2013) and in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001) but is comparable to the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

G. **Common bottlenose dolphin:** Miyashita (1993) reports an abundance estimate of 168,791 animals (CV=0.261), which is used to represent the WNP stock in this mission area while LGL (2011) derived a density estimate of 0.0008 animals/km^2 for pelagic bottlenose dolphins in this region. This is comparable to the density estimate around Guam and the Mariana Islands (0.00021 animals/km^2; Fulling et al., 2011).

H. **Cuvier's beaked whale:** No density or stock estimate data are available for Cuvier's beaked whales in this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best available abundance of 90,725 animals derived from the long-term ETP time series (Ferguson and Barlow, 2001, 2003) and the best available density estimate of 0.0037 animals/km^2 derived by LGL (2011) most optimally represent this stock in this region. This density estimate is greater than that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

I. **Dwarf sperm whale:** Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic, non-aggregated distribution. Although only the pygmy sperm whale is expected to occur in this area, given the lack of information about this species in this region, the dwarf sperm whale is also included in this mission area. Given the lack of population level data on either *Kogia* species in the western North Pacific, the most representative abundance for the WNP stock of the dwarf sperm whale was derived by summing the abundances of *Kogia* spp. in the geographic ETP strata defined by Ferguson and Barlow (2001, 2003), resulting in an overall abundance of 350,553 animals. LGL's (2011) density estimate of 0.0043 animals/km^2 is the best available for this species in this region. This density is comparable to the density estimates for pygmy sperm whale (0.00291

animals/km^2 CV=1.12) and dwarf sperm whale (0.00714 animals/km^2 CV=0.74) observed within the Hawaii EEZ (Barlow, 2006).

J. **False killer whale**: Little occurrence or population data are available in these waters for the false killer whale. The most representative estimates of the WNP stock and density of false killer whales is Miyashita's (1993) estimated abundance of 16,668 animals (CV=0.263) from 34 sighting cruises associated with the Japanese drive fishery and his density estimate of 0.0036 animals/km^2. This density is within the range of average densities estimated in the eastern North Pacific (0.0027 animals/km^2; Ferguson and Barlow, 2001, 2003) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012).

K. **Hubbs' beaked whale**: All known occurrences to date of Hubb's beaked whales in the western North Pacific Ocean having been strandings along Japan's shore (MacLeod et al., 2006). Miyazaki et al. (1987) reported five strandings of Hubbs' beaked whales along the Pacific coast of northern Honshu. Since no data on density or stock estimates are available for the Hubb's beaked whale in the waters of this mission area, *Mesoplodon* spp. data from the ETP (Ferguson and Barlow, 2001 and 2003) are considered to be the most appropriate population estimates available from which to extrapolate population estimates for this mission area. Using the northernmost strata from Ferguson and Barlow's (2001, 2003) data, a density of 0.0005 animals/km^2 and an abundance of 22,799 animals are estimated for the NP stock of Hubb's beaked whales. Ferguson and Barlow's (2001, 2003) density is comparable to that estimated for unidentified *Mesoplodon* whales in the Hawaii EEZ (0.0021 animals/km^2; Bradford et al., 2013) and the mean predicted density estimated for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

Z. **Killer whale**: Killer whales have been observed in the waters off the southeast coast of Honshu, Japan, but no killer whales were taken in Japanese drive fisheries (Miyashita, 1993). Without any population or occurrence data on killer whales for the western North Pacific, the best available abundance estimate of 12,256 animals is derived from Ferguson and Barlow's (2001, 2003) long time series in the ETP while the best available density estimate of 0.0001 animals/km^2 is derived from LGL's (2011) compilation of data for the Marianas area. LGL's (2011) density is comparable to the density, 0.00004 animals/km^2, estimated for killer whales in the Hawaii EEZ (Bradford et al., 2013).

L. **Longman's beaked whale:** Considering the lack of occurrence or population data for the WNP stock of Longman's beaked whales, the abundance of 4,571 animals estimated for Longman's beaked whales in offshore Hawaiian waters (Bradford et al., 2013) and the density of 0.0003 animals per km^2 (LGL, 2011) derived from the Marianas regions are considered most appropriate to represent the WNP stock in this mission area.

M. **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 are probably uncommon outside of the warm waters of the Kuroshio Current. With these limited data and information available, a density estimate of 0.0027 animals/km^2 from LGL (2011) was considered most appropriate to represent the WNP stock in this region. This density is comparable to Mobley et al.'s (2000) density estimate for Hawaii waters of 0.0021 animals/km^2 and the Guam/Marianas estimate of 0.00428 animals/km^2 (Fulling et al., 2011). An abundance estimate of 36,770 whales was derived from ETP data (Ferguson and Barlow, 2001, 2003) was used to represent the WNP stock in this region.

N. ***Mesoplodon* spp:** Miyazaki et al. (1987) reported five strandings of *M. ginkgodens* from the east coast of Japan. Of the 15 known strandings of *M. ginkgodens,* Palacios (1996) reported eight off Taiwan and Japan. Since so very little occurrence or population data are available for this species, especially in this oceanic region, data on *Mesoplodon* spp. from the northernmost ETP stratum

(Ferguson and Barlow, 2001, 2003) were considered most appropriate to represent the Mesoplodon genus in this mission area. Ferguson and Barlow's (2001, 2003) derived density estimate of 0.0005 animals/km^2 and abundance estimate of 22,799 animals represents *Mesoplodon* whales in the WNP stock. This density estimate is comparable to that for unidentified beaked whales in the Hawaii EEZ (0.00015 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

O. **Pacific white-sided dolphin:** No data on density or stock estimates of Pacific white-sided dolphins in this region are available (Miyashita, 1993). Due to this lack, the density (0.0048 animals/km^2) estimated from eastern Pacific waters (Ferguson and Barlow, 2001, 2003) was used to best represent the WNP stock of these dolphins in this mission area, while Buckland et al.'s (1993) abundance of 931,000 animals is most appropriate to characterize the WNP stock of Pacific white-sided dolphins. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al., 2000; Barlow, 2006).

P. **Pantropical spotted dolphin:** With the lack of population level data on pantropical spotted dolphins in this offshore mission area, Miyashita's (1993) abundance estimate of 438,064 animals (CV=0.174) and LGL's (2011) density estimate of 0.0113 animals/km^2 best characterize this species in this oceanic area. This density is an order of magnitude higher than that derived for the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013), and nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

Q. **Pygmy killer whale:** Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries and reported that no pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan). Leatherwood and Reeves (1983), however, reported that pygmy killer whales were seen relatively frequently in the tropical Pacific off Japan. Given such sparsely available data on this species in this region, the best available density estimate (0.0001 animals/km^2) was derived from LGL (2011) data in the Mariana Islands. This density is an order of magnitude less than that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013). No pygmy killer whales were seen in nearshore aerial during the spring, summer, and fall (Mobley et al., 2000). The best available abundance estimate of 30,214 animals from the eastern Pacific survey data (Ferguson and Barlow, 2001, 2003) best represents the WNP stock of this species.

R. **Pygmy sperm whale:** Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic, non-aggregated distribution. At this northern latitude, only *Kogia breviceps* is expected to occur. With so few *Kogia* data available in this region, an abundance was derived for the WNP stock by summing the abundances of *Kogia* spp. in the ETP geographic strata defined by Ferguson and Barlow (2001, 2003), which resulted in an overall abundance of 350,553 animals. LGL (2011) calculated a density estimate of 0.0018/km^2 for the pygmy sperm whale in the Mariana region and this estimate was considered to be represent this species in this mission area. This density is comparable to the density estimates for pygmy sperm whale (0.00291 animals/km^2 CV=1.12) observed within the Hawaii EEZ (Barlow, 2006).

S. **Risso's dolphin:** With little occurrence information available on the Risso's dolphin in this ocean mission area, Miyashita's (1993) abundance of 83,289 animals (CV=0.179) best represents the WNP stock, while LGL's (2011) density estimate of 0.0005 animals/km^2 derived for the species in the waters of the Mariana Islands is the best available density. This is an order of magnitude lower than that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013).

T. **Rough-toothed dolphin:** Due to the very limited amount of population data available on this dolphin species in this offshore Japan mission area, the best available density estimate of 0.0019 animals/km^2 derived from LGL's (2011) data from the Mariana region. This density is comparable to that observed in the Hawaii EEZ (0.0026 animals/km^2; Bradford et al., 2013) and in nearshore Hawaii

waters (0.0017 animals/km^2; Mobley et al., 2000). The best available representative abundance of 145,729 animals is estimated from eastern Pacific waters (Ferguson and Barlow, 2001, 2003).

U. **Short-beaked common dolphin:** There are no data on density or stock estimates in the western Pacific for the short-beaked common dolphin (Miyashita, 1993). With no data on stock or density estimates for the western North Pacific, the data from the ETP for the short-beaked common dolphin is considered most representative for the WNP stock with a density estimated at 0.0863 animals/km^2 and an abundance estimated at 3,286,163 animals (Ferguson and Barlow, 2001, 2003).

V. **Short-finned pilot whale:** Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43°N). Miyashita (1993) questioned whether the entire range consisted of a single stock or population but had no way of delineating the available data. Thus, Miyashita (1993) estimated the abundance of short-finned pilot whales for one stock as 53,608 animals (CV=0.224) from data from 34 sighting cruises associated with the Japanese drive fishery; this abundance is considered the best available to typify the WNP of short-finned pilot whales. The most appropriate density estimate for this offshore site, 0.0021 animals/km^2, was derived from LGL (2011) data in the Mariana region.

W. **Sperm whale**: Stock structure of sperm whales in the North Pacific is not well resolved. Sightings collected by Kasuya and Miyashita (1988) suggest that in the summer, the density of sperm whales is high south of the Kuroshio Current System (south of approximately 35°N) but extremely low north of 35°N. These data suggest 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 southern WNP stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N) (Kasuya and Miyashita, 1988). 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 (Kasuya and Miyashita, 1988). However, until further data are available, sperm whales are considered to belong to only one NP stock. Potentially, sperm whales of the NP stock, numbering 102,112 individuals (Kato and Miyashita, 1998), may occur year-round in the waters of this offshore mission area. The best density estimated for sperm whales in mission area 8 is 0.0022 animals/km^2, derived by LGL (2011). This density is higher but in the same order of magnitude as that derived by Bradford et al. (2013; 0.0014 animals/km^2) for the Hawaii EEZ and Fulling et al. (2011; 0.00123 animals/km^2) for the waters around Guam and Mariana Islands.

X. **Spinner dolphin:** Gilpatrick et al. (1987) did not report any sightings of spinner dolphins from the Pacific coast of Japan and neither is this species mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993). With no data on density or stock estimates available (Miyashita, 1993), the best stock and density estimates for the WNP stock of spinner dolphins is considered to be Ferguson and Barlow (2001, 2003) estimate of 1,015,059 spinner dolphins from a similar latitude of the ETP and LGL's (2011) estimate of 0.0019 animals/km^2, respectively.

Y. **Striped dolphin:** Two concentrations of striped dolphins exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N, with a third possible east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate for the WNP striped dolphin stock of 570,038 animals (CV=0.186). LGL (2011) derived a density estimate of 0.0058 animals/km^2 from data derived from the Mariana region. This density is comparable to the density estimates from the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013), from nearshore Hawaii (0.0016 animals/km^2; Mobley et al., 2000), and from Guam and the Mariana Islands (0.00616 animals/km^2; Fulling et al., 2011).

Z. **Hawaiian monk seal**: Monk seals are known to haul out on Kure Atoll, the westernmost atoll in the northwest Hawaiian Islands (NWHI) (Carretta et al., 2014). Monk seals from Kure Atoll may forage on the Hancock Banks, NW of Kure Atoll. Parrish et al. (2002) compiled information on monk seal diving wherein the authors referenced a study by Abernathy (1999), who reported that monk seals may travel up to 400 km (216 nmi) to forage. The Hancock Banks are approximately 300 km (162 nmi) NW of Kure Atoll and are characterized by a single pinnacle that is shallower than 450 m (1,476 ft); this single pinnacle is within the known range of movements of monk seals. However, it appears unlikely that many, if any, seals would travel a distance near their maximum-recorded and dive to a depth near their maximum recorded depth to access a small potential foraging area. However, to account for the possibility that monk seals may forage such distances from known foraging areas, monk seals were included in the marine mammal fauna for this mission area. The abundance of the Hawaiian monk seal stock is estimated at 1,209 animals (Carretta et al., 2014). Although no density for the very rare Hawaiian monk seal is available, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis for this species to reflect the very low probability of occurrence in this region.

9. MISSION AREA 9—OFFSHORE JAPAN/WESTERN NORTH PACIFIC 10º TO 25ºN

A. **Blue whale**: Few data are available on blue whale occurrence in the North Pacific Ocean and the stock structure in the North Pacific remains uncertain[26]. Stafford et al. (2001) studied the geographic variation of blue whale calls in the North Pacific, and although there was no hydrophone coverage in the mid-latitudes off Japan, there was some coverage near the Kamchatka Peninsula and along the western Aleutian Islands chain. All calls recorded on these hydrophones were northwest Pacific blue whale calls (Stafford et al., 2001). Based on the Stafford et al. (2001) data and the lack of population data on blue whales in this region, the most appropriate proxy abundance data would be those from fin whales derived from sighting surveys associated with Japanese whaling (Tillman, 1977; Carretta et al., 2014). Thus, the best available abundance for the CNP blue whale stock is 9,250 animals (Tillman, 1977). The best density for blue whales in this mission area is 0.0001 whales/km^2, which was estimated for the winter, spring, and fall seasons (Tillman, 1977, Ferguson and Barlow, 2001 and 2003; LGL, 2008).

B. **Bryde's whale:** Yoshida and Kato (1999) identified three stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. 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. The IWC provides the best available population estimate, 20,501 whales, for the WNP Bryde's whale stock (IWC, 2009). The best available density estimate for this species in this region, 0.0003 animals/km^2, is calculated by LGL (2011). This density is comparable to density estimates from offshore areas of the ETP (0.00003/km^2; Ferguson and Barlow, 2001, 2003) and the Hawaii EEZ (0.00033 animals/km^2; Bradford et al., 2013).

C. **Fin whale**: Fin whales have been reported migrating south in the winter to about 20°N (Mizroch et al., 2009) and occur in the summer from a line north of Japan to the Chukchi Sea and Aleutian Islands (Evans, 1987). Population data for the fin whale are sparse in this area of the North Pacific Ocean, but an abundance for the WNP stock, which occurs in this mission area, numbering 9,250 animals was derived from whaling data (Tillman, 1977) and occurrence information Mizroch et al. (2009). Although no density information are available for the fin whale in the waters of mission area #9, a density estimate is needed to compute potential acoustic impacts. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis for this species to reflect the very low probability of occurrence in this region during winter and spring. This is an order of magnitude higher than that calculated for around Hawaii (0.00002 animals/km^2; Bradford et al., 2013).

D. **Omura's whale:** Little population information is known or available for this species only described in 2003 but this baleen whale ranges from roughly northern Japan to Australia in the eastern Indian Ocean and western Pacific Ocean (Yamada, 2009). With so little information available, the Omura's whale is assumed to comprise one stock, the WNP, throughout its range in the western Pacific Ocean. The only abundance information available is an estimate made by Ohsumi (1980) for Bryde's whales in the Solomon Sea, which are now known to have been Bryde's and Omura's whales. Lacking other data, Ohsumi's (1980) abundance of 1,800 animals was used to represent the WNP stock of Omura's whales. While no density estimate is available, one is needed to assess risk to this species due to exposure from SURTASS LFA sonar, therefore a density of 0.0001 animals/km^2 was used to represent the scarcity of this species in this area.

E. **Sei whale**: Sei whales are present throughout the temperate North Pacific Ocean but have been observed as far south as 20°N (Horwood, 1987). The IWC recognizes one stock of sei whales in the North Pacific (Donovan, 1991), although some evidence exists for several populations (Carretta et al., 2014). Very few sightings of sei whales have occurred in any region of the North Pacific, and adding to the difficulty, sei whales are extremely difficult to differentiate from Bryde's whales at sea. Therefore, the best available estimate for the entire NP stock, of which sei whales found in the waters of mission area #9 belong, is 8,600 animals based on very old whaling data (Tillman, 1977). A seasonal density estimate of 0.0001 animals/km^2 was derived from LGL (2011) data and information collected in the Mariana Islands region. This is an order of magnitude higher than that calculated for around Hawaii (0.00007 animals/km^2; Bradford et al., 2013).

F. **Blainville's beaked whale**: Lacking data on population estimates for the Blainville's beaked whale in the western North Pacific, the abundance data derived for this species in waters of the ETP (Ferguson and Barlow, 2001, 2003) are deemed most appropriate to represent the species in the WNP stock. Ferguson and Barlow's (2001, 2003) abundance derived for *Mesoplodon densirostris* added to one-fifth of the *Mesoplodon* spp. abundance provides an estimate of 8,032 animals to represent the WNP stock. The density estimate derived by LGL (2011), 0.0007 animals/km^2; is most appropriate for this beaked whale in this oceanic mission area. This density estimate is lower than that derived for Blainville's beaked whales in the Hawaii EEZ (0.0010 animals/km^2; Bradford et al., 2013) and in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), but is comparable to the mean predicted density estimate for the ETP *Mesoplodon* spp. (0.000296 animals/km^2; Ferguson et al., 2006).

G. **Common bottlenose dolphin:** Little population data are available on the bottlenose dolphin in this oceanic region. Given this lack of data, the best available WNP stock abundance estimate was derived from Miyashita's (1993) estimate of 168,791 animals (CV=0.261), while the best available density of bottlenose dolphins in this mission area of 0.0008 animals/km^2 as derived by LGL (2011) for this species in waters of the Mariana region. This density is comparable to the density estimate around Guam and the Mariana Islands (0.00021 animals/km^2; Fulling et al., 2011).

H. **Cuvier's beaked whale:** No density or stock estimate data are available for Cuvier's beaked whales in this oceanic region. Considering habitat preferences (e.g., water temperature, bathymetry), the best available abundance for the WNP stock of 90,725 animals was derived for this beaked whale from long-term time ETP series data (Ferguson and Barlow, 2001, 2003). The best density for this species in this region is LGL's (2011) estimate of 0.0037 animals/km^2. This density estimate is greater than that estimated for the Hawaii EEZ (0.0008 animals/km^2; Bradford et al., 2013) but comparable to the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006).

I. **Deraniyagala beaked whale**: Dalebout et al. (2014) conducted genetic and molecular analyses to demonstrate that *M. hotaula* was genetic distinct from the ginkgo-toothed beaked whale (*M. ginkgodens*). Little is known about this beaked whale species. No abundance or stock information is available for the Deraniyagala beaked whale. Given that this species was synonymous with the

ginkgo-toothed beaked whale, which is part of the *Mesoplodon* spp. complex, the best available density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the ETP are most appropriate for this region (Ferguson and Barlow, 2001, 2003). Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density estimate of 0.0009 animals/km^2 and abundance estimate of 22,799 animals were used for analyses for the Deraniyagala beaked whale in this mission area.

J. **Dwarf sperm whale:** Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic, disbursed distribution. Although at this latitude only the pygmy sperm whale is expected to occur, the dwarf sperm whale is included in this mission area due to the lack of concrete data and information on it's deep ocean occurrence. To derive the best available abundance for the WNP stock of dwarf sperm whales, the abundances of *Kogia* spp. in the appropriate geographic ETP strata were summed to derive an overall abundance of 350,553 animals (Ferguson and Barlow, 2001 and 2003). LGL's density estimate of 0.0043 animals/km^2 best represents this species in this region. This density is comparable to the density estimates for pygmy sperm whale (0.00291/km^2 (CV=1.12) and dwarf sperm whale (0.00714 animals/km^2 CV=0.74) observed within the Hawaii EEZ (Barlow, 2006).

K. **False killer whale:** With so sparse occurrence data available for false killer whales in this oceanic mission area, Miyashita's (1993) abundance of 16,668 false killer whales (CV=0.263) from 34 sighting cruises associated with the Japanese drive fishery best typifies the WNP stock. LGL's (2011) density of 0.0006 animals/km^2 is most representative of this species in mission area #9. This density is comparable to the pelagic stock of false killer whales in the Hawaii EEZ (0.0006 animals/km^2; Bradford et al., 2012) but lower than nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000), including the Main Hawaiian Islands insular stock (0.0012 animals/km^2; Oleson et al., 2010) and the Northwest Hawaiian Islands insular stock (0.0013 animals/ km^2; Bradford et al., 2012) and much lower than the average densities estimated in the eastern North Pacific (0.0045 animals/km^2; Ferguson and Barlow, 2001, 2003).

L. **Fraser's dolphin**: Without data on abundance or density estimates for the western North Pacific Ocean for the Fraser's dolphin, Bradford et al. (2013) abundance estimate of 16,992 animals is extrapolated to represent the central North Pacific stock of Fraser's dolphins. The density estimated by LGL (2011) as 0.0025 animals/km^2 is considered the best available and most appropriate to characterize Fraser's dolphin in this mission area.

M. **Gingko-toothed beaked whale**: During the genetic and molecular analyses of Dalebout et al. (2014), additional distribution information about the ginkgo-toothed beaked whale was demonstrated, suggesting that it may occur in this mission area. Little is known about this beaked whale species, with no live sightings having been recorded. No abundance or stock information is available; therefore the best available density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the ETP are most appropriate for this region (Ferguson and Barlow, 2001, 2003). Using Ferguson and Barlow's (2001, 2003) northernmost strata, a density estimate of 0.0009 animals/km^2 and abundance estimate of 22,799 animals were used for analyses for the ginkgo-toothed beaked whale in this mission area.

N. **Killer whale**: Without any population or occurrence data on killer whales for the western North Pacific, the best available abundance estimate of 12,256 animals for the WNP stock was derived from Ferguson and Barlow's (2001, 2003) long time series of ETP data. The best available density for the killer whale in this region is represented by the density of 0.0001 animals/km^2 (LGL, 2011) estimated for the Marianas area. LGL's (2011) density is comparable to the density, 0.00004 animals/km^2, estimated for killer whales in the Hawaii EEZ (Bradford et al., 2013).

O. **Longman's beaked whale:** Ferguson and Barlow (2001) reported that all Longman's beaked whale sightings in their ETP surveys occurred south of 25ºN. Considering the lack of occurrence or population data for the WNP stock of Longman's beaked whales, the abundance of 4,571 animals

estimated for Longman's beaked whales in offshore Hawaiian waters (Bradford et al., 2013) and the density of 0.0003 animals per km^2 (LGL, 2011) derived from the Marianas regions are considered most appropriate to represent the WNP stock in this oceanic region.

P. **Melon-headed whale:** Leatherwood and Reeves (1983) stated that melon-headed whales are rare in all western North Pacific waters except those of the Philippine Sea. With such limited data available, a density estimate derived by LGL (2011) of 0.0027 animals/km^2 is the best available to characterize the occurrence of melon-headed whales in this region. This density is very comparable to Mobley et al.'s (2000) density estimate for Hawaii waters of 0.0021 animals/km^2 and the Guam/Marianas estimate of 0.00428 animals/km^2 (Fulling et al., 2011). An abundance estimate of 36,770 derived from eastern Pacific data by Ferguson and Barlow (2001, 2003) is most optimal to represent the WNP stock.

Q. **Pantropical spotted dolphin:** Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. With so little data available on this dolphin in this mission area, Miyashita's (1993) abundance estimate of 438,064 animals (CV=0.174) is judged best to portray the size of the WNP stock. The best available density of 0.0113 animals/km^2 is estimated from this species data from the Mariana region (LGL, 2011). This density is comparable to that observed in the Hawaii EEZ (0.0067 animals/km^2; Bradford et al., 2013) and an order of magnitude less than that observed in nearshore waters of Hawaii (0.0407 animals/km^2; (Mobley et al., 2000).

R. **Pygmy killer whale:** Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries and reported that no pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan). However, Leatherwood and Reeves (1983) reported that pygmy killer whales were seen relatively frequently in the tropical Pacific waters off Japan. Few data are available for this species in this oceanic mission area. Thus, the best available density estimate of 0.0001 animals/km^2 for this area was derived by LGL (2011) from Mariana Islands data. This density is an order of magnitude less than that observed for pygmy killer whales in the Hawaii EEZ (0.0014 animals/km^2; Bradford et al., 2013). No pygmy killer whales were seen in nearshore aerial during the spring, summer, and fall by Mobley et al. (2000). The best abundance estimate to represent the WNP stock of pygmy killer whales is 30,214 animals derived from the eastern Pacific survey data(Ferguson and Barlow, 2001, 2003).

S. **Pygmy sperm whale:** Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic, dispersed distribution. Although only this species of *Kogia* is expected to occur at this the latitude of this site, due to the lack of concrete data, to be conservative both *Kogia* species are included for this mission area. The best estimated abundance for the WNP stock of pygmy sperm whales is derived by summing the abundances of *Kogia* spp. in the ETP geographic strata defined by Ferguson and Barlow (2001, 2003), which results in an overall abundance of 350,553 animals. The density of 0.0018 animals/km^2 derived for the greater Mariana Islands region (LGL, 2011) is the most representative of this species in this region. This density is comparable to the density estimates for pygmy sperm whale (0.00291/km^2 (CV=1.12) and dwarf sperm whale (0.00714 animals/km^2 CV=0.74) observed within the Hawaii EEZ (Barlow, 2006).

T. **Risso's dolphin:** Very sparse occurrence or population level data are available for the Risso's dolphin in this oceanic area. Miyashita's (1993) estimated abundance for the WNP stock of 83,289 animals (CV=0.179) is the best data available. Likewise, LGL's (2011) density estimate of 0.0005 animals/km^2 best represents this species in this region. This density is lower than the density estimate off Hawaii (0.0067 animals/km^2; Bradford et al., 2013).

U. **Rough-toothed dolphin:** With few data available for this dolphin species in mission area #9, the best available density, 0.0019 animals/km^2, is estimated from data for the Mariana region LGL (2011). This density is comparable to those estimated in the Hawaii EEZ (0.0026 animals/km^2; Bradford et al., 2013) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000). The best available

abundance estimate of 145,729 animals to typify the WNP stock of rough-toothed dolphins is derived from eastern Pacific data (Ferguson and Barlow, 2001, 2003).

V. **Short-finned pilot whale:** Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35 to 43°N). Miyashita (1993) questioned the stock delineation of this species but had insufficient information to further define the stock. For this reason, Miyashita (1993) estimated an abundance of short-finned pilot whales for the entire WNP as 53,608 animals (CV=0.224) from 34 sighting cruises associated with the Japanese drive fishery. The most appropriate and best available density for this whale in this region is 0.0021 animals/km^2, estimated by LGL (2011).

W. **Sperm whale**: Sightings collected by Kasuya and Miyashita (1988) suggest that in the summer, the density of sperm whales is high south of the Kuroshio Current System (south of approximately 35°N) but extremely low north of 35°N. Kasuya and Miyashita's (1988) data suggest 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). Male sperm whales of these two stocks are found north of the range of the corresponding females. Based on this information, sperm whales may occur throughout the year in this mission area. However, data is insufficient to clearly define the stock structure of sperm whales in the North Pacific Ocean, except in the U.S. EEZ waters. For this reason, Kato and Miyashita's (1988) stock estimate of 102,112 animals is the best available estimate of the NP stock of sperm whales in this mission area. A density estimate of 0.0022 animals/km^2 was derived from LGL data (2011) and is considered optimal to represent this species occurrence in this area. This density is higher than the Bradford et al. (2013) estimate (0.0014 animals/km^2) calculated from the summer/fall survey off Hawaii in 2010 and the density estimate (0.00123 animals/km^2) calculated from the winter/spring surveys around Guam and Mariana Islands (Fulling et al., 2011).

X. **Spinner dolphin:** The spinner dolphin is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or stock estimates are available for this species from data compiled by Miyashita (1993). The best available density estimate (0.0019 animals/km^2) is calculated by LGL (2011) and is comparable to that observed in the Hawaii EEZ (0.00137 animals/km^2; Barlow, 2006) but is an order of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000); no sightings of spinner dolphins occurred during systematic effort in the 2010 summer/fall survey (Bradford et al., 2013). The abundance estimated as 1,015,059 animals for spinner dolphins from the ETP data (Ferguson and Barlow, 2001, 2003) is the best available to characterize the WNP stock.

Y. **Striped dolphin:** Two concentrations of striped dolphins exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N, but it is likely that only one population exists south of 30°N. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita's (1993) total WNP population estimate of 570,038 animals (CV=0.186) is the best available for this stock in this area. The best existing density of 0.0058 animals/km^2 was derived by LGL (2011) and is comparable to the density estimates from nearshore Hawaii (0.0016/km^2; Mobley et al., 2000), and the Hawaii EEZ (0.0084 animals/km^2; Bradford et al., 2013) and Guam and the Mariana Islands (0.00616/km^2; Fulling et al., 2011).

10. MISSION AREA 10—HAWAII NORTH

A. **Blue whale**: Due to the general lack of occurrence data for blue whales in the North Pacific Ocean, stock structure remains uncertain[26]. Blue whales occur rarely in the central North Pacific, with few sightings and acoustic detections having been made (Carretta et al., 2014). No sightings of blue

whales were made around Hawaii during the Acoustic Thermometry of Ocean Climate Marine Mammal Research Program of a summer/fall 2002 line-transect survey (Barlow, 2006; Mobley, 2006). A 2010 shipboard line-transect survey of the Hawaii EEZ estimated an abundance of 81 (CV=1.14) animals and a density of 0.00003 animals/km^2 (Bradford et al., 2013; Carretta et al., 2014). Further evidence of their occurrence in the area exists from acoustic recordings. Stafford et al. (2001) reported that recordings made near Kaneohe, Hawaii from August 1992 through April 1993 consisted of approximately 30% of the northwest Pacific blue whale call type and 70% of northeast Pacific call type, with western North Pacific calls dominating during the winter and eastern North Pacific calls dominating during the summer.

A. **Bryde's whale:** Sightings of the Bryde's whale in Hawaiian waters have been recorded sporadically since 1977 (Carretta et al., 2014). Occurrence data are sufficient to define a Hawaiian stock of Bryde's whales. Bradford et al.'s (2013) estimates of the Hawaiian stock of Bryde's whales are the best available, with a density for the whales estimated as 0.00033 animals/km^2 and a stock abundance of 798 animals (CV=0.28), calculated for the summer/fall surveys in the Hawaii EEZ.

B. **Common minke whale:** A Hawaii stock is recognized that occurs seasonally (November-March) in Hawaiian waters, though no estimate of abundance has been calculated (Carretta et al., 2014). Minke whales were observed and acoustically detected during the 2002 summer/fall survey of the Hawaiian EEZ (Barlow, 2006). One off-effort sighting was made during the 2010 summer/fall survey (Bradford et al., 2013). A year-long analysis of acoustic recordings made at Station ALOHA (A Long-term Oligotrophic Habitat Assessment) 100 km (54 nmi) north of Oahu detected "central" or "Hawaii" boings from 22 October 2007 to 21 May 2008 and not at all during the months of June to September, though this does not indicate that no minke whales were present (Oswald et al., 2011). Using passive acoustic detections from hydrophones on the Pacific Missile Range Facility off Kauai, Martin et al. (2013) estimated 2.15 "boing"-calling minke whales per 1000 km^2. However, the relationship between the number of whales vocalizing and the number of whale present is not known to provide an estimate of abundance. Lacking abundance data for this stock in Hawaiian waters, the best estimate of abundance (25,049 animals) is derived from sighting surveys in July and August in the western North Pacific and Sea of Okhotsk (Buckland et al., 1992). The best density estimate, 0.0002 animals/km^2, for minkes in Hawaiian waters is calculated from the eastern North Pacific (Ferguson and Barlow, 2001, 2003).

C. **Fin whale**: There has been acoustic evidence for fin whale presence in fall and winter (Thompson and Friedl, 1982; Moore et al., 1998) and one sighting in nearshore waters (February) (Mobley et al., 1996). From the sightings reported during the 2010 summer/fall survey (Bradford et al., 2013), an abundance estimate of 58 animals (CV=1.12) was calculated for the Hawaii stock of fin whales (Carretta et al., 2014). A density of 0.00002 animals/km^2 fin whales was also derived for these waters (Bradford et al., 2013). This estimate is similar to that of McDonald and Fox (1999) who derived an average calling whale density estimate of 0.027 animals per 1000 km^2 (0.000027 animals/km^2) based on recordings made north of Oahu, Hawaii. The seasonal maximum calling whale density was about three times the average, or 0.000081 animals/km^2 (McDonald and Fox, 1999).

D. **Humpback whale**: The CNP stock of humpback whales is identified as individuals that migrate from summer/fall feeding grounds of northern British Columbia and southeast Alaska (Prince William Sound west to Kodiak), to winter/spring breeding and calving grounds of the Hawaiian Islands (Carretta et al., 2014). Some exchange between winter/spring areas has been documented, as well as movement between Japan and British Columbia, and Japan and the Kodiak Archipelago (Calambokidis et al., 1997). Acoustic surveys suggest a northbound migration heading of approximately magnetic north (10° true), with a "migration corridor" of 150° to 160°W (Norris et al., 1999) and a winter presence in the Northwestern Hawaiian Islands (Lammers et al., 2010). Animals are cycling through the breeding grounds with an average residency of approximately 30 to 45 days. Based on the recent North Pacific humpback whale abundance updates from Calambokidis et al.

(2008), the best available abundance estimate for the CNP stock of humpback whales is 10,103 individuals, which is a much higher estimate than former surveys and research provided. Humpback whales are not expected in this mission area during summer. A density estimate of 0.0009 animals/km^2 from LGL (2008) data was used for this mission area and stock.

E. **Sei whale**: Sei whales are present throughout the temperate North Pacific Ocean but have been observed as far south as 20°N (Horwood, 1987), with whaling effort distributed continuously across the North Pacific between 45°N and 55°N (Masaki, 1977). The IWC only considers one stock of sei whales in the North Pacific (Donovan, 1991), but NMFS recognizes three stocks, including a Hawaiian stock. The best estimate of abundance is from a 2010 summer/fall shipboard line-transect survey of the entire Hawaiian Islands EEZ that estimated 178 (CV=0.90) sei whales (Bradford et al., 2013), though the majority of sei whales would be expected to be distributed at a higher latitude during this time of year. A density estimate of 0.00007 animals/km^2; was derived from the 2010 line-transect survey (Bradford et al., 2013).

F. **Blainville's beaked whale:** Blainville's beaked whales potentially occur in the deep waters of this mission area. The best available density estimate (0.0010 animals/km^2) and abundance estimate (2,338 animals, CV=1.13) are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is comparable to nearshore Hawaiian waters (0.0012 animals/km^2; Mobley et al., 2000).

G. **Common bottlenose dolphin**: Recent photo-id and genetic studies around the main Hawaiian Islands suggest limited movements among islands and offshore waters (Baird et al., 2009). Five Pacific Islands Region stocks are identified: (1) Kauai and Niihau; (2) Oahu; (3) the "4-Island Region" including Molokai, Lanai, Maui, and Kahoolawe; (4) Hawaii Island; and (5) Hawaii pelagic stock (Carretta et al., 2014). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath.

Hawaii pelagic stock: The best available density estimate (0.0025 animals/km^2) and abundance estimate (5,950 animals) for this oceanic stock of bottlenose dolphins are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013; Carretta et al., 2014).

Kauai/Niihau stock: The best abundance estimate for this insular stock is 184 dolphins based on 2003 to 2005 photo-ID studies (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0001 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

Oahu stock: The best abundance estimate for this insular stock is 743 dolphins based on 2002, 2003, and 2006 in Oahu waters (except the windward waters) (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0003 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

4-Islands stock: The best abundance estimate for this insular stock is 191 dolphins based on 2002 to 2006 photo-ID studies of individual common bottlenose dolphins in the waters of Maui and Lanai (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available

density estimate (0.0.0001 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

Hawaii Island stock: The best abundance estimate for this insular stock is 128 dolphins based on 2003 to 2006 photo-ID studies (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0001 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

H. **Cuvier's beaked whale:** The best available density estimate (0.0008 animals/km^2) and abundance estimate (1,941 individuals, CV=0.70) for the Hawaiian stock of Cuvier's beaked whales are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013; Carretta et al., 2014). The density estimate is comparable to the density estimate in nearshore Hawaiian waters (0.0008 animals/km^2; Mobley et al., 2000).

I. **Dwarf sperm whale**: Dwarf sperm whales are known in Hawaii from both strandings and sightings, with Mobley et al. (2000) having observed two pods of dwarf and pygmy sperm whales for a total of five individuals during his 1993 to 1998 survey efforts, although no density or abundance estimates were derived. Dwarf sperm whales were also observed near Niihau, Kauai, Lanai, and Hawaii during small boat surveys between 2000 and 2003 (Baird, 2005). The best available estimates for the Hawaiian stock of dwarf sperm whales are the density and abundance, 0.0029 animals/km2 and 17,519 animals, respectively, estimated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006).

J. **False killer whale**: Five Pacific Islands Region management stocks of false killer whales are currently recognized (Carretta et al., 2014): the main Hawaiian Islands insular stock (which includes false killer whales occurring within 140 km [approximately 75 nmi] of the main Hawaiian Islands; the Northwestern Hawaiian Islands stock (which includes false killer whales inhabiting waters within 93 km (50 nmi) of the NWHI and Kauai); the Hawaii pelagic stock (including false killer whales occurring in waters further than 44 km [approximately 22 nmi] of the main Hawaiian Islands; the Palmyra Atoll stock (which includes false killer whales within the U.S. EEZ of Palmyra Atoll); and the American Samoa stock (including animals within the U.S. EEZ of American Samoa). Overlap of the stock's ranges occurs between the main Hawaiian Islands insular, Northwestern Hawaiian Islands, and pelagic stocks of the false killer whale; the ranges of the insular and pelagic populations overlap in the area between about 42 km and 112 km from shore of the main Hawaiian Islands while overlap in the ranges of insular and Northwestern Hawaiian Islands stocks occurs in water within 40 km of Kauai and Niihau (Forney et al., 2010; Carretta et al., 2014). False killer whales occur year-round in Hawaiian waters. Only the Main Hawaiian Islands, Northwestern Hawaiian Islands, and Pelagic stocks of false killer whales potentially occur in the Hawaii-North mission area.

Main Hawaiian Islands insular stock: The best available abundance estimate (151 animals, CV=0.20) for the Main Hawaiian Islands insular stock is derived from the 2006 to 2009 recent sighting histories and open population models presented in unpublished assessments for the status review of Hawaiian false killer whales (Caretta et al., 2014). A density estimate of 0.0012 animals/km^2 is the best available estimate of the insular stock (Oleson et al., 2010).

Hawaii pelagic stock: The abundance of the Hawaii pelagic stock of false killer whales is estimated as 1,503 individuals CV=0.66) from 2010 visual line-transect data; this estimate, however, has not been yet corrected for shipboard attraction (Bradford et al., 2012). As indicated by behavioral observations and assessment of the detection function, false killer whales are attracted to the survey vessel, so that the abundance estimated is an overestimate (Carretta et al., 2014). The best available density

estimate for the Hawaii pelagic stock, 0.0006 individuals/km^2, was also estimated from the 2010 dedicated survey of Hawaiian EEZ waters (Bradford et al., 2012).

Northwestern Hawaiian Islands stock: This stock was defined only recently, and the abundance of this stock estimated from 2010 visual line-transect survey data is 552 whales (CV=1.09) this estimate, however, has not been yet corrected for shipboard attraction (Bradford et al., 2012). As indicated by behavioral observations and assessment of the detection function, false killer whales are attracted to the survey vessel, so that the abundance estimated is an overestimate (Carretta et al., 2014). The most current density estimated for the Northwestern Hawaiian Island stock is 0.0013 individuals/km^2 (CV = 1.09) (Bradford et al., 2012).

K. **Fraser's dolphin**: Fraser's dolphins were first documented in Hawaiian waters during the 2003 summer/fall survey (Barlow, 2006). The best available density estimate of 0.0069 animals/km^2 and abundance estimate of 16,992 animals (CV=0.66) are from the 2010 summer/fall survey (Bradford et al., 2013).

L. **Killer whale**: Killer whales are considered rare in Hawaiian waters with limited sightings having been reported (Carretta et al., 2014). The best available density estimate (0.00004 animals/km^2) and abundance estimate (101 animals, CV=1.00) are calculated from the summer/fall survey in the waters of the Hawaii EEZ (Bradford et al., 2013). Mobley et al. (2000) did not report any sightings in their surveys of coastal waters of the Main Hawaiian Islands.

M. **Longman's beaked whale:** Longman's beaked whale has only recently been identified to species (Dalebout et al., 2003; Pitman et al., 1999) and is considered one of the rarest and least known of cetacean species. The best available density estimate (0.00187 animals/km^2) and abundance estimate (4,571 animals, CV=0.65) for the Hawaiian stock of this beaked whale were calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). No other density estimates exist for this species around Hawaii (Mobley et al., 2000).

N. **Melon-headed whale**: Recent studies reveal evidence for island-associated stock structure in melon-headed whales in the main Hawaiian Islands and NMFS now recognizes two stocks (Carretta et al., 2014): (1) a Kohala Resident Stock, consisting of animals within the 2,500 m (8,202.5 ft) isobath around the west and northwest sides of Hawaii Island (Oleson et al., 2013); and (2) a Hawaiian Islands Stock, consisting of the remainder of melon-headed whales found within the Hawaii EEZ. The northern boundary between the two stocks provisionally runs through the Alenuihaha Channel between Hawaii Island and Maui, bisecting the distance between the 1,000-m (3,281-ft) depth contours (Oleson et al., 2013).

Hawaiian Islands stock: Recent studies of photo-identification data using mark-recapture techniques provide the best available abundance estimate (5,794 animals CV=0.20) (Baird et al., 2010; Aschettino, 2012; Carretta et al., 2014). The best available density estimate (0.0012 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). The density estimate is comparable to nearshore Hawaiian waters (0.0021 animals/km^2; Mobley et al., 2000).

Kohala Resident stock: Individuals in the smaller Kohala resident stock have a range restricted to shallower waters of the Kohala shelf and west side of Hawaii Island (Aschettino et al., 2012). Satellite telemetry data indicate they occur in waters less than 2,500 m (8,202.5 ft) depth around the northwest and west shores of Hawaii Island, west of 1560 45' W and north of 190 15'N (Oleson et al., 2013). The best available abundance estimate (447 animals, CV=0.12) is from photo-identification work between 2002 and 2009 (Aschettino, 2010). A density estimate (0.03725 animals/km^2) was derived from the abundance estimate and the estimated spatial range of the stock.

O. **Pantropical spotted dolphin:** Genetic analyses support the recognition of three island-associated insular stocks: a Hawaii Island Stock that extends 65 km (35 nmi) from shore, a 4-Islands Stock that extends 20 km (11 nmi) from shore, and an Oahu Stock that extends 20 km (11 nmi) from shore

(Oleson et al., 2013), in addition to a Hawaii Pelagic Stock that consists of all other pantropical spotted dolphins within the Hawaii EEZ (Carretta et al., 2014).

Hawaii Pelagic stock: The best available density estimate (0.0067 animals/km^2) and abundance estimate (15,917 animals, CV=0.40) are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013).

Hawaii Island stock: The best abundance estimate for this insular stock is the effective population size estimated by Courbis et al. (2014) as 220 animals. There are no data from which to derive a density estimate; therefore the density of the Hawaii Pelagic Stock is determined to be the best available (0.0067 animals/km^2).

Oahu stock: There are no data to estimate the abundance or density of this stock. Therefore, the best available data are those from the Hawaii Island Stock (220 animals) and the Hawaii Pelagic Stock (0.0067 animals/km^2), respectively.

4-Islands stock: There are no data to estimate the abundance or density of this stock. Therefore, the best available data are those from the Hawaii Island Stock (220 animals) and the Hawaii Pelagic Stock (0.0067 animals/km^2), respectively.

P. **Pygmy killer whale:** Very little information exists about this species in the Hawaii region. Mobley et al. (2000) did not report any sightings in their surveys of the Main Hawaiian Islands. The summer/fall survey in the Hawaii EEZ resulted in the best available density estimate (0.0014 animals/km^2) and abundance estimate (3,433 animals, CV=0.52) (Bradford et al., 2013).

Q. **Pygmy sperm whale**: Mobley et al. (2000) observed pygmy sperm whales during his 1993 to 1998 survey efforts, while two sightings were observed during Barlow's (2006) 2002 sighting survey; many strandings of this species are also recorded in Hawaiian waters (Carretta et al., 2014). A Hawaii stock of pygmy sperm whales is recognized (Carretta et al., 2014). The best available estimates for the Hawaiian stock of pygmy sperm whales is the density of 0.0071 animals/km^2 and the abundance 7,138 animals calculated from the summer/fall survey data in the Hawaii EEZ (Barlow, 2006; Carretta et al., 2014).

R. **Risso's dolphin:** A Hawaiian stock of Risso's dolphins is recognized, although this dolphin appears to occur rarely in the Hawaiian waters (Carretta et al., 2014). Mobley et al. (2000) observed insufficient sightings of Risso's dolphins to derive density or abundance estimates in nearshore waters. NMFS suggests that based on the locations of Hawaiian longline-fishery interactions of this species, it is likely that Risso's dolphins primarily occur in pelagic waters tens to hundreds of miles from the main Hawaiian Islands and are only occasionally found nearshore (Carretta et al., 2014). The best available density estimate (0.0067 animals/km^2) and abundance estimate (7,256 animals, CV=0.41) are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013).

S. **Rough-toothed dolphin:** A Hawaiian stock of rough-toothed dolphins is recognized. The best available density estimate (0.0026 animals/km^2) and abundance estimate (6,288 animals, CV=0.39) were calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is comparable to nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000).

T. **Short-finned pilot whale:** Short-finned pilot whales occur both in the NWHI and the MHI, where they occur commonly, and a Hawaiian stock is recognized (Carretta et al., 2014). The best available density estimate (0.0051 animals/km^2) and abundance estimate (12,422 animals, CV=0.43) were calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is an order of magnitude less than near-shore Hawaiian waters (0.0237 animals/km^2; Mobley et al., 2000).

U. **Sperm whale**: Sperm whales are known from many strandings and sightings in Hawaiian waters, and sperm whales occurring in the deep waters of the Hawaiian Islands are considered to be part of the

Hawaiian stock, which numbers 3,354 animals (CV=0.34) (Bradford et al., 2013). The best available density estimate (0.0014 animals/km^2) for sperm whales in this mission area was calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is slightly higher but comparable to near-shore Hawaiian waters (0.0010 animals/km^2; Mobley et al., 2000).

V. **Spinner dolphin:** Based on analyses of genetic data, movement patterns of dolphins, and the geographic distances among the Hawaiian Islands, five separate island-associated, insular stocks are recognized in the central North Pacific: Hawaii Island, Oahu/4-Islands Region, Kauai/Niihau, Pearl and Hermes Reef, and Midway Atoll/Kure (Hill et al., 2010; Carretta et al., 2014). The seaward boundary of the insular stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). All five of the Hawaii spinner dolphin insular stocks are found in the Hawaii North mission area, as well as the Hawaii Pelagic stock.

Hawaii Pelagic stock: Spinner dolphins beyond 18.5 km (10 nmi) from shore or around other islands within the Hawai'i EEZ belong to the Hawaii Pelagic Stock. A 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 3,351 spinner dolphins (Barlow, 2006). However, this study assumed a single Hawaiian Islands stock and occurred over eight years old. A 2010 shipboard line-transect study within the Hawaiian EEZ did not record any sightings of pelagic spinner dolphins (Bradford et al., 2013). Given the need for a density and abundance estimate for take calculations, the best available density estimate (0.0008 animals/km^2) and abundance estimate (3,351 animals, CV=0.74) are calculated from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006). This density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0443 animals/km^2; Mobley et al., 2000).

Hawaii Island stock: The seaward boundary of the island-associated stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). The best estimate of abundance for the Hawaii Island Stock is from intensive year-round photo-identification surveys in Kauhako Bay, Kealakekua Bay, Honaunau Bay, and Makako Bay along the Kona Coast of Hawaii Island in 2010 and 2011, 631 animals (CV=0.09) (Tyne et al. 2013; Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

Oahu/4 Islands stock: The seaward boundary of the island-associated stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). The best estimate of abundance for the Oahu/4-Islands Region Stock is from a photo-identification study conducted July to September 2007 on the leeward coast of Oahu, which resulted in an estimate of 355 animals (CV=0.09), though it is recognized that this is likely an underestimate because of its limited spatial scope (Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

Kauai/Niihau stock: The seaward boundary of the island-associated stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). The best estimate of abundance for the Kauai/Niihau Stock is from a photo-identification study conducted October to November 2005 on the leeward coast of Kauai, which resulted in an estimate of 601 animals (CV=0.20), though it is recognized that this is likely an underestimate because of its limited spatial scope (Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

Kure/Midway Atoll stock: During a 2010 shipboard line-transect survey within the Hawaiian EEZ, only one off-effort spinner dolphin was sighted at Kure Atoll (Carretta et al., 2014). An earlier multi-year photo-identification study at Midway Atoll identified a population of 260 spinner dolphins based on 139 identified individuals (Karczmarski et al., 1998), which remains the best available stock estimate for the Kure/Midway Atoll stock of spinner dolphins (Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

Pearl and Hermes Reef stock: While spinner dolphins in this area have been photo-identified, little survey and low re-sighting rates of these dolphins makes estimating an abundance challenging. However, based on the work of Andrews et al. (2006) and Hoos (2013), the best available abundance for the Pearl and Hermes Reef stock has been estimated at 300 animals, while the best density estimate for this stock, 0.0070 animals/km^2, is derived from the summer/fall survey of the Hawaiian EEZ waters (Barlow, 2006).

W. **Striped dolphin:** Striped dolphins in Hawaiian waters are separated into a discrete Hawaiian stock (Carretta et al., 2014). The best available density and abundance estimates for the Hawaiian stock of striped dolphins are 0.0084 animals/km^2 and 20.650 individuals (CV=0.36), respectively, as derived from the summer/fall surveys in the Hawaiian EEZ (Bradford et al., 2013). This density estimate is comparable to nearshore Hawaiian waters (0.0016 animals/km^2; Mobley et al., 2000).

X. **Hawaiian monk seal**: Monk seals primarily occur in the NWHI, though a respectable population is beginning to establish itself throughout the MHI in 2006 (Carretta et al., 2014). Migration occurs amongst the NWHI subpopulations, so these subpopulations are not isolated (Harting, 2002). Foraging behavior suggests offshore movement patterns (Parrish et al., 2000; Parrish et al., 2002). The current abundance estimated for the stock of Hawaiian monk seals is 1,209 animals (Carretta et al., 2014). Although no density for the very rare Hawaiian monk seal is available, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis for this species to reflect the very low probability of occurrence in this region.

11. MISSION AREA 11—HAWAII SOUTH

A. **Blue whale**: Although there is uncertainty about the structure of blue whale stocks in the North Pacific, blue whales occurring in Hawaiian waters are considered part of the CNP stock (Carretta et al., 2014). Blue whales occur rarely in the central North Pacific, with few sightings and acoustic detections having been made (Carretta et al., 2014). No sightings of blue whales were made around Hawaii during the Acoustic Thermometry of Ocean Climate Marine Mammal Research Program of a summer/fall 2002 line-transect survey (Barlow, 2006; Mobley, 2006). A 2010 shipboard line-transect survey of the Hawaii EEZ estimated an abundance of 81 (CV=1.14) animals and a density of 0.00003 animals/km^2 (Bradford et al., 2013; Carretta et al., 2014). Additional evidence of blue whale occurrence in this mission area exists from acoustic recordings. Stafford et al. (2001) showed that recordings made near Kaneohe, Hawaii from August 1992 through April 1993 consisted of approximately 30% of the northwest Pacific blue whale call type and 70% of northeast Pacific call type, with western North Pacific calls dominating during the winter and eastern North Pacific calls dominating during the summer.

B. **Bryde's whale:** Sightings of the Bryde's whale in Hawaiian waters have been recorded sporadically since 1977 (Carretta et al., 2014). Occurrence data are sufficient to define a Hawaiian stock of Bryde's whales. Bradford et al.'s (20013) estimates of the Hawaiian stock of Bryde's whales are the best available, with a density for the whales estimated as 0.00033 animals/km^2 and a stock abundance of 798 animals (CV=0.28), calculated for the summer/fall surveys in the Hawaii EEZ.

C. **Common minke whale:** A Hawaii stock is recognized that occurs seasonally (November-March) in Hawaiian waters, though no estimate of abundance has been calculated (Carretta et al., 2014). Minke whales were observed and acoustically detected during the 2002 summer/fall survey of the Hawaiian EEZ (Barlow, 2006). One off-effort sighting was made during the 2010 summer/fall survey (Bradford et al., 2013). A year-long analysis of acoustic recordings made at Station ALOHA (A Long-term Oligotrophic Habitat Assessment) 100 km (54 nmi) north of Oahu detected "central" or "Hawaii" boings from 22 October 2007 to 21 May 2008 and not at all during the months of June to September, though this does not indicate that no minke whales were present (Oswald et al., 2011). Using passive acoustic detections from hydrophones on the Pacific Missile Range Facility off Kauai, Martin et al.

(2013) estimated 2.15 "boing"-calling minke whales per 1000 km^2. However, the relationship between the number of whales vocalizing and the number of whale present is not known to provide an estimate of abundance. Lacking abundance data for this stock in Hawaiian waters, the best estimate of abundance (25,049 animals) is derived from sighting surveys in July and August in the western North Pacific and Sea of Okhotsk (Buckland et al., 1992). The best density estimate, 0.0002 animals/km^2, for minkes in Hawaiian waters is calculated from the eastern North Pacific (Ferguson and Barlow, 2001, 2003).

D. **Fin whale**: A sighting in nearshore waters in February (Mobley et al., 1996) and acoustic data support the presence of fin whale during fall and winter in Hawaiian waters (Thompson and Friedl, 1982; Moore et al., 1998). From the sightings reported during the 2010 summer/fall survey (Bradford et al., 2013), an abundance estimate of 58 animals (CV=1.12) and a density of 0.00002 animals/km^2 fin whales was calculated for the Hawaii stock of fin whales (Carretta et al., 2014). This density estimate is similar to that of McDonald and Fox (1999) with an average calling whale density estimate of 0.027 animals per 1000 km^2 (0.000027 animals/km^2) based on recordings made north of Oahu, Hawaii. The seasonal maximum calling whale density was about three times the average, or 0.000081 animals/km^2 (McDonald and Fox, 1999).

E. **Humpback whale**: The CNP stock of humpback whales is identified as individuals that migrate from summer/fall feeding grounds of northern British Columbia and southeast Alaska (Prince William Sound west to Kodiak), to winter/spring breeding and calving grounds of the Hawaiian Islands (Carretta et al., 2014). Some exchange between winter/spring areas has been documented, as well as movement between Japan and British Columbia, and Japan and the Kodiak Archipelago (Calambokidis et al., 1997). Acoustic surveys suggest a northbound migration heading of approximately magnetic north (10° true), with a "migration corridor" of 150° to 160°W (Norris et al., 1999) and a winter presence in the NWHI, with animals cycled through the breeding grounds with an average residency of approximately 30 to 45 days (Lammers et al., 2010). Based on the recent North Pacific humpback whale abundance updates from Calambokidis et al. (2008), the best available abundance estimate for the CNP stock of humpback whales is 10,103 individuals, which is a much higher estimate than former surveys and research provided. Humpback whales are not expected in this mission area during summer. A density estimate of 0.0009 animals animals/km^2 from LGL (2008) data was used for this mission area and stock.

F. **Sei whale**: Sei whales are present throughout the temperate North Pacific Ocean but have been observed as far south as 20°N (Horwood, 1987), with whaling effort distributed continuously across the North Pacific between 45°N and 55°N (Masaki, 1977). The IWC only considers one stock of sei whales in the North Pacific (Donovan, 1991), but NMFS recognizes three stocks, including a Hawaiian stock. The best estimate of abundance for the Hawaii sei whale stock is from a 2010 summer/fall shipboard line-transect survey of the entire Hawaiian Islands EEZ that estimated 178 (CV=0.90) sei whales (Bradford et al., 2013), though the majority of sei whales would be expected to be distributed at a higher latitude during this time of year (Carretta et al., 2014). A density estimate of 0.00007 animals/km^2 (Bradford et al., 2013) was derived from the 2010 line-transect survey.

G. **Blainville's beaked whale:** Blainville's beaked whales potentially occur in the deep waters of this mission area. The best available density estimate (0.0010 animals/km^2) and abundance estimate (2,338 animals, CV=1.13) are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is comparable to nearshore Hawaiian waters (0.0012 animals/km^2; Mobley et al., 2000).

H. **Common bottlenose dolphin:** Recent photo-id and genetic studies around the main Hawaiian Islands suggest limited movements among islands and offshore waters (Baird et al., 2009). Five Pacific Islands Region stocks are identified: (1) Kauai and Niihau; (2) Oahu; (3) the "4-Island Region" including Molokai, Lanai, Maui, and Kahoolawe; (4) Hawaii Island; and (5) Hawaii Pelagic (Carretta et

al., 2014). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath.

Hawaii pelagic stock: The best available density estimate (0.0025 animals/km^2) and abundance estimate (5,950 animals) for this oceanic stock of bottlenose dolphins are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013; Carretta et al., 2014).

Kauai/Niihau stock: The best abundance estimate for this insular stock is 184 dolphins based on 2003 to 2005 photo-ID studies (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0001 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

Oahu stock: The best abundance estimate for this insular stock is 743 dolphins based on 2002, 2003, and 2006 in Oahu waters (except the windward waters) (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0003 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

4-Islands stock: The best abundance estimate for this insular stock is 191 dolphins based on 2002 to 2006 photo-ID studies of individual common bottlenose dolphins in the waters of Maui and Lanai (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0001 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

Hawaii Island stock: The best abundance estimate for this insular stock is 128 dolphins based on 2003 to 2006 photo-ID studies (Baird et al., 2009; Carretta et al., 2014). Density estimates are not available for the insular stocks of the Hawaiian Island Stock Complex; therefore, density estimates were derived for the insular stocks by scaling the density estimate of the Hawaii Pelagic stock by the ratio of the Pelagic stock abundance and each of the given insular stock abundances. This resulted in the best available density estimate (0.0.0001 animals/km^2). The density estimate is an order of magnitude less than that calculated from nearshore Hawaiian waters (0.0013 animals/km^2; Mobley et al., 2000).

I. **Cuvier's beaked whale:** The best available density estimate (0.0008 animals/km^2) and abundance estimate (1,941 individuals, CV=0.70) for the Hawaiian stock of Cuvier's beaked whales are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013; Carretta et al., 2014). The density estimate is comparable to the density estimate in nearshore Hawaiian waters (0.0008 animals/km^2; Mobley et al., 2000).

J. **Deraniyagala beaked whale**: Dalebout et al. (2014) conducted genetic and molecular analyses to demonstrate that *M. hotaula* was genetic distinct from the ginkgo-toothed beaked whale (*M. ginkgodens*). Little is known about this beaked whale species. No abundance or stock information is available for the Deraniyagala beaked whale. Given that this species was synonymous with the ginkgo-toothed beaked whale, which is part of the *Mesoplodon* spp. complex, the best available density and abundance estimates for *Mesoplodon* spp. at the same latitudes in the ETP are most appropriate for this region (Ferguson and Barlow, 2001, 2003). Using Ferguson and Barlow's (2001,

2003) northernmost strata, a density estimate of 0.0009 animals/km^2 and abundance estimate of 22,799 animals were used for analyses for the Deraniyagala beaked whale in this mission area.

K. **Dwarf sperm whale**: Dwarf sperm whales are known in Hawaii from both strandings and sightings, with Mobley et al. (2000) having observed two pods of dwarf and pygmy sperm whales for a total of five individuals during his 1993 to 1998 survey efforts, although no density or abundance estimates were derived. Dwarf sperm whales were also observed near Niihau, Kauai, Lanai, and Hawaii during small boat surveys between 2000 and 2003 (Baird, 2005). The best available estimates for the Hawaiian stock of dwarf sperm whales are the density and abundance, 0.0029 animals/km2 and 17,519 animals, respectively, estimated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006).

L. **False killer whale**: Five Pacific Islands Region management stocks of false killer whales are currently recognized (Carretta et al., 2014): the main Hawaiian Islands insular stock (which includes false killer whales occurring within 140 km [approximately 75 nmi] of the main Hawaiian Islands; the Northwestern Hawaiian Islands (NWHI) stock (which includes false killer whales inhabiting waters within 93 km (50 nmi) of the NWHI and Kauai); the Hawaii pelagic stock (including false killer whales occurring in waters further than 44 km [approximately 22 nmi] of the main Hawaiian Islands; the Palmyra Atoll stock (which includes false killer whales within the U.S. EEZ of Palmyra Atoll); and the American Samoa stock (including animals within the U.S. EEZ of American Samoa). Overlap of the stock's ranges occurs between the main Hawaiian Islands insular, Northwestern Hawaiian Islands, and pelagic stocks of the false killer whale; the ranges of the insular and pelagic populations overlap in the area between about 42 km and 112 km from shore of the main Hawaiian Islands while overlap in the ranges of insular and Northwestern Hawaiian Islands stocks occurs in water within 40 km of Kauai and Niihau (Forney et al., 2010; Carretta et al., 2014). False killer whales occur year-round in Hawaiian waters. Only the Main Hawaiian Islands (MHI) and Pelagic stocks of false killer whales potentially occur in the Hawaii-South mission area.

Hawaii pelagic stock: The abundance of the Hawaii pelagic stock of false killer whales is estimated as 1,503 individuals CV=0.66) from 2010 visual line-transect data; this estimate, however, has not been yet corrected for shipboard attraction (Bradford et al., 2012). As indicated by behavioral observations and assessment of the detection function, false killer whales are attracted to the survey vessel, so that the abundance estimated is an overestimate (Carretta et al., 2014). The best available density estimate for the Hawaii pelagic stock, 0.0006 individuals/km^2, was also estimated from the 2010 dedicated survey of Hawaiian EEZ waters (Bradford et al., 2012).

Main Hawaiian Islands insular stock: The best available abundance estimate (151 animals, CV=0.20) for the MHI insular stock is derived from the 2006 to 2009 recent sighting histories and open population models presented in unpublished assessments for the status review of Hawaiian false killer whales (Caretta et al., 2014). A density estimate of 0.0012 animals/km^2 is the best available estimate of the insular stock (Oleson et al., 2010).

M. **Fraser's dolphin:** Fraser's dolphins were first documented in Hawaiian waters during the 2003 summer/fall survey (Barlow, 2006). The best available density estimate of 0.0069 animals/km^2 and abundance estimate of 16,992 animals (CV=0.66) are from the 2010 summer/fall survey (Bradford et al., 2013).

N. **Killer whale:** Killer whales are considered rare in Hawaiian waters with limited sightings having been reported (Carretta et al., 2014). The best available density estimate (0.00004 animals/km^2) and abundance estimate (101 animals, CV=1.00) are calculated from the summer/fall survey in the waters of the Hawaii EEZ (Bradford et al., 2013). Mobley et al. (2000) did not report any sightings in their surveys of coastal waters of the MHI.

O. **Longman's beaked whale:** Longman's beaked whale has only recently been identified to species (Pitman et al., 1999; Dalebout et al., 2003) and is considered one of the rarest and least known of

cetacean species. The best available density estimate (0.00187 animals/km^2) and abundance estimate (4,571 animals, CV=0.65) for the Hawaiian stock of this beaked whale were calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). No other density estimates exist for this species around Hawaii (Mobley et al., 2000).

P. **Melon-headed whale:** Recent studies reveal evidence for island-associated stock structure in melon-headed whales in the main Hawaiian Islands and NMFS now recognizes two stocks (Carretta et al., 2014): (1) a Kohala Resident Stock, consisting of animals within the 2,500 m (8,202.5 ft) isobath around the west and northwest sides of Hawaii Island (Oleson et al., 2013); and (2) a Hawaiian Islands Stock, consisting of the remainder of melon-headed whales found within the Hawaii EEZ. The northern boundary between the two stocks provisionally runs through the Alenuihaha Channel between Hawaii Island and Maui, bisecting the distance between the 1000-m depth contours (Oleson et al., 2013).

Hawaiian Islands stock: Recent studies of photo-identification data using mark-recapture techniques provide the best available abundance estimate (5,794 animals CV=0.20) (Baird et al., 2010; Aschettino, 2012; Carretta et al., 2014). The best available density estimate (0.0012 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). The density estimate is comparable to nearshore Hawaiian waters (0.0021 animals/km^2; Mobley et al., 2000).

Kohala Resident stock: Individuals in the smaller Kohala resident stock have a range restricted to shallower waters of the Kohala shelf and west side of Hawaii Island (Aschettino et al., 2012). Satellite telemetry data indicate they occur in waters less than 2500 m depth around the northwest and west shores of Hawaii Island, west of 1560 45' W and north of 190 15'N (Oleson et al., 2013). The best available abundance estimate (447 animals, CV=0.12) is from photo-id work between 2002 and 2009 (Aschettino, 2010). A density estimate (0.03725 animals/km^2) was derived from the abundance estimate and the estimated spatial range of the stock.

Y. **Pantropical spotted dolphin:** Genetic analyses support the recognition of three island-associated insular stocks: a Hawaii Island Stock that extends 65 km (35 nmi) from shore, a 4-Islands Stock that extends 20 km (11 nmi) from shore, and an Oahu Stock that extends 20 km (11 nmi) from shore (Oleson et al., 2013), in addition to a Hawaii Pelagic Stock that consists of all other pantropical spotted dolphins within the Hawaii EEZ (Carretta et al., 2014).

Hawaii Pelagic stock: The best available density estimate (0.0067 animals/km^2) and abundance estimate (15,917 animals, CV=0.40) are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013).

Hawaii Island stock: The best abundance estimate for this insular stock is the effective population size estimated by Courbis et al. (2014) as 220 animals. There are no data from which to derive a density estimate, therefore the density of the Hawaii Pelagic stock is determined to be the best available (0.0067 animals/km^2).

Oahu stock: There are no data to estimate the abundance or density of this stock. Therefore, the best available data are those from the Hawaii Island Stock (220 animals) and the Hawaii Pelagic stock (0.0067 animals/km^2), respectively.

4-Islands stock: There are no data to estimate the abundance or density of this stock. Therefore, the best available data are those from the Hawaii Island Stock (220 animals) and the Hawaii Pelagic stock (0.0067 animals/km^2), respectively.

Q. **Pygmy killer whale**: Very little information exists about pygmy killer whales in the Hawaii region. Mobley et al. (2000) did not report any sightings in their surveys of waters of the MHI. The summer/fall survey in the Hawaii EEZ resulted in the best available density estimate (0.0014 animals/km^2) and abundance estimate (3,433 animals, CV=0.52) (Bradford et al., 2013).

R. **Pygmy sperm whale**: Mobley et al. (2000) observed pygmy sperm whales during his 1993 to 1998 survey efforts, while two sightings were observed during Barlow's (2006) 2002 sighting survey; many strandings of this species are also recorded in Hawaiian waters (Carretta et al., 2014). A Hawaii stock of pygmy sperm whales is recognized (Carretta et al., 2014). The best available estimates for the Hawaiian stock of pygmy sperm whales is the density of 0.0071 animals/km^2 and the abundance 7,138 animals calculated from the summer/fall survey data in the Hawaii EEZ (Barlow, 2006; Carretta et al., 2014).

S. **Risso's dolphin:** A Hawaiian stock of Risso's dolphins is recognized, although this dolphin appears to occur rarely in the Hawaiian waters (Carretta et al., 2014). Mobley et al. (2000) observed insufficient sightings of Risso's dolphins to derive density or abundance estimates in nearshore waters. NMFS suggests that based on the locations of Hawaiian longline-fishery interactions of this species, it is likely that Risso's dolphins primarily occur in pelagic waters tens to hundreds of miles from the main Hawaiian Islands and are only occasionally found nearshore (Carretta et al., 2014). The best available density estimate (0.0067 animals/km^2) and abundance estimate (7,256 animals, CV=0.41) are calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013).

T. **Rough-toothed dolphin:** A Hawaiian stock of rough-toothed dolphins is recognized. The best available density estimate (0.0026 animals/km^2) and abundance estimate (6,288 animals, CV=0.39) were calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is comparable to nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000).

U. **Short-finned pilot whale:** Short-finned pilot whales occur both in the NWHI and the MHI, where they occur commonly, and a Hawaiian stock is recognized (Carretta et al., 2014). The best available density estimate (0.0051 animals/km^2) and abundance estimate (12,422 animals, CV=0.43) were calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is an order of magnitude less than near-shore Hawaiian waters (0.0237 animals/km^2; Mobley et al., 2000).

V. **Sperm whale**: Sperm whales are known from many strandings and sightings in Hawaiian waters, and sperm whales occurring in the deep waters of the Hawaiian Islands are considered to be part of the Hawaiian stock, which numbers 3,354 animals (CV=0.34) (Bradford et al., 2013). The best available density (0.0014 animals/km^2) estimate for sperm whales in this mission area was calculated from the summer/fall survey in the Hawaii EEZ (Bradford et al., 2013). This density estimate is slightly higher but comparable to near-shore Hawaiian waters (0.0010 animals/km^2; Mobley et al., 2000).

W. **Spinner dolphin:** Based on analyses of genetic data, movement patterns of dolphins, and the geographic distances among the Hawaiian Islands, five separate island-associated insular stocks are recognized in the central North Pacific: Hawaii Island, Oahu/4-Islands Region, Kauai/Niihau, Pearl and Hermes Reef, and Midway Atoll/Kure (Hill et al., 2010; Carretta et al., 2014). The seaward boundary of the insular stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). Three of the five Hawaii spinner dolphin insular stocks, Kauai/Niihau, Oahu/4 Islands, and Hawaii Island, are found within the Hawaii South mission area, as well as the Hawaii Pelagic stock.

Hawaii Pelagic stock: Spinner dolphins beyond 18.5 km (10 nmi) from shore or around other islands within the Hawai'i EEZ belong to the Hawaii Pelagic Stock. A 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 3,351 spinner dolphins (Barlow, 2006). However, this study assumed a single Hawaiian Islands stock and occurred over eight years old. A 2010 shipboard line-transect study within the Hawaiian EEZ did not record any sightings of pelagic spinner dolphins (Bradford et al., 2013). Given the need for a density and abundance estimate for take calculations, the best available density estimate (0.0070 animals/km^2) and abundance estimate (3,351 animals, CV=0.74) are calculated from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006). This density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0443 animals/km^2; Mobley et al., 2000).

Kauai/Niihau stock: The seaward boundary of the island-associated stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). The best estimate of abundance for the Kauai/Niihau Stock is from a photo-identification study conducted October to November 2005 on the leeward coast of Kauai, which resulted in an estimate of 601 animals (CV=0.20), though it is recognized that this is likely an underestimate because of its limited spatial scope (Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

Oahu/4 Islands stock: The seaward boundary of the island-associated stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). The best estimate of abundance for the Oahu/4-Islands Region Stock is from a photo-identification study conducted July to September 2007 on the leeward coast of Oahu, which resulted in an estimate of 355 animals (CV=0.09), though it is recognized that this is likely an underestimate because of its limited spatial scope (Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

Hawaii Island stock: The seaward boundary of the island-associated stocks is 18.5 km (10 nmi) around each island or island group (Hill et al., 2010). The best estimate of abundance for the Hawaii Island Stock is from intensive year-round photo-identification surveys in Kauhako Bay, Kealakekua Bay, Honaunau Bay, and Makako Bay along the Kona Coast of Hawaii Island in 2010 and 2011, 631 animals (CV=0.09) (Tyne et al. 2013; Carretta et al., 2014). The best available density estimate (0.0070 animals/km^2) is from the 2002 summer/fall survey in the Hawaii EEZ (Barlow, 2006).

W. **Striped dolphin**: Striped dolphins in Hawaiian waters are separated into a discrete Hawaiian stock (Carretta et al., 2014). The best available density and abundance estimates for the Hawaiian stock of striped dolphins are 0.0084 animals/km^2 and 20.650 individuals (CV=0.36), respectively, as derived from the summer/fall surveys in the Hawaiian EEZ (Bradford et al., 2013). This density estimate is comparable to nearshore Hawaiian waters (0.0016 animals/km^2; Mobley et al., 2000).

X. **Hawaiian monk seal**: Monk seals primarily occur in the NWHI, though a respectable population is beginning to establish itself throughout the MHI in 2006 (Carretta et al., 2014). Migration occurs amongst the NWHI subpopulations, so these subpopulations are not isolated (Harting, 2002). Foraging behavior suggests offshore movement patterns (Parrish et al., 2000; Parrish et al., 2002). The current abundance estimated for the stock of Hawaiian monk seals is 1,209 animals (Carretta et al., 2014). Although no density for the very rare Hawaiian monk seal is available, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.0001 animals/km^2 was used in the risk analysis for this species to reflect the very low probability of occurrence in this region.

APPENDIX B: POTENTIALLY AFFECTED MARINE MAMMAL SPECIES BY STOCK IN THE WESTERN AND CENTRAL NORTH PACIFIC OCEAN

Table B1. Percent of stocks and associated number of blue whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	CNP	9,250	0.01	2
3	West Philippine Sea	3	CNP	9,250	0.00	2
4	Offshore Guam	3	CNP	9,250	0.00	2
9	Offshore Japan (10° to 25°N)	1	CNP	9,250	0.00	1
Total Central North Pacific Stock					***0.01%***	***7***
10	Hawaii-North	2	CNP	81	1.03	1
11	Hawaii-South	2	CNP	81	1.41	2
Total Central North Pacific-Hawaii Stock					***2.44%***	***3***
Totals		**14**			**2.45%**	**10**

27 Stock names: CNP=Central North Pacific; WNP=Western North Pacific; ECS=East China Sea; NP=North Pacific; SOJ=Sea of Japan; IA=Inshore Archipelago; NMI=Northern Mariana Islands

28 Percent (%) stock has been rounded up to two decimal places.

29 Fractional animals potentially affected have been rounded up to the next whole number.

Table B2. Percent of stocks and associated number of Bryde's whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[28]
Number	Name					
1	East of Japan	1	WNP	20,501	0.21	52
2	North Philippine Sea	3	WNP	20,501	0.21	46
3	West Philippine Sea	3	WNP	20,501	0.21	44
4	Offshore Guam	3	WNP	20,501	0.05	12
5	Sea of Japan	2	WNP	20,501	0.02	6
7	South China Sea	1	WNP	20,501	0.21	53
8	Offshore Japan (25° to 40°N)	1	WNP	20,501	0.06	14
9	Offshore Japan (10° to 25°N)	1	WNP	20,501	0.03	8
Total Western North Pacific Stock					***1.00%***	***235***
6	East China Sea	1	ECS	137	5.60	8
Total East China Sea Stock					***5.60%***	***8***
10	Hawaii-North	2	Hawaii	798	1.91	16
11	Hawaii-South	2	Hawaii	798	1.32	11
Total Hawaii Stock					***3.23%***	***27***
Totals		**20**			**9.83%**	**270**

Table B3. Percent of stocks and associated number of common minke whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP "O"	25,049	0.21	52
2	North Philippine Sea	3	WNP "O"	25,049	1.28	321
3	West Philippine Sea	3	WNP "O"	25,049	0.93	234
4	Offshore Guam	3	WNP "O"	25,049	0.03	8
5	Sea of Japan	2	WNP "O"	25,049	0.07	18
6	East China Sea	1	WNP "O"	25,049	0.39	99
7	South China Sea	1	WNP "O"	25,049	0.21	53
8	Offshore Japan (25° to 40°N)	1	WNP "O"	25,049	0.05	14
Total Western North Pacific "O" Stock					***3.17%***	***799***
5	Sea of Japan	2	WNP "J"	893	0.78	8
6	East China Sea	1	WNP "J"	893	4.50	41
7	South China Sea	1	WNP "J"	893	3.21	29
Total Western North Pacific "J" Stock					***8.49%***	***78***
10	Hawaii-North	2	Hawaii	25,049	0.02	6
11	Hawaii-South	2	Hawaii	25,049	0.03	9
Total Hawaii Stock					***0.05%***	***15***
Totals		**23**			**11.71%**	**892**

Table B4. Percent of stocks and associated number of fin whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	9,250	0.03	3
2	North Philippine Sea	3	WNP	9,250	0.11	11
3	West Philippine Sea	3	WNP	9,250	0.05	5
4	Offshore Guam	3	WNP	9,250	0.00	2
5	Sea of Japan	2	WNP	9,250	0.49	46
7	South China Sea	1	WNP	9,250	0.03	4
8	Offshore Japan (25° to 40°N)	1	WNP	9,250	0.06	6
9	Offshore Japan (10° to 25°N)	1	WNP	9,250	0.00	1
Total Western North Pacific Stock					***0.77%***	***78***
6	East China Sea	1	ECS	500	0.86	5
Total East China Sea Stock					***0.86%***	***5***
10	Hawaii-North	2	Hawaii	58	0.96	1
11	Hawaii-South	2	Hawaii	58	1.20	2
Total Hawaii Stock					***2.16%***	***3***
Totals		**20**			**3.79%**	**86**

Table B5. Percent of stocks and associated number of humpback whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	1,107	3.93	45
3	West Philippine Sea	3	WNP	1,107	3.98	45
4	Offshore Guam	3	WNP	1,107	0.87	11
Total Western North Pacific Stock					***8.78%***	***101***
10	Hawaii-North	2	CNP	10,103	0.24	25
11	Hawaii-South	2	CNP	10,103	0.27	29
Total Central North Pacific Stock					***0.51%***	***54***
Totals		**13**			**9.29%**	**155**

Table B6. Percent of stock and associated number of North Pacific right whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	922	—[30]	—
2	North Philippine Sea	3	WNP	922	0.05	2
5	Sea of Japan	2	WNP	922	0.02	1
6	East China Sea	1	WNP	922	—	—
7	South China Sea	1	WNP	922	0.03	1
Totals		**8**			**0.10%**	**4**

30 "—" indicates that an animal is not expected in the mission area during that season.

Table B7. Percent of stock and associated number of Omura's whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	1,800	0.24	6
3	West Philippine Sea	3	WNP	1,800	0.24	6
4	Offshore Guam	3	WNP	1,800	0.06	3
5	Sea of Japan	2	WNP	1,800	0.03	2
6	East China Sea	1	WNP	1,800	0.09	2
7	South China Sea	1	WNP	1,800	0.05	1
9	Offshore Japan (10° to 25°N)	1	WNP	1,800	0.04	1
Totals		**14**			**0.75%**	**21**

Table B8. Percent of stocks and associated number of sei whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	NP	8,600	0.15	13
4	Offshore Guam	3	NP	8,600	0.09	9
8	Offshore Japan (25° to 40°N)	1	NP	8,600	0.11	10
9	Offshore Japan (10° to 25°N)	1	NP	8,600	0.04	4
Total North Pacific Stock					***0.39%***	***36***
10	Hawaii-North	2	Hawaii	178	1.57	3
11	Hawaii-South	2	Hawaii	178	1.97	4
Total Hawaii Stock					***3.54%***	***7***
Totals		**10**			**3.93%**	**43**

Table B9. Percent of stock and associated number of Western Pacific gray whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
5	Sea of Japan	2	WNP	140	0.06	2
6	East China Sea	1	WNP	140	—[30]	—
7	South China Sea	1	WNP	140	0.03	1
Totals		**4**			**0.09%**	**3**

Table B10. Percent of stock and associated number of Baird's beaked whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 15 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	8,000	0.71	57
5	Sea of Japan	2	WNP	8,000	0.14	12
8	Offshore Japan (25° to 40°N)	1	WNP	8,000	0.02	2
Totals		**4**			**0.87%**	**71**

Table B11. Percent of stocks and associated number of Blainville's beaked whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	8,032	0.25	22
3	West Philippine Sea	3	WNP	8,032	0.22	20
4	Offshore Guam	3	WNP	8,032	0.46	39
6	East China Sea	1	WNP	8,032	0.11	9
7	South China Sea	1	WNP	8,032	0.06	5
8	Offshore Japan (25° to 40°N)	1	WNP	8,032	0.10	8
9	Offshore Japan (10° to 25°N)	1	WNP	8,032	0.08	7
Total Western North Pacific Stock					***1.28%***	***110***
10	Hawaii-North	2	Hawaii	2,338	1.05	25
11	Hawaii-South	2	Hawaii	2,338	0.94	23
Total Hawaii Stock					***1.99%***	***48***
Totals		**17**			**3.27%**	**158**

Table B12. Percent of stock and associated number of common bottlenose dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	168,791	0.11	181
2	North Philippine Sea	3	WNP	168,791	0.39	662
3	West Philippine Sea	3	WNP	168,791	0.39	652
4	Offshore Guam	3	WNP	168,791	0.03	53
8	Offshore Japan (25° to 40°N)	1	WNP	168,791	0.01	15
9	Offshore Japan (10° to 25°N)	1	WNP	168,791	0.01	11
Total Western North Pacific Stock					***0.94%***	***1,574***
5	Sea of Japan	2	IA	105,138	0.02	21
6	East China Sea	1	IA	105,138	0.03	28
7	South China Sea	1	IA	105,138	0.01	7
Total Inshore Archipelago Stock					***0.06%***	***56***
10	Hawaii-North	2	Hawaii Pelagic	5,950	1.16	70
11	Hawaii-South	2	Hawaii Pelagic	5,950	0.98	59
Total Hawaii Pelagic Stock					***2.14%***	***129***
10	Hawaii-North	2	Kauaii/ Niihau	184	0.00	2
11	Hawaii-South	2	Kauaii/ Niihau	184	0.00	2
Total Kauaii/Niihau Stock					***0.00%***	***4***
10	Hawaii-North	2	Oahu	743	0.02	2
11	Hawaii-South	2	Oahu	743	0.00	2
Total Oahu Stock					***0.02%***	***4***
10	Hawaii-North	2	4-Islands	191	0.04	2
11	Hawaii-South	2	4-Islands	191	0.00	2
Total 4-Islands Stock					***0.04%***	***4***
10	Hawaii-North	2	Hawaii Island	128	0.00	2
11	Hawaii-South	2	Hawaii Island	128	0.00	2

Table B12. Percent of stock and associated number of common bottlenose dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
Total Hawaii Island Stock					***0.00%***	***4***
Totals		**36**			**3.20%**	**1,775**

Table B13. Percent of stocks and associated number of Cuvier's beaked whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	90,725	0.05	50
2	North Philippine Sea	3	WNP	90,725	0.24	221
3	West Philippine Sea	3	WNP	90,725	0.01	12
4	Offshore Guam	3	WNP	90,725	0.03	31
5	Sea of Japan	2	WNP	90,725	0.12	113
6	East China Sea	1	WNP	90,725	0.01	6
7	South China Sea	1	WNP	90,725	0.00	3
8	Offshore Japan (25° to 40°N)	1	WNP	90,725	0.05	42
9	Offshore Japan (10° to 25°N)	1	WNP	90,725	0.04	35
Total Western North Pacific Stock					***0.55%***	***513***
10	Hawaii-North	2	Hawaii	1,941	1.01	21
11	Hawaii-South	2	Hawaii	1,941	0.91	18
Total Hawaii Stock					***1.92%***	***39***
Totals		**20**			**2.47%**	**552**

Table B14. Percent of stock and associated number of Dall's porpoises potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
5	Sea of Japan	2	SOJ	76,720	1.00	767
Totals		**2**			**1.00%**	**767**

Table B15. Percent of stock and associated number of Deraniyagala beaked whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
4	Offshore Guam	3	NP	22,799	0.16	37
7	South China Sea	1	NP	22,799	0.02	5
9	Offshore Japan (10° to 25°N)	1	NP	22,799	0.04	9
11	Hawaii-South	2	NP	22,799	0.09	22
Totals		**7**			**0.31%**	**73**

Table B16. Percent of stocks and associated number of false killer whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	16,668	0.29	48
2	North Philippine Sea	3	WNP	16,668	0.80	135
3	West Philippine Sea	3	WNP	16,668	0.78	131
4	Offshore Guam	3	WNP	16,668	0.15	25
8	Offshore Japan (25° to 40°N)	1	WNP	16,668	0.44	74
9	Offshore Japan (10° to 25°N)	1	WNP	16,668	0.05	8
Total Western North Pacific Stock					***2.51%***	***421***
5	Sea of Japan	2	IA	9,777	0.79	78
6	East China Sea	1	IA	9,777	0.20	20
7	South China Sea	1	IA	9,777	0.10	11
Total Inshore Archipelago Stock					***1.09%***	***109***
10	Hawaii-North	2	Hawaii Pelagic	1,503	1.25	20
11	Hawaii-South	2	Hawaii Pelagic	1,503	1.02	16
Total Hawaii Pelagic Stock					***2.27%***	***36***
10	Hawaii-North	2	Main Hawaiian Islands Insular	151	1.27	3
11	Hawaii-South	2	Main Hawaiian Islands Insular	151	0.18	2
Total Main Hawaiian Islands Insular Stock					***1.45%***	***5***
10	Hawaii-North	2	Northwestern Hawaiian Islands	552	0.38	4
Total Northwestern Hawaiian Islands Stock					***0.38%***	***4***
Totals		**26**			**7.70%**	**575**

Table B17. Percent of stocks and associated number of Fraser's dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	220,789	0.14	307
3	West Philippine Sea	3	WNP	220,789	0.13	294
6	East China Sea	1	WNP	220,789	0.06	140
7	South China Sea	1	WNP	220,789	0.03	70
9	Offshore Japan (10° to 25°N)	1	WNP	220,789	0.19	32
Total Western North Pacific Stock					***0.55%***	***843***
4	Offshore Guam	3	CNP	16,992	0.97	167
Total Central North Pacific Stock					***0.97%***	***167***
10	Hawaii-North	2	Hawaii	16,992	0.92	158
11	Hawaii-South	2	Hawaii	16,992	1.09	186
Total Hawaii Stock					***2.01%***	***344***
Totals		**16**			**3.53%**	**1,354**

Table B18. Percent of stock and associated number of ginkgo-toothed beaked whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	NP	22,799	0.03	8
2	North Philippine Sea	3	NP	22,799	0.09	22
3	West Philippine Sea	3	NP	22,799	0.08	20
4	Offshore Guam	3	NP	22,799	0.16	37
6	East China Sea	1	NP	22,799	0.04	9
7	South China Sea	1	NP	22,799	0.02	5
9	Offshore Japan (10° to 25°N)	1	NP	22,799	0.04	9
Totals		**13**			**0.46%**	**110**

Table B19. Percent of stock and associated number of harbor porpoises potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	31,046	1.15	358
5	Sea of Japan	2	WNP	31,046	0.56	176
Totals		**3**			**1.71**	**534**

Table B20. Percent of stock and associated number of Hubbs' beaked whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	NP	22,799	0.03	8
8	Offshore Japan (25° to 40°N)	1	NP	22,799	0.02	6
Totals		**2**			**0.05%**	**14**

Table B21. Pecent of stocks and associated number of killer whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	12,256	0.01	2
2	North Philippine Sea	3	WNP	12,256	0.03	6
3	West Philippine Sea	3	WNP	12,256	0.03	6
4	Offshore Guam	3	WNP	12,256	0.03	5
5	Sea of Japan	2	WNP	12,256	0.02	4
6	East China Sea	1	WNP	12,256	0.01	2
7	South China Sea	1	WNP	12,256	0.01	1
8	Offshore Japan (25° to 40°N)	1	WNP	12,256	0.01	2
9	Offshore Japan (10° to 25°N)	1	WNP	12,256	0.01	2
Total Western North Pacific Stock					***0.16%***	***30***
10	Hawaii-North	2	Hawaii	101	1.24	2
11	Hawaii-South	2	Hawaii	101	1.21	2
Total Hawaii Stock					***2.45%***	***4***
Totals		**20**			**2.61%**	**34**

Table B22. Percent of stocks and associated number of *Kogia* spp. as well as dwarf and pygmy sperm whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	350,553	0.01	50
2	North Philippine Sea	3	WNP	350,553	0.04	146
3	West Philippine Sea	3	WNP	350,553	0.02	83
5	Sea of Japan	2	WNP	350,553	0.01	50
6	East China Sea	1	WNP	350,553	0.01	31
7	South China Sea	1	WNP	350,553	0.00	16
Total Kogia spp. Western North Pacific Stock					***0.09%***	***376***
4	Offshore Guam	3	WNP	350,553	0.06	226
8	Offshore Japan (25° to 40°N)	1	WNP	350,553	0.02	88
9	Offshore Japan (10° to 25°N)	1	WNP	350,553	0.02	57
Total Western North Pacific Dwarf Sperm Whale Stock					***0.10%***	***371***
10	Hawaii-North	2	Hawaii	17,519	1.27	224
11	Hawaii-South	2	Hawaii	17,519	1.10	194
Total Hawaii Dwarf Sperm Whale Stock					***2.37%***	***418***
4	Offshore Guam	3	WNP	350,553	0.03	93
8	Offshore Japan (25° to 40°N)	1	WNP	350,553	0.01	36
9	Offshore Japan (10° to 25°N)	1	WNP	350,553	0.01	24
Total Western North Pacific Pygmy Sperm Whale Stock					***0.05%***	***153***
10	Hawaii-North	2	Hawaii	7,138	1.27	91
11	Hawaii-South	2	Hawaii	7,138	1.10	80
Total Hawaii Pygmy Sperm Whale Stock					***2.37%***	***171***
Totals		**29**			**4.98%**	**1,489**

Table B23. Percent of stocks and associated number of long-beaked common dolphins potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	279,182	1.78	4,962
3	West Philippine Sea	3	WNP	279,182	1.63	4,559
5	Sea of Japan	2	WNP	279,182	1.24	3,467
6	East China Sea	1	WNP	279,182	0.71	1,988
7	South China Sea	1	WNP	279,182	0.41	1,135
Totals		**10**			**5.77%**	**16,111**

Table B24. Percent of stocks and associated number of Longman's beaked whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	4,571	0.22	11
3	West Philippine Sea	3	WNP	4,571	0.20	11
4	Offshore Guam	3	WNP	4,571	1.56	55
6	East China Sea	1	WNP	4,571	0.43	5
7	South China Sea	1	WNP	4,571	0.05	3
8	Offshore Japan (25° to 40°N)	1	WNP	4,571	0.08	4
9	Offshore Japan (10° to 25°N)	1	WNP	4,571	0.05	3
Total Western North Pacific Stock					***2.59%***	***92***
10	Hawaii-North	2	Hawaii	4,571	1.02	47
11	Hawaii-South	2	Hawaii	4,571	0.92	43
Total Hawaii Stock					***1.94%***	***90***
Totals		**17**			**4.53%**	**182**

Table B25. Percent of stocks and associated number of melon-headed whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
2	North Philippine Sea	3	WNP	36,770	0.54	198
3	West Philippine Sea	3	WNP	36,770	0.52	193
6	East China Sea	1	WNP	36,770	0.21	76
7	South China Sea	1	WNP	36,770	0.11	39
8	Offshore Japan (25° to 40°N)	1	WNP	36,770	0.15	55
9	Offshore Japan (10° to 25°N)	1	WNP	36,770	0.10	36
Total Western North Pacific Stock					***1.63%***	***597***
4	Offshore Guam	3	NMI	2,455	3.82	96
Total Northern Mariana Islands Stock					***3.82%***	***96***
10	Hawaii-North	2	Kohala Resident	447	0.22	2
11	Hawaii-South	2	Kohala Resident	447	0.03	2
Total Kohala Resident Stock					***0.25%***	***4***
10	Hawaii-North	2	Hawaiian Islands	5,794	0.65	39
Total Hawaii Stock					***0.65%***	***39***
Totals		**19**			**6.35%**	**736**

Table B26. Percent of stock and associated number of *Mesoplodon* spp. potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
8	Offshore Japan (25° to 40°N)	1	WNP	22,799	0.02	6
Totals		1			**0.02%**	**6**

Table B27. Percent stock and associated number of Pacific white-sided dolphins potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	931,000	0.01	57
2	North Philippine Sea	3	WNP	931,000	0.04	358
8	Offshore Japan (25° to 40°N)	1	WNP	931,000	0.01	117
Total Western North Pacific Stock					***0.06%***	***532***
5	Sea of Japan	2	IA	931,000	0.00	29
6	East China Sea	1	IA	931,000	0.00	43
Total Inshore Archipelago Stock					***0.00%***	***72***
Totals		**8**			**0.06**	**604**

Table B28. Percent stocks and associated number of pantropical spotted dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	438,064	0.03	151
2	North Philippine Sea	3	WNP	438,064	0.13	569
3	West Philippine Sea	3	WNP	438,064	0.11	498
4	Offshore Guam	3	WNP	438,064	0.07	289
8	Offshore Japan (25° to 40°N)	1	WNP	438,064	0.04	175
9	Offshore Japan (10° to 25°N)	1	WNP	438,064	0.03	144
Total Western North Pacific Stock					***0.41%***	***1,826***
6	East China Sea	1	IA	219,032	0.09	196
7	South China Sea	1	IA	219,032	0.03	74
Total Inshore Archipelago Stock					***0.12%***	***270***
10	Hawaii-North	2	Hawaii Pelagic	15,917	0.96	154
11	Hawaii-South	2	Hawaii Pelagic	15,917	0.87	140
Total Hawaii Pelagic Stock					***1.83%***	***294***
10	Hawaii-North	2	Hawaii Island	220	1.91	5
11	Hawaii-South	2	Hawaii Island	220	0.31	2
Total Hawaii Island Stock					***2.22%***	***7***
10	Hawaii-North	2	Oahu	220	2.07	6
11	Hawaii-South	2	Oahu	220	0.31	2
Total Oahu Stock					***2.38%***	***8***
10	Hawaii-North	2	4-Islands	220	3.24	8
11	Hawaii-South	2	4-Islands	220	0.46	2
Total 4-Islands Stock					***3.70%***	***10***
Totals		**18**			**10.66%**	**2,415**

Table B29. Percent and number of pygmy killer whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	30,214	0.09	28
2	North Philippine Sea	3	WNP	30,214	0.32	98
3	West Philippine Sea	3	WNP	30,214	0.31	95
4	Offshore Guam	3	WNP	30,214	0.01	5
6	East China Sea	1	WNP	30,214	0.01	3
7	South China Sea	1	WNP	30,214	0.00	2
8	Offshore Japan (25° to 40°N)	1	WNP	30,214	0.00	2
9	Offshore Japan (10° to 25°N)	1	WNP	30,214	0.00	1
Total Western North Pacific Stock					***0.74%***	***234***
10	Hawaii-North	2	Hawaii	3,433	1.27	45
11	Hawaii-South	2	Hawaii	3,433	1.04	37
Total Hawaii Stock					***2.31%***	***82***
Totals		**18**			**3.05%**	**316**

Table B30. Percent and number of Risso's dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	83,289	0.18	154
2	North Philippine Sea	3	WNP	83,289	0.59	491
3	West Philippine Sea	3	WNP	83,289	0.60	504
4	Offshore Guam	3	WNP	83,289	0.12	100
8	Offshore Japan (25° to 40°N)	1	WNP	83,289	0.01	9
9	Offshore Japan (10° to 25°N)	1	WNP	83,289	0.01	6
Total Western North Pacific Stock					***1.51%***	***1,264***
5	Sea of Japan	2	IA	83,289	0.29	242
6	East China Sea	1	IA	83,289	0.27	228
7	South China Sea	1	IA	83,289	0.14	116
Total Inshore Archipelago Stock					***0.70%***	***586***
10	Hawaii-North	2	Hawaii	7,256	1.20	88
11	Hawaii-South	2	Hawaii	7,256	1.05	78
Total Hawaii Stock					***2.25%***	***166***
Totals		**20**			**4.46%**	**2,016**

Table B31. Percent and number of rough-toothed dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	145,729	0.06	91
2	North Philippine Sea	3	WNP	145,729	0.20	295
3	West Philippine Sea	3	WNP	145,729	0.18	269
4	Offshore Guam	3	WNP	145,729	0.07	82
5	Sea of Japan	2	WNP	145,729	0.02	33
6	East China Sea	1	WNP	145,729	0.04	53
7	South China Sea	1	WNP	145,729	0.01	14
8	Offshore Japan (25° to 40°N)	1	WNP	145,729	0.02	27
9	Offshore Japan (10° to 25°N)	1	WNP	145,729	0.02	24
Total Western North Pacific Stock					***0.62%***	***888***
10	Hawaii-North	2	Hawaii	6,288	0.94	60
11	Hawaii-South	2	Hawaii	6,288	1.07	68
Total Hawaii Stock					***2.01%***	***128***
Totals		**20**			**2.63%**	**1,016**

Table B32. Percent and number of short-beaked common dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	3,286,163	0.04	1,245
2	North Philippine Sea	3	WNP	3,286,163	0.07	2,409
5	Sea of Japan	2	WNP	3,286,163	0.08	2,575
6	East China Sea	1	WNP	3,286,163	0.02	792
8	Offshore Japan (25° to 40°N)	1	WNP	3,286,163	0.06	1,835
Totals		**8**			**0.27%**	**8,856**

Table B33. Percent and number of short-finned pilot whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	53,608	0.29	158
2	North Philippine Sea	3	WNP	53,608	1.29	692
3	West Philippine Sea	3	WNP	53,608	0.61	329
4	Offshore Guam	3	WNP	53,608	0.23	122
5	Sea of Japan	2	WNP	53,608	0.08	43
6	East China Sea	1	WNP	53,608	0.06	30
7	South China Sea	1	WNP	53,608	0.02	14
8	Offshore Japan (25° to 40°N)	1	WNP	53,608	0.09	48
9	Offshore Japan (10° to 25°N)	1	WNP	53,608	0.05	27
Total Western North Pacific Stock					***2.72%***	***1,463***
10	Hawaii-North	2	Hawaii	12,422	1.17	146
11	Hawaii-South	2	Hawaii	12,422	0.97	122
Total Hawaii Stock					***2.14%***	***268***
Totals		**20**			**4.86%**	**1,731**

Table B34. Percent and number of sperm whales potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	NP	102,112	0.01	15
2	North Philippine Sea	3	NP	102,112	0.05	48
3	West Philippine Sea	3	NP	102,112	0.04	46
4	Offshore Guam	3	NP	102,112	0.03	36
5	Sea of Japan	2	NP	102,112	0.06	63
6	East China Sea	1	NP	102,112	0.02	18
7	South China Sea	1	NP	102,112	0.01	11
8	Offshore Japan (25° to 40°N)	1	NP	102,112	0.02	23
9	Offshore Japan (10° to 25°N)	1	NP	102,112	0.02	24
Total North Pacific Stock					***0.26%***	***284***
10	Hawaii-North	2	Hawaii	3,354	0.99	34
11	Hawaii-South	2	Hawaii	3,354	0.83	29
Total Hawaii Stock					***1.82%***	***63***
Totals		**20**			**2.08%**	**347**

Table B35. Percent stocks and associated number of spinner dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	1,015,059	0.00	5
2	North Philippine Sea	3	WNP	1,015,059	0.00	36
3	West Philippine Sea	3	WNP	1,015,059	0.00	31
4	Offshore Guam	3	WNP	1,015,059	0.00	11
5	Sea of Japan	2	WNP	1,015,059	0.00	5
6	East China Sea	1	WNP	1,015,059	0.00	12
7	South China Sea	1	WNP	1,015,059	0.00	5
8	Offshore Japan (25° to 40°N)	1	WNP	1,015,059	0.00	29
9	Offshore Japan (10° to 25°N)	1	WNP	1,015,059	0.00	24
Total Western North Pacific Stock					***0.00%***	***158***
10	Hawaii-North	2	Hawaii Pelagic	3,351	0.54	20
11	Hawaii-South	2	Hawaii Pelagic	3,351	0.49	18
Total Hawaii Pelagic Stock					***1.03%***	***38***
10	Hawaii-North	2	Kauai/Niihau	601	0.00	2
11	Hawaii-South	2	Kauai/Niihau	601	0.00	2
Total Kauai/Niihau Stock					***0.00%***	***4***
10	Haw-North	2	Kure/ Midway	260	0.00	2
Total Kure/Midway Atoll Stock					***0.00%***	***2***
10	Hawaii-North	2	Pearl and Hermes Reef	300	0.00	2
Total Pearl and Hermes Reef Stock					***0.00%***	***2***
10	Hawaii-North	2	Oahu/4-Islands	355	3.55	13
11	Hawaii- South	2	Oahu/4-Islands	355	0.51	3
Total Oahu/4-Islands Stock					***4.06%***	***16***
10	Hawaii-North	2	Hawaii Island	631	0.03	2
11	Hawaii-South	2	Hawaii Island	631	0.00	2
Total Hawaii Island Stocks					***0.03%***	***4***
Totals		**36**			**5.12%**	**224**

Table B36. Percent stock and associated number of Stejneger's beaked whales potentially exposed to SURTASS LFA sonar in the western North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
5	Sea of Japan	2	WNP	8,000	0.23	19
Totals		**2**			**0.23%**	**19**

Table B37. Percent stock and associated number of striped dolphins potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
1	East of Japan	1	WNP	570,038	0.01	65
2	North Philippine Sea	3	WNP	570,038	0.24	1,366
3	West Philippine Sea	3	WNP	570,038	0.10	597
4	Offshore Guam	3	WNP	570,038	0.01	80
8	Offshore Japan (25° to 40°N)	1	WNP	570,038	0.02	91
9	Offshore Japan (10° to 25°N)	1	WNP	570,038	0.01	74
Total Western North Pacific Stock					***0.39%***	***2,273***
5	Sea of Japan	2	IA	570,038	0.01	73
6	East China Sea	1	IA	570,038	0.01	84
7	South China Sea	1	IA	570,038	0.01	32
Total Inshore Archipelago Stock					***0.03%***	***189***
10	Hawaii-North	2	Hawaii	20,650	0.93	192
11	Hawaii-South	2	Hawaii	20,650	0.84	175
Total Hawaii Stock					***1.77%***	***367***
Totals		**20**			**2.19%**	**2,829**

Table B38. Percent stock and associated number of Hawaiian monk seals potentially exposed to SURTASS LFA sonar in the western and central North Pacific Ocean during 15 August 2015 to 14 August 2016.

Mission Area		Number of Missions Estimated in Each Mission Area	Stock[27]	Number Individuals in Stock	Percent Stock Affected 120 to 180 dB[28]	Number Individuals Affected 120 to 180 dB[29]
Number	Name					
8	Offshore Japan (25° to 40°N)	1	Hawaii	1,209	0.04	1
10	Hawaii-North	2	Hawaii	1,209	0.23	4
11	Hawaii-South	2	Hawaii	1,209	0.22	4
Totals		**5**			**0.49%**	**9**