DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350

IN REPLY REFER TO
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19 Apr 12

From: Deputy for Undersea Surveillance (N2/N6F24)
To: Chief, Permits and Conservation Division
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway
Silver Spring, Maryland 20910

Subj: APPLICATION FOR INITIAL LETTERS OF AUTHORIZATION FOR THE TAKING OF MARINE MAMMALS INCIDENTAL TO THE OPERATION OF SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE SONARS ONBOARD USNS IMPECCABLE (T-AGOS 23), USNS EFFECTIVE (T-AGOS 21), USNS ABLE (T-AGOS 20), AND USNS VICTORIOUS (T-AGOS 19) UNDER NMFS PROPOSED RULE (50 CFR 218 SUBPART X)

Ref: (a) Application for Letters of Authorization and Rulemaking under Section 101 (A)(5)(A) of the Marine Mammal Protection Act for Activities Associated with the Employment of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar, Department of the Navy, August 2011
(b) Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to U.S. Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar; Proposed Rule (Federal Register 77(4): 6 Jan 2012)
(c) Draft Supplemental Environmental Impact Statement/ Supplemental Overseas Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar, Department of the Navy, August 2011

Encl: (1) Background for Marine Mammal Density and Stock Estimates for SURTASS LFA Sonar Letter of Authorization (LOA) Applications
(2) Estimates of Potential Effects to Marine Mammal Stocks for Initial Year LOAs for the Northwestern Pacific Ocean and Hawaii Operational Areas

Subj: APPLICATION FOR INITIAL LETTERS OF AUTHORIZATION FOR THE TAKING OF MARINE MAMMALS INCIDENTAL TO THE OPERATION OF SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE SONARS ONBOARD USNS IMPECCABLE (T-AGOS 23), USNS EFFECTIVE (T-AGOS 21), USNS ABLE (T-AGOS 20), AND USNS VICTORIOUS (T-AGOS 19) UNDER NMFS PROPOSED RULE (50 CFR 218 SUBPART X)

1. In August 2011, the Navy submitted an application to the National Marine Fisheries Service (NMFS) for letters of authorization (LOA) and rulemaking under Section 101(A)(5)(A) of the Marine Mammal Protection Act (MMPA) for activities associated with the employment of Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar (reference [a]). On 6 January 2012, NMFS published the Proposed Rule for the taking of marine mammals incidental to the Navy operation of SURTASS LFA sonar in areas of the world's oceans, with the exception of Arctic and Antarctic waters and certain geographic restrictions, from 16 August 2012 through 15 August 2017 (reference [b]).

2. Pursuant to references (a) and (b) and the conditions of the Final Rule as issued, initial LOAs for the USNS IMPECCABLE (T-AGOS 23), USNS EFFECTIVE (T-AGOS 21), USNS ABLE (T-AGOS 20), and USNS VICTORIOUS (T-AGOS 19), are requested for the taking of marine mammals (Levels A and B) incidental to operations of the Navy's SURTASS LFA sonar for the 12-month period commencing August 16, 2012, as specified below. As defined in references (a), (b), and (c), the proposed mission areas requested under this application are comprised of operational areas: 1) East of Japan, 2) North Philippine Sea, 3) West Philippine Sea, 4) Offshore Guam, 5) Sea of Japan, 6) East China Sea, 7) South China Sea, 8) Offshore Japan (25° to 40° N), 9) Offshore Japan (10° to 25° N), 10) Northern Hawaii, and 11) Southern Hawaii.

3. The same analytical methodology utilized in the Navy's application for LOAs and rulemaking (reference [a]) and the Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (DSEIS/SOEIS) for SURTASS LFA Sonar (reference [c]) was utilized to provide reasonable and realistic estimates of the potential effects on marine mammal stocks specific to likely mission areas in the northwestern Pacific Ocean and the Hawaii operational areas. It is infeasible to analyze all potential mission areas for all species' stocks for all seasons. Acoustic model sites and seasons are based on reasonable and realistic scenarios for SURTASS LFA sonar operations proposed herein. The Chief of Naval Operations' mission for SURTASS LFA sonar operations to be conducted under the requested LOAs is to train the Navy crews manning the vessels and to test and operate the LFA systems in as many and varied at-sea environments as possible. The Navy has determined that operations of SURTASS LFA sonar, which are the subject of NMFS' rule making, include routine testing and training, as well as the use of the system during military operations. Furthermore, these operations constitute a military readiness activity as that term is defined in Public Law

107-314 (16 U.S.C. § 703 note) because those 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."

4. Marine mammal density and stock/abundance estimates were derived for the selected acoustic model sites from current, available published source documentation and are discussed in enclosure (1). Enclosure (2) provides estimates of potential effects on marine mammal stocks during the 12-month period commencing August 16, 2012. They are based on 16 collective missions in the northwestern Pacific Ocean and 4 collective missions in the Hawaii Range Complex. Upon completion of the missions under the requested authorizations, these estimates will be refined and submitted to NMFS under the reporting requirements pursuant to the Final Rule and the conditions of the LOAs, as issued.

5. SURTASS LFA sonar systems will be operated in accordance with the geographic restrictions and monitoring mitigation delineated by the Navy’s application (reference [a]), the Proposed Rule (reference [b]), and DSEIS/SOEIS (reference [c]) as finalized in the FSEIS/SOEIS and Final Rule, as issued.

6. For the period of the LOAs, the means to increase knowledge of marine mammal species and estimate the potential for impacts on marine mammals from SURTSS LFA sonar testing, training, and military operations will be determined by the Navy, in consultation with NMFS. Long-term independent scientific research efforts on topics designed to fill data gaps and further the overall understanding of the effects of anthropogenic sound and noise on the marine environment are being performed to fulfill conditions of the Final Rule and LOAs.

6. As the point of contact on this matter, I can be reached at (703) 695-8266.

R. A. Dempsey

Subj: APPLICATION FOR INITIAL LETTERS OF AUTHORIZATION FOR THE TAKING OF MARINE MAMMALS INCIDENTAL TO THE OPERATION OF SURVEILLANCE TOWED ARRAY SENSOR SYSTEM LOW FREQUENCY ACTIVE SONARS ONBOARD USNS IMPECCABLE (T-AGOS 23), USNS EFFECTIVE (T-AGOS 21), USNS ABLE (T-AGOS 20), AND USNS VICTORIOUS (T-AGOS 19) UNDER NMFS PROPOSED RULE (50 CFR 218 SUBPART X)

Copy to:

J. Harrison, NMFS OPR1
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Enclosure (1): Background for Marine Mammal Density and Stock Estimates for SURTASS LFA Sonar LOA Applications

The following information describes the estimation approach and scientific literature sources used in this LOA application to derive density and stock estimates for the marine mammal species potentially occurring in each of the SURTASS LFA sonar operating areas. Information is listed by operating area and marine mammal species.

1. Operational Area #1—East of Japan

- Blue whale: Few data are available on blue whale occurrence in the North Pacific Ocean or in Japanese waters. Blue whales occur, perhaps seasonally, in the open ocean waters from Japan northward to Kamchatka, Russia but can come close to shore to feed and possibly breed in some areas (Nishiwaki, 1967; Jefferson et al., 2008). 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 northwest Pacific blue whales. Based on this 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). 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. The fin whale estimates from Japanese whaling data (Tillman, 1977) are comparable to density estimates in offshore areas of the eastern tropical Pacific (ETP) (Ferguson and Barlow, 2001, 2003). Based on vocalization patterns, two stocks are recognized in Pacific waters of the U.S. Exclusive Economic Zone (EEZ) (Carretta et al., 2011). The eastern North Pacific stock winters off Mexico and Central America and summers off California and the U.S. west coast. The central North Pacific stock, found at this mission area, winters in the western North Pacific and, less frequently, in the central North Pacific, and summers southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska.

- Fin whale: Although the precise distribution of fin whales in the North Pacific is not known, occurrence records have indicated seasonal migrations in the western North Pacific (Mizroch et al., 2009). Fin whales move south in the winter, when sighting data suggest that they are sparsely distributed from about 60° to 20°N, whereas in the summer, fin whales are distributed northward from near Japan to the Chukchi Sea and Aleutian Islands (Evans, 1987; Mizroch et al., 2009; Carretta et al., 2011). The density (0.0002 animals/km^2) and stock (9,250 individuals) estimates were derived from encounter rates of scouting boats during Japanese whaling in the northwest Pacific (Masaki, 1977; Ohsumi, 1977; Tillman, 1977). These data are comparable to density estimates in offshore areas of the ETP (Ferguson and Barlow 2001, 2003).

- Sei whale: Sei whales are present throughout the temperate North Pacific Ocean but have been observed as far south as 20°N (Horwood, 1987). In the western North Pacific, sei whales range as far south as Japan and Korea (Horwood, 1987). Sei whales are extremely difficult to differentiate from Bryde's whales at sea. Tillman (1977) derived an abundance estimate of 8,600 individuals for sei/Bryde's whale in the North Pacific from whaling catch statistics. Initial estimates for a portion of the sei whale range off Japan indicate abundance estimates of similar magnitude (7,744 for May-June and 5,406 for July-Sep; Hakamada et al., 2009). Whale sighting data obtained during Japanese whaling expeditions were used to derive the density estimate of 0.0006 animals/km^2 for the sei whale (Masaki, 1977; Tillman, 1977).

- Bryde's whale: Bryde's whales are difficult to distinguish from sei whales at sea. Bryde's whales are found throughout tropical and subtropical waters of the North Pacific and migrate east to west from near Japan to the central Pacific (Kishiro, 1996; Jefferson et al., 2008). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is about the southern limit of their summer range. 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 at 20,501 whales (IWC, 2009). The density

estimate (0.0006 animals/km^2) for the Western North Pacific stock is derived from whaling sighting data (Ohsumi, 1977). Barlow (2006) observed Bryde's whales around the Hawaiian Islands, deriving a similar density estimate (0.00019 animals/km^2) to that derived for the western North Pacific stock.

- Minke whale: The waters off the south coast of Honshu and Shikoku (Japan) were whaling grounds for this species (Ohsumi, 1978). Minke whales are migratory animals, with a summer distribution extending north to the Chukchi Sea and a winter distribution extending south to near the equator (Perrin and Brownell, 2002). Two stocks of minke whales are recognized in the western North Pacific, the "O" stock, which ranges from the Okhotsk Sea to the waters off eastern Japan, and the "J" stock, which is located around the Korean peninsula and in the Sea of Japan (Pastene et al., 1998). Minke whales potentially occurring in this region are believed to be part of the "O" stock. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk and derived density (0.0022 animals/km^2) and abundance (25,049 individuals) estimates for the western North Pacific/Sea of Okhotsk stock (Buckland et al., 1992). The density estimates that Ferguson and Barlow (2001; 2003) computed for this species in the offshore areas of the ETP are an order of a magnitude lower.

- North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern Pacific 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 presumed sub-populations in the western population that are kept separate by the Japanese Islands, though this seems unlikely (Brownell et al., 2001; Clapham et al., 2004). The western population may be affected by proposed LFA operations in the spring and fall in the areas east of Japan. Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al., 2001) for the western North Pacific population. 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.

- 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 with females that summer off the Kuril Islands (~50°N) and winter off Hokkaido and Sanriku (~40°N), and a southwestern stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of both 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). The best available population estimate for the sperm whale in the western North Pacific is Kato and Miyashita's (1998) estimate of 102,112 animals (CV=0.155). 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. Therefore, in summer, this site (35°N) is located on the northern edge of the concentration of southwestern females. This concentration of sperm whales is analogous to the region where Mobley et al. (2000) estimated a density of 0.0010 animals/km^2, and sperm whales were generally seen in the outer 5% of the survey effort; thus the Mobley et al. (2000) density was used for this site. This density value is comparable to the density estimate (0.00123 animals/km^2) calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011).

- *Kogia* spp.: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution and no specific areas of concentration. 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 population estimate for *Kogia* spp. in the western North Pacific. The density estimate of 0.0031 animals/km^2 calculated for *Kogia* spp. from the eastern Pacific Ocean at about 30° N is considered the best estimate (Ferguson and Barlow, 2001; 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]) estimated within the Hawaii EEZ (Barlow, 2006).

- 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. Kasuya (1986) collected aerial survey sighting records over 25 years and shipboard sightings in 1984 off the Pacific coast of Japan. Based on Kasuya's (1986) encounter rate and effective search width, a summer 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 stock estimate of 4,220 is increased to 8,000 Baird's beaked whales to account for unsurveyed areas.

- Cuvier's beaked whale: In the western Pacific Ocean, Cuvier's beaked whales have been reported from Japan to southern New Zealand (MacLeod et al., 2006). No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature and bathymetry), the best population data available to use for this species in this region are the long-term time series from the ETP (Ferguson and Barlow, 2003), which estimated the density of 0.0054 animals/km^2 and abundance of 90,725 animals. These population estimates are comparable to those estimated for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- Ginkgo-toothed beaked whale: The ginkgo-toothed whale is only known from strandings in the temperate and tropical waters of the Pacific (Palacios, 1996). Miyazaki et al. (1987) reported five strandings of the ginkgo-toothed beaked whale from the east coast of Japan, while Palacios (1996) reported eight off Taiwan and Japan. Since no data on density or stock estimates are available for this species in the western North Pacific, the best population estimations are those derived from *Mesoplodon* spp. data from the ETP (Ferguson and Barlow; 2001, 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. This derived density estimate is comparable to that computed for unidentified beaked whales in the Hawaiian 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., 2006b).

- Hubbs' beaked whale: Hubb's beaked whales appear to be resricted to the Pacific Ocean, with all known occurrences to date for the western North Pacific having been strandings in Japan (MacLeod et al., 2006). Miyazaki et al. (1987) reported five strandings of Hubbs' beaked whales along the Pacific coast of northern Honshu. As a cold temperate species, Leatherwood and Reeves (1983) suggested that its southern limit in the western North Pacific is the warm Kuroshio Current, while its northern limit might be the cold Oyashio Current. Since no data on density or stock estimates are available for this species, the data on *Mesoplodon* spp. from the ETP (Ferguson and Barlow, 2001, 2003) are considered to be the most appropriate population estimates available. Using the northernmost strata from Ferguson and Barlow (2001, 2003) data, a density of 0.0005 animals/km^2 and an abundance of 22,799 animals are estimated. This density estimate is comparable to that for unidentified beaked whales estimated for 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., 2006b).

- 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 was derived for the modeled site (0.0036 animals/km^2). This is comparable to density estimates in the Hawaii EEZ

(0.0001 animals/km^2; (Barlow, 2006)) and to nearshore Hawaii waters (0.0017 animals/km^2; (Mobley et al., 2000).

- Pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate (0.0021 animals/km^2) and an abundance estimate (30,214 individuals) were used from the ETP (Ferguson and Barlow, 2003). This density is almost an order of magnitude larger than that observed in the Hawaii EEZ (0.00039 animals/km^2; Barlow, 2006).

- Short-finned pilot whale: Miyashita (1993) 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. Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales in the western North Pacific off Japan and Taiwan; a southern form is found south of the Kuroshio Current front (south of 35° N), while the northern form occurs between the fronts of the Kuroshio and Oyashio Currents (~35° to 43° N). Miyashita (1993) questioned whether the entire range consisted of a single stock or population, but had no way of delineating the data. However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya, 1993), and it, therefore, was not included in the above analyses (Miyashita, 1993).

- Risso's dolphin: Miyashita (1993) reports a western North Pacific stock (83,289 individuals; CV=0.179) and density estimate (0.0097 animals/km^2) derived for the Pacific coast of Japan. This density is an order of magnitude larger than that observed in the Hawaii EEZ (0.00097 animals/km^2; Barlow, 2006), and no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al., 2000).

- Common dolphin, short-beaked: There are no data on density or stock estimates in the western Pacific (Miyashita, 1993). Common dolphins are a gregarious species, and it is not unusual to find them associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and are found in waters of temperature 10° to 28° C. This species is very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on stock or density estimates for the western North Pacific, the population data derived from ETP surveys of 3,286,163 animals and 0.0761 animals/km^2 (Ferguson and Barlow, 2001, 2003) are most appropriate for use in this region.

- Fraser's dolphin: A highly gregarious species, groups of a hundred to a thousand have been observed. Fraser's dolphins are occasionally found mixed in herds of spotted dolphins, and observed in company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. Without any data on stock or density estimates for the western North Pacific for the Fraser's dolphin, density and abundance estimates (0.0040 animals/km^2 and 220,789 animals) from the ETP (Ferguson and Barlow, 2001, 2003) are most appropriate for use in analyses for this region. The ETP density is comparable to that observed in the Hawaii EEZ (0.00417 animals/km^2; Barlow, 2006).

- Bottlenose dolphin: Miyashita (1993) reports an abundance estimate, 168,791 individuals (CV=0.261) and a density estimate (0.0171 animals/km^2) off the Pacific coast of Japan. This density is comparable to that observed in nearshore Hawaii waters (0.0103 animals/km^2; Mobley, et al. 2000) and is an order of magnitude larger than that observed in the Hawaii EEZ (0.00131 animals/km^2; Barlow, 2006).

- 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 individuals (CV=0.174) and a density estimate, 0.0259 animals/km^2, east of Japan. This density is comparable to that observed in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000), while it is higher

than that estimated for pantropical spotted dolphins in the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006).

- Striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for two populations in the area: one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 individuals (CV=0.186), and a density estimate of striped dolphins in the Pacific coast waters of Japan was used for this site (0.0111 animals/km^2).

- Spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan. This species is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or stock estimates are available (Miyashita, 1993). Without no data available on stock or density estimates for the western North Pacific, density and abundance estimates (0.0005 animals/km^2 and 1,015,059 animals) from the ETP (Ferguson and Barlow, 2001, 2003) at a similar latitude are appropriate.

- Pacific white-sided dolphin: No data on density or stock estimates are available (Miyashita, 1993) for this gregarious, pelagic species in this region. Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different dolphin population than animals found in offshore North Pacific waters (Hayano et al., 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al., 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow, 2001, 2003). Without any data on density estimates for the western North Pacific (Miyashita 1993), population data, 931,000 animals and 0.0082 animals/km^2, from the ETP are appropriate (Ferguson and Barlow, 2001, 2003). No sightings of Pacific white-sided dolphins were reported in Hawaiian surveys (Barlow, 2006; Mobley et al., 2000).

- Rough-toothed dolphin: Species distribution of this species is primarily in pelagic tropical to warm-temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales. The rough-toothed dolphin is reportedly rare in Japanese waters as well as in the heavily studied ETP. There are no data on stock or density estimates for the western North Pacific; therefore, density (0.0059 animals/km^2) and abundance (145,729 individuals) estimates from the eastern Pacific waters were used (Ferguson and Barlow, 2001, 2003). This is similar to those observed in the Hawaii EEZ (0.00355 animals/km^2; Barlow, 2006) while higher than that estimated for nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

2. Operational Area #2—North Philippine Sea

- 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 density estimate (0.0006 animals/km^2) for the Western North Pacific stock is derived from derived from scouting vessels sighting data (Ohsumi, 1977). The IWC provides the best available population estimate for the western North Pacific stock at 20,501 whales (IWC, 2009). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is the southern limit of their summer range. Barlow (2006) observed Bryde's whales around the Hawaiian Islands, deriving a comparable density estimate (0.00019 animals/km^2).

- Minke whale: The south coast of Honshu and Shikoku were whaling grounds for this species (Ohsumi, 1978). Minke whales migrate through western North Pacific waters, traveling in summer north to the Chukchi Sea and in winter south to near the equator (Perrin and Brownell, 2002). Two stocks of minke whales are recognized in the western North Pacific, the "O" stock in the Okhotsk Sea and off the eastern side of Japan and the "J" stock around the Korean peninsula and in the Sea of Japan (Pastene et al., 1998). Minkes in this region are believed to be part of the "O" stock. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. The density estimate, 0.0044 animals/km^2, for 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 western North Pacific/Sea of Okhotsk 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 a magnitude lower.

- North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al. 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al., 2001) where animals are typically found May through September (Clapham et al., 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December 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=404-2,108) (Best et al., 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the spring, fall, and winter in the North Philippine Sea. 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.

- Sperm whale: Stock structure of this species has not been completely delineated for the western North Pacific. 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 the southwestern North Pacific stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea (~55°N) and off Hokkaido and Sanriku (~40°N), respectively, during the summer. The best abundance estimate for the western North Pacific stock of sperm whales is 102,112 individuals (CV=0.155) (Allen and Angliss, 2011). As no densities have been derived from sperm whale sighting data for the western North Pacific, the most appropriate density estimate for use is this region is 0.00282 animals/km^2, which was estimated from the 2002 summer/fall survey data off Hawaii (Barlow, 2006).

- *Kogia* spp.: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution and no specific areas of concentration. 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 region, the abundance from the ETP remains the best population estimate for *Kogia* spp. in the western North Pacific. The density estimate of 0.0031 animals/km^2 calculated for *Kogia* spp. from the eastern Pacific Ocean at about 30° N is considered the best estimate (Ferguson and Barlow, 2001, 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).

- Cuvier's beaked whale: No density or stock estimate data are available for this region on this beaked whale. Considering habitat preferences (e.g., water temperature, bathymetry), the best data available are the density (0.0054 animals/km^2) and abundance estimates of (90,725 animals) from the eastern Pacific (Ferguson and Barlow, 2003). This density is comparable to that estimated for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- Blainville's beaked whale: Miyazaki et al. (1987) reported two strandings of Blainville's on Taiwan and one stranding on the southern Ryukyu Archipelago. Without any data on stock or density estimates for the western North Pacific, data from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate.

A density estimate of 0.0005 animals/km^2 and equals a stock estimate of 8,032 individuals, the *Mesoplodon densirostris* abundance estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate, were used for this analysis. This density estimate is lower than the density of Blainville's beaked whales estimated in the Hawaii EEZ (0.00117 animals/km^2; Barlow, 2006) 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., 2006b) for the ETP *Mesoplodon* spp. is comparable.

- Ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported five strandings of *M. ginkgodens* from the east coast of Japan and two strandings from the east coast of Taiwan. Of the 15 known strandings of *M. ginkgodens*, Palacios (1996) reported eight being reported on Taiwan and Japan. With no data on stock or density estimates available for ginkgo-toothed beaked whales in the western North Pacific, the best population estimations are those derived from the ETP for *Mesoplodon* spp. (Ferguson and Barlow, 2001, 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. This density estimate is similar 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. 2006b).
- Killer whale: A few schools have been seen off the southeast coast of Honshu (off Taiji) in April, October, and November; however, none have been taken in the drive fisheries (Miyashita, 1993). Without any data for the western North Pacific, the best available data are from the long-term time series in the ETP, with density (0.0004 animals/km^2) and abundance estimates (12,256 animals) reported (Ferguson and Barlow, 2001, 2003). This density can be compared to the density estimate from the Hawaii EEZ of 0.00014 animals/km^2 (Barlow, 2006).
- False killer whale: Miyashita (1993) estimated an abundance of 16,668 (CV=0.263) false killer whales from 34 sighting cruises associated with the Japanese drive fishery, as well as the derived density estimate of 0.0029 animals/km^2. This estimated density is higher than the density estimated in the Hawaii EEZ (0.0001 animals/km^2; Barlow 2006) but is more similar to the nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al. 2000).
- Pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. Without data available in the western North Pacific, a density estimate (0.0021 animals/km^2) and abundance estimate (30,214 animals) from eastern Pacific (Ferguson and Barlow, 2003) were used. This density estimate is almost an order of magnitude larger than that observed in the Hawaii EEZ (0.00039 animals/km^2; Barlow, 2006). No pygmy killer whales were sighted in nearshore Hawaii waters (Mobley et al., 2000).
- Melon-headed whale: Leatherwood and Reeves (1983) reported that melon-headed whales are not observed frequently anywhere except in the Philippine Sea, especially near Cebu Island. An abundance estimated by Ferguson and Barlow (2001, 2003) from the eastern Pacific of 36,770 animals and a density estimate of 0.0012 animals/km^2 for the offshore region around the Hawaiian archipelago (Barlow, 2006) were used in the analysis for this region. The density estimate from Mobley et al. (2000) for near the Main Hawaiian Islands, 0.0021/km^2, is higher.
- Short-finned pilot whale: Miyashita (1993) estimated the abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery at 53,608 individuals (CV=0.224), while the derived average density estimated in 1° blocks was 0.0153 animals/km^2 derived.
- Risso's dolphin: Miyashita (1993) reported an abundance estimate (83,289 (CV=0.179)) and density estimate off southern Japan/east Taiwan (0.0106 animals/km^2). This is an order of magnitude larger than that observed in the Hawaii EEZ (0.00097 animals/km^2; Barlow, 2006) and no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al. 2000).
- Common dolphin, short-beaked: There are no data on density or abundance estimates for this species in the western Pacific (Miyashita, 1993). Common dolphins are gregarious, and it is not unusual to find them associated with Pacific white-sided dolphins in eastern North Pacific feeding

grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and found in waters of temperature 10-28°C (50-82.4ºF). These animals are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on stock or density estimates for the western North Pacific, the population data derived from ETP surveys of 3,286,163 animals and 0.0761 animals/km^2 from the eastern Pacific (Ferguson and Barlow, 2001, 2003) are appropriate.

- Fraser's dolphin: As a highly gregarious species, groups of a hundred to a thousand Fraser's dolphins have been observed. Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. Dolar et al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Without any data on abundance or density estimates for the western North Pacific, it is roughly estimated that estimates (0.0040 animals/km^2 and 220,789 animals) from the ETP (Ferguson and Barlow 2001, 2003) are appropriate. This is comparable to that observed in the Hawaii EEZ (0.00417 animals/km^2; Barlow, 2006).

- Bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 animals CV=0.261) and density estimate off southern Japan (0.0146 animals/km^2). This is comparable to that observed in the nearshore Hawaii waters (0.0103 animals/km^2; Mobley et al., 2000) and an order of magnitude larger than that observed in the Hawaii EEZ (0.00131 animals/km^2; Barlow, 2006).

- Pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Taiwan and in the Philippine Sea. Miyashita (1993) abundance estimate (438,064 animals, CV=0.174) and density estimate off southern Japan/east Taiwan (0.0137 animals/km^2) were used. This is comparable to those observed in the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

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

- Spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan, and this species was not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993). No data on density or abundance estimates are available (Miyashita, 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that estimates (0.0005 animals/km^2 and 1,015,059 animals) from the ETP (Ferguson and Barlow, 2001, 2003) at a similar latitude are appropriate.

- Pacific white-sided dolphin: No data on density or abundance estimates are available in the western North Pacific (Miyashita, 1993). A gregarious species, these pelagic, offshore creatures are encountered along or seaward of the 183-m (100-fm) contour. They feed at night on the deep-scattering layer and have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves, 1983). Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different population than animals found in offshore North Pacific waters (Hayano et al., 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al., 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow, 2001, 2003). Without any data on density estimates for the western North Pacific (Miyashita, 1993), it is roughly estimated that the data from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al., 2000; Barlow, 2006).

- Rough-toothed dolphin: This species has a primarily pelagic distribution in tropical to warm temperate waters. They are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied ETP. There are no data on abundance or density estimates for the western North Pacific; therefore, a density estimate (0.0059 animals/km^2) an abundance (145,729 animals) from the eastern Pacific waters was used (Ferguson and Barlow, 2001,

2003). This is comparable to those observed in the Hawaii EEZ (0.00355 animals/km^2; Barlow, 2006) but was higher than those estimated in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

3. Operational Area #3—West Philippine Sea

- Fin whale: In the western North Pacific, fin whales winter to about 20°N, including waters along the Pacific coast of Japan (Mizroch et al., 2009). Since fin whales migrate south from offshore waters of the northwest Pacific, density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki, 1977, Ohsumi, 1977, Tillman, 1977). These data are comparable to density estimates in offshore areas of the ETP (Ferguson and Barlow, 2001, 2003).

- Bryde's whale: Animals found around the Bonin Islands are an offshore morph of *Balaenoptera edeni*. three stocks are currently recognized in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific (Yoshida and Kato, 1999). The Ohsumi (1977) density estimate (0.0006 animals/km^2) was used for this analysis. The IWC provides the best available population estimate for the western North Pacific stock at 20,501 whales (IWC, 2009). Ohizumi et al. (2002) conducted winter sighting surveys, observing Bryde's whales at about 20°N, which is the southern limit of their summer range. Barlow (2006) observed Bryde's whales around the Hawaiian Islands, deriving a higher density estimate (0.00019 animals/km^2).

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

- Humpback whale: Many specific humpback feeding and wintering grounds have been identified in the North Pacific Ocean. 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, 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 feed in other regions of the North Pacific, principally off Russia but also to the Bering Sea and the Gulf of Alaska (Calambokidis et al., 2008). Thus, humpback whales are only expected in the western Philippine Sea during winter. The SPLASH consortium derived an average abundance for the Asian wintering grounds of 1,107 humpback whales (Calambokidis et al., 2008). Since no density estimate for the Asian humpback wintering grounds is available, a density estimated for the California/Oregon/Washington wintering humpback stock of 0.00083 animals/km^2 was used for this region (Barlow and Forney, 2007).

- Sperm whale: Although the sperm whale stock structure is better defined in U.S. North Pacific EEZ waters, some uncertainty exists in the delineation of the remaining North Pacific stock structure. The best available population estimate for sperm whales in the western North Pacific is Kato and Miyashita's (1998) estimate of 102,112 animals (CV=0.155). Sightings collected by Kasuya and Miyashita (1988) suggest that that there are two stocks of sperm whales in the western North Pacific, a northwestern stock with females that summer off the Kuril Islands (~50°N) and winter off Hokkaido and Sanriku (~40°N), and the southwestern North Pacific stock with females that summer off Hokkaido and Sanriku (~40°N) and winter around the Bonin Islands (~25°N). The males of these two stocks are found north of the range of the corresponding females, i.e., in the Bering Sea (~55°N) and

off Hokkaido and Sanriku (~40°N), respectively, during the summer. Although no densities for sperm whales in this region have been estimated, the estimated density for sperm whales (0.0010 animals/km^2) derived from the sighting data collected by Mobley et al. (2000), where sperm whales were generally seen in the outer 5% of survey effort, is most applicable for this region. This density estimate is comparable to the sperm whale density (0.00123 animals/km^2) estimated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011).

- *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), an overall abundance of 350,553 animals was computed in the ETP. At this latitude, *Kogia breviceps* and *Kogia sima* are expected to occur. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20°N (Ferguson and Barlow, 2003), a density estimate of 0.0017 animals/km^2 was modeled. This 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).

- Cuvier's beaked whale: No data are available for Cuvier's beaked whales in this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that best data available are a density estimate (0.0003 animals/km^2) and an abundance estimate of 90,725 animals from the same latitudes in the eastern Pacific (Ferguson and Barlow, 2003). This density was lower than those estimated for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- Blainville's beaked whale: Miyazaki et al. (1987) reported two strandings on Taiwan and one stranding on the southern Ryukyu Archipelago. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the data from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. The *Mesoplodon densirostris* abundance estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032 animals. The density estimate for *Mesoplodon* spp. at the same latitudes in the eastern Pacific is appropriate (0.0005 animals/km^2; Ferguson and Barlow, 2001, 2003). This density estimate is comparable to that for Blainville's beaked whales in the Hawaii EEZ (0.00117 animals/km^2; Barlow, 2006), 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., 2006b).

- Ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported two strandings of *M. ginkgodens* from the east coast of Taiwan. Of the 15 known *M. ginkgodens* strandings, Palacios (1996) reported eight off Taiwan and Japan. Leatherwood and Reeves (1983) stated that some hunting of this species apparently takes place in Taiwan. Since no data on density or stock estimates are available for this species, the density (0.0005 animals/km^2) and abundance (22,799 animals) estimates for *Mesoplodon* spp. at the same latitudes in the eastern Pacific are appropriate (Ferguson and Barlow, 2001, 2003). 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., 2006b).

- False killer whale: Miyashita (1993) estimated the abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668, CV=0.263). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average was derived for the modeled site (0.0029 animals/km^2). This is comparable to density estimates in the Hawaii EEZ (0.0001 animals/km^2; Barlow, 2006) and to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

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

observed in the Hawaii EEZ (0.00039 animals/km^2; Barlow, 2006). None were sighted in nearshore Hawaii waters (Mobley et al., 2000).

- Melon-headed whale: Leatherwood and Reeves (1983) reported that melon-headed whales are not observed frequently anywhere except in the Philippine Sea, especially near Cebu Island. Abundance estimated from eastern Pacific (36,770 animals) (Ferguson and Barlow, 2001, 2003). A density estimate for the offshore region around the Hawaiian archipelago (Barlow, 2006) was used (0.0012 animals/km^2). This value is very similar to the estimate from Mobley et al. (2000) for near the Main Hawaiian Islands: 0.0021 animals/km^2.

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

- Risso's dolphin: Miyashita (1993) abundance estimate (83,289 animals CV=0.179) and density estimate off southern Japan/east Taiwan (0.0106 animals/km^2) were used. This is an order of magnitude larger than that observed in the Hawaii EEZ (0.00097 animals/km^2; Barlow, 2006) and no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al., 2000).

- Common dolphin, short-beaked: There are no data on density or stock estimates for this gregarious species (Miyashita, 1993). It is not unusual to find common dolphins associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. These pelagic, offshore creatures are encountered along or seaward of the 183-m (100-fm) contour and are found in waters of temperature 10-28°C (50-82.4°F). They are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on stock or density estimates for the western North Pacific, the population data estimated of 3,286,163 animals and 0.0562 animals/km^2 from the eastern Pacific (Ferguson and Barlow, 2001, 2003) are appropriate to use for this area.

- Fraser's dolphin: Kishiro and Kasuya (1993) reported takes of Fraser's dolphin off the Pacific coast of Japan in the Japanese drive fisheries. Dolar et al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Amano et al. (1996) also stated that Fraser's dolphins are common in Philippine waters. A highly gregarious species, groups of a hundred to a thousand have been observed, are occasionally found mixed in herds of spotted dolphins, and observed in the company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the estimates (0.0040 animals/km^2 and 220,789 animals) from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. This is comparable to that observed in the Hawaii EEZ (0.00417 animals/km^2; Barlow, 2006).

- Bottlenose dolphin: Miyashita (1993) abundance estimate (168,791 (CV=0.261)) and density estimate off southern Japan (0.0146/km^2) were used. This is comparable to that observed in the nearshore Hawaii waters (0.0103/km^2; Mobley et al., 2000) and an order of magnitude larger than that observed in the Hawaii EEZ (0.00131/km^2; Barlow, 2006).

- Pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Taiwan and in the Philippine Sea. The Miyashita (1993) abundance estimate (438,064, CV=0.174) and density estimate off southern Japan/east Taiwan (0.0137 animals/km^2) were used. This is comparable to those observed in the Hawaii EEZ (0.00366/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

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

- Spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait, but none were reported from the Philippine Sea. Spinners are also not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or abundance estimates are available (Miyashita, 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that estimates (0.0005 animals/km^2 and 1,015,059 animals) from the ETP (Ferguson and Barlow, 2001, 2003) at a similar latitude are appropriate.

- Pacific white-sided dolphin: There are no data on density or stock estimates available for this species (Miyashita, 1993). These pelagic, offshore animals are encountered along or seaward of the 183-m (100-fm) contour. Pacific white-sided dolphins have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves, 1983). Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a different population than animals found in offshore North Pacific waters (Hayano et al., 2004). Sighting surveys in the North Pacific were analyzed to estimate the abundance of Pacific white-sided dolphins as 931,000 individuals (Buckland et al., 1993). This estimate is over an order of magnitude larger than the abundance estimate in the eastern North Pacific (Ferguson and Barlow, 2001, 2003). Without any data on density estimates for the western North Pacific (Miyashita 1993), it is roughly estimated that the data from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al., 2000; Barlow, 2006).

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

4. Operational Area #4—Guam

The only recent research on marine mammals in the vicinity of Guam is from a January-April 2007 survey (DoN, 2007; Fulling et al., 2011), an August 2007 survey (Mobley, 2007), and small-boat surveys around the islands of Guam and Saipan in February-March 2010 (Ligon et al., 2011). Eldredge (1991) compiled the first list of published and unpublished records, reporting 19 species from the region. A compilation of the best available information for the region was recently completed (DoN, 2005).

- Blue whale: Based on vocalization patterns, two stocks are recognized in Pacific waters of the U.S. EEZ (Carretta et al., 2011). The eastern North Pacific stock winters off Mexico and Central America and summers off California and the U.S. west coast. The central North Pacific stock, found at this mission area, winters in the western North Pacific and, less frequently, in the central North Pacific, and summers southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska. Blue whales occur rarely in the central North Pacific, with few sightings and acoustic detections having been made (Carretta et al., 2011). Evidence of their occurrence around Guam exists in acoustic recordings (Stafford et al., 2001; Stafford, 2003). Since data are so limited on the central North Pacific stock, and given the current uncertainty in blue whale stock delineation in the North Pacific (IWC recognizes only one stock in North Pacific, NMFS delineates two stocks in U.S. EEZ waters, up to five populations are believed to exist in the entire North Pacific basin [Reeves et al. 1998], and acoustic data suggest two populations), data from the ETP are most appropriate for application to this area. Due to their rare status and lack of sightings in the region, the lowest density estimate (0.0001 animals/km^2) for blue whales in the ETP is considered appropriate for a year-round estimate in this region (Ferguson and Barlow, 2001, 2003). Since there is currently no stock estimate available for the

central North Pacific stock, the most appropriate stock estimate for use in analysis of this area is 9,250 individuals, which is based on sighting survey data associated with Japanese whaling (Tillman, 1977)..

- Fin whale: Fin whales are typically not expected south of 20°N, so it is unlikely that they would be encountered near Guam (Mizroch et al., 2009). Within U.S. Pacific EEZ waters, three stocks are recognized: a California/Oregon/Washington stock, a northeast Pacific stock, and a Hawaii stock (Carretta et al., 2011). Any animals found around Guam would likely be part of the migratory western North Pacific stock (Mizroch et al., 2009). Because of the limited data available for the western North Pacific stock, and no data available for the Guam region, a density estimate of 0.0003 animals/km^2 is based on the lowest density estimate for fin whales in the ETP (Ferguson and Barlow, 2003). The stock estimate (9,250 individuals) was derived from encounter rates of scouting boats during Japanese whaling in the northwest Pacific (Masaki, 1977; Ohsumi, 1977; Tillman, 1977). It is conservative to use the eastern North Pacific data because McDonald and Fox (1999) derived an average calling whale density estimate of 0.027 animals per 1000 km^2 (0.000027 animals/km^2) based on recordings made north of Oahu, Hawaii–a value an order of magnitude less than what was modeled. The seasonal maximum calling whale density was about three times the average, or 0.081 animals/1000 km^2 (McDonald and Fox, 1999), still considerably less than the modeled density. Based on the chosen methodology and parameters, the call density was variable and ranged from 0.011/1000 km^2 to 0.106/1,000 km^2.

- Sei whale: The IWC recognizes one stock of sei whales in the North Pacific (Donovan, 1991), however some evidence exists for several populations (Carretta et al., 2011). Very few sightings of sei whales have occurred in any region of the North Pacific. Until the recent survey conducted in the Mariana Island Range Complex (DoN, 2007; Fulling et al., 2011), sei whales were considered rare in the Marianas region. The best density estimate is 0.00029 animals animals/km^2, derived from that survey (DoN, 2007; Fulling et al., 2011). The Marianas survey 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., 2011). Therefore, the best available estimate for the entire North Pacific stock region is 8,600 animals based on very old catch data (Tillman, 1977). Initial estimates for a portion of the sei whale range off Japan indicate abundance estimates of similar magnitude (7,744 for May-June and 5,406 for July-Sep; Hakamada et al., 2009).

- Bryde's whale: The IWC provides the best available population estimate for the western North Pacific stock at 20,501 whales (IWC, 2009). The best available density estimate (0.00041 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to density estimates from the ETP (0.0009/km^2) (Ferguson and Barlow, 2001, 2003) and the Hawaii EEZ (0.00019 animals/km^2; Barlow, 2006).

- Minke whale: They are not abundant anywhere in the Pacific except in the Bering and Chukchi seas and in the Gulf of Alaska. Within U.S. Pacific EEZ waters, migratory Hawaii and Alaska stocks are recognized, as well as a "resident" CA/OR/WA stock that establishes home ranges (Dorsey et al., 1990; Carretta et al. 2011). The IWC identifies three Pacific stocks—one in the Sea of Japan/East China Sea, one in the remainder of western Pacific west of 180°, and one east of 180°. The stock estimate is for the western North Pacific/Sea of Okhotsk stock (25,049 individuals) (Buckland et al., 1992). This is conservative because it is significantly higher than the limited data available on the CA/OR/WA stock. Rankin and Barlow (2005) acoustically identified the "boing" as minke whales, suggesting that they are more common than previously thought. No density or abundance estimates were provided from the visual data, but are forthcoming from the acoustic data. A recent survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011) heard but did not observe minke whales. It is estimated that the best density is 0.0003 animals/km^2, the highest density reported for minke whales in the ETP (Ferguson and Barlow, 2001, 2003).

- Humpback whale: Humpback whales are only expected in this region during the winter (October through May), and they are typically found in water depths of less than 183 m (100 fm) (Mobley et al. 2001). A central North Pacific stock has been identified as individuals that migrate from summer/fall feeding grounds of northern British Columbia and southeast Alaska (Prince William Sound west to Kodiak), to winter/spring breeding and calving grounds off the Hawaiian Islands (Carretta et al.,

2011). 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 around Hawaii (Norris et al., 1999) suggest a northbound migration heading of approximately magnetic north (10° true), with a "migration corridor" of 150° to 160°W. Animals are cycling through the breeding grounds with an average residency of approximately 30 to 45 days. The best abundance estimate for the central North Pacific stock is 10,103 animals, from mark-recapture model estimates for North Pacific data from 2004 to 2006 (Calambokidis et al., 2008). A recent survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011) heard humpback whales and conducted photo-id work with the observed animals; however, density estimate was not derived. Therefore, the best available density estimate is 0.0069 animals/km^2, the highest density reported for humpback whales in the ETP (Ferguson and Barlow 2001, 2003).

- Sperm whale: Three stocks are recognized in U.S. EEZ waters, a North Pacific stock that migrates between Alaska and the western North Pacific, the Hawaii stock around Hawaii, and a California/Oregon/Washington stock off the U.S. west coast (Allen and Angliss, 2011). Although sperm whales in the Guam site are considered part of the U.S. North Pacific stock, currently available population estimates for this stock are considered unreliable by NMFS (Allen and Angliss, 2011). Thus, the best abundance estimate for this region is that of the western North Pacific stock, estimated at 102,112 individuals (Kato and Miyashita, 1998). A density estimate of 0.00123 sperm whales/km^2, calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011), was used in the analyses for this site.

- *Kogia* spp.: California/Oregon/Washington and Hawaii stocks of pygmy and dwarf sperm whales are recognized (Carretta et al., 2011). 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. Ferguson and Barlow's (2003) derived an abundance estimate for *Kogia* spp. of 350,553 for in the ETP, which is the best estimate available for the Guam area. The combined densities of 0.00291 animals/km^2 (CV=1.12) for pygmy sperm whales and 0.00714 animals/km^2 (CV=0.74) for dwarf sperm whales derived for the Hawaii EEZ (Barlow, 2006) were used for *Kogia* spp. in the Guam region.

- Cuvier's beaked whale: The best data available on density and abundance estimates are 0.00621 animals/km^2 for the Hawaii EEZ (Barlow, 2006) and 90,725 animals from the ETP (Ferguson and Barlow, 2003). This is comparable to the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- Blainville's beaked whale: The best available data are a density estimate (0.00117 animals/km^2) from the Hawaii EEZ (Barlow, 2006) and an abundance estimate from the eastern Pacific (Ferguson and Barlow, 2003). The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032 animals. The 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., 2006b).

- 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 0.0005 animals/km^2 and abundance estimate of 22,799 animals were used for analyses at this site.

- Longman's beaked whale: Longman's beaked whale is 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 were south of 25ºN. Beaked whales may be expected to occur in the area including seaward of the shelf break. There was no density estimate for Longman's beaked whales available from the Mariana Islands (DoN, 2007; Fulling et al., 2011), therefore, a density estimate of 0.00041 animals per km^2 (CV = 1.26) and an abundance estimate of 1,007 animals were derived from the Hawaii offshore area (Barlow, 2006).

- Killer whale: Killer whales are considered rare with limited sightings reported (Carretta et al., 2011). The best available density estimate (0.00014 animals/km^2) and abundance estimate (349 animals,

CV=0.98) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). 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 DoN (2007) surveys around the Mariana Islands.

- False killer whale: Miyashita (1993) estimated the abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 animals (CV=0.263)). The best available density estimate (0.00111 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of magnitude larger than the density estimate (0.0001 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006) and comparable to nearshore Hawaii waters (0.0017 animals/km^2) during the spring, summer and fall (Mobley et al., 2000).
- Pygmy killer whale: One sighting of six animals was observed during surveys around the Mariana Islands, from which a density estimate (0.00014 animals/km^2) was derived (DoN, 2007; 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, 2003). This is comparable to that observed in the Hawaii EEZ (0.00039 animals/km^2; Barlow, 2006). None were sighted in nearshore Hawaii waters (Mobley et al., 2000).
- Melon-headed whale: The best available density estimate (0.00428 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; 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 (Barlow, 2006) and in nearshore Hawaii waters (0.0021 animals/km^2) during the spring, summer and fall (Mobley et al., 2000). An abundance estimate in the eastern North Pacific (36,770) (Ferguson and Barlow, 2003) was used.
- Short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 animals, CV=0.224). The best available density estimate (0.00159 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to the density estimate (0.0036 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006) 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).
- Risso's dolphin: Neither DoN (2007) or Mobley et al. (2000) collected sufficient sighting data to derive density nor abundance estimates. One Hawaiian stock is recognized, though animals appear to be rare in pelagic waters far from shore with only very rare sightings near shore (Carretta et al., 2011). Leatherwood and Reeves (1983) stated that there is a sighting hiatus at about 20°N along the western coast of the U.S. where Risso's have been intensely studied. This sighting hiatus may extend out to the main Hawaiian Islands which are centered at about 20°N, and contribute to the rarity of their sightings. Miyashita (1993) reports a western North Pacific stock estimate of 83,289 animals (CV=0.179). The density estimate (0.00097 animals/km^2) used for this site is from surveys in the Hawaii EEZ (Barlow, 2006). This density is comparable to the density estimate calculate for the eastern North Pacific (0.0007 animals/km^2; Ferguson and Barlow, 2003).
- Common dolphin, short-beaked: These pelagic, offshore creatures are encountered along or seaward of the 183-m (100-fm) contour and are found in waters of temperature 10 to 28°C (50 to 82.4°F). They are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on stock or density estimates for the western North Pacific, the population data estimated of 3,286,163 animals and 0.0021 animals/km^2 from the eastern Pacific (Ferguson and Barlow, 2001, 2003) are appropriate for this site.
- Fraser's dolphin: Fraser's dolphin is an oceanic, tropical species. They were first documented in Hawaii waters during a recent summer/fall survey (Barlow, 2006), resulting in the best available density estimate (0.0042 animals/km^2) and abundance estimate (10,226 individuals, CV=1.16) for the Guam/Mariana Islands region.
- Bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 animals CV=0.261). The best available density estimate (0.00021 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of

magnitude less than that observed in the Hawaii EEZ (0.00131 animals/km^2; Barlow, 2006) and in the eastern North Pacific at similar latitudes and distance from the mainland (0.0025 animals/km^2) (Ferguson and Barlow, 2003).

- Pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. Miyashita (1993) reports an abundance estimate (438,064 animals, CV=0.174) and density estimate east of Japan (0.0259 animals/km^2). The best available density estimate (0.00226 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006) and an order of magnitude less than that observed in nearshore waters of Hawaii (0.0407 animals/km^2; Mobley et al., 2000).
- Striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for two populations in the area: one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 (CV=0.186). The best available density estimate (0.00616 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00536 animals/km^2; Barlow, 2006) and in nearshore waters of Hawaii (0.0016 animals/km^2; Mobley et al., 2000).
- Spinner dolphin: The best available density estimate (0.00314 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00137 animals/km^2; Barlow, 2006) and an order of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000). The best data available abundance estimate is for spinner dolphins (1,015,059 animals) from the ETP (Ferguson and Barlow, 2003).
- Rough-toothed dolphin: The best available density estimate (0.00029/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of magnitude less than 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).The best available data on for an abundance estimate is from the eastern North Pacific (145,729 individuals) (Ferguson and Barlow, 2003).

5. Operational Area #5—Sea of Japan

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

- Fin whale: In the western North Pacific, fin whales migrate south in the winter to about 20°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). A historic stock estimate (9,250 animals) was derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki, 1977; Ohsumi, 1977; Tillman, 1977). The density estimate (0.0009 animals/km^2) for this region is roughly estimated from data of the ETP (Ferguson and Barlow, 2001, 2003).
- Bryde's whale: Omura (1977) refers to four major whaling grounds on the coast of Japan: waters off Bonin Islands, Sanriku, Wakayama (Taiji), and West Kyushu. None of these are in the Sea of Japan. However, Evans (1987) says that Bryde's whales are found from northern Japan to the equator in the western North Pacific. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best density data available are the long-term time series from the ETP (Ferguson and Barlow, 2003): density estimate (0.0001 animals/km^2). The IWC population estimate of 20,501 whales for the western North Pacific stock was used for in analyses for this site (IWC, 2009). Barlow (2006) observed Bryde's whales around the Hawaiian Islands, deriving a comparable density estimate (0.00019 animals/km^2).

- 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 modeled density estimate (0.0004 animals/km^2) of "O" stock animals was derived from the ETP (Ferguson and Barlow, 2003). An abundance estimate for the western North Pacific (25,049 individuals) was used (Buckland et al., 1992).
- Minke whale J-stock: Some of the individuals in this area are believed to be from the J-stock (Butterworth et al., 1996; Gong, 1988). The modeled density estimate of "J" stock animals (0.0002 animals/km^2) was derived from 40% of the western North Pacific density, as the maximum proportion of J-stock animals reported in this area was 40.3% (Pastene and Goto, 1998). J-stock population size is estimated at 893 (Pastene and Goto, 1998).
- North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al., 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al., 2001) where animals are typically found May through September (Clapham et al. 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December-February) makes a definitive assessment impossible (Brownell et al., 2001). Clapham et al. (2004) note the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February-April) and south in fall (peak months September-December) suggest the possibility of two putative sub-populations in the western population that are kept apart by the Japanese islands, though this seems unlikely (Brownell et al., 2001, Clapham et al., 2004). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al., 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the spring, fall and winter in the Sea of Japan. 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.
- Gray whale: Western gray whales are genetically distinct from eastern gray whales (LeDuc et al., 2002). Present day range appears to be from summering grounds in west central Okhotsk Sea off the northeast coast of Sakhalin Island, to wintering grounds in the South China Sea (Meier et al., 2007; Weller et al., 2002). They migrate through the Sea of Japan in November to December. The exact migration route is not known, and Omura (1988) indicates that animals were caught along the Chinese and North Korea Sea of Japan coasts. Gray whales presumably maintain a shallow water/nearshore affinity throughout the southern portion of their range. Current IWC abundance estimates report less than 121 animals in the western Pacific stock (IWC, 2009). With no density estimate for this rare species available, a minimal density of <0.0001 animals/km^2 was used in analyses for this site to reflect the extremely low potential for this species occurring.
- Sperm whale: Kasuya and Miyashita (1988) had no reports of any 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 conditions for sperm whales. The best available abundance estimate for the western North Pacific population of sperm whales is 102,112 animals (CV=0.155) (Kato and Miyashita, 1998). The density, 0.0008 animals/km^2, estimated for sperm whales from the ETP by Ferguson and Barlow (2003) is the best available density for this site. Kato and Miyashita's (1998) sperm whale abundance estimate for the North Pacific stock that migrates between Alaska and the western North Pacific is the best currently available for the overall stock. This ETP density is comparable to that (0.0010 animals/km^2) estimated for the main Hawaiian

Islands (Mobley et al., 2000) and the density estimate (0.00123 animals/km^2) calculated from the winter/spring surveys around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011).

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

- Baird's beaked whale: Kasuya (1986) reported catches of Baird's in the Sea of Japan around approximately 37°N (Toyama Bay) and off southern Hokkaido (41°-42°N). He states that animals are only found in water depths of 1000-3000 m (3281 to 9842 ft). Leatherwood and Reeves (1983) refer to a sizeable fishery in Japan where catches of several hundred per year were made in the 1950s. Kasuya (1986) did not report density or stock estimates for the Sea of Japan; therefore, based on his encounter rate and effective search width, a summer abundance estimate of 4220 (CV=0.295) is derived for his survey. This covered the region from about 32° to 40°N and seaward of the Pacific Japanese coast out to about 150°E. Since his surveys did not include habitat further north, the stock estimate is increased to 8,000 to account for unsurveyed areas. The density estimate (0.0003 animals/km^2) is comparable to the most western strata density estimates in the eastern Pacific (Ferguson and Barlow, 2003).

- Cuvier's beaked whale: No density or stock estimate data are available for this region, 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), it was determined that the best available density and abundance data are derived from Ferguson and Barlow (2003): density estimate (0.0043 animals/km^2), abundance estimate (90,725 animals). This is comparable to the density estimate for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- Ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported one stranding of *M. ginkgodens* from the southern Sea of Japan. This is probably a separate population from that of the offshore western North Pacific, but no data are available. Since no data on density or stock estimates are available for this species, it is roughly estimated that the data on *Mesoplodon* spp. from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. Using the northernmost strata, the density estimate is 0.0005 animals/km^2 and the abundance estimate is 22,799 animals. 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. 2006b).

- False killer whale: Kishiro and Kasuya (1993) reviewed the history of Japanese coastal whaling, reporting that false killer whales were caught on the Noto coast of Japan in the Sea of Japan. Miyashita (1993) suggested that animals summering in the Sea of Japan were probably from a separate, inshore Archipelago stock, by analogy from Pacific white-sided dolphins, than animals 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 multiplied by 3 for the inshore Archipelago stock estimate (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). Miyashita (1993) also derived density estimates in 1° latitude by 1° longitude boxes from 34 sighting cruises associated with the Japanese drive fishery from which an average was derived for the Pacific coast of Japan. Since no sightings of false killer whales were made during the survey effort in the Sea of Japan and East China Sea (Miyashita, 1993), the western North Pacific density estimate (0.0027 animals/km^2) is estimated from the northernmost region of eastern North Pacific (Ferguson and Barlow. 2003). This is an order of magnitude larger than the density estimate in the Hawaii EEZ (0.0001 animals/km^2; Barlow, 2006) and comparable to nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000).

- Melon-headed whale: The first record of melon-headed whales in Korean waters occurred in January 2009 with the stranding of an adult male on the southeast corner of the country (Kim et al., 2010). Distributed in tropical and subtropical waters, preferring equatorial water masses, they are probably uncommon in the colder waters of the Sea of Japan. With such limited data available, the density (0.00001 animals/km^2) and abundance (36,770 animals, CV=0.467) estimates from ETP data (Ferguson and Barlow, 2003) at the same latitude are appropriate for this site.

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

- Risso's dolphin: Kishiro and Kasuya (1993) reported that Risso's 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). He suggested by analogy to bottlenose dolphins and Pacific white-sided dolphins that animals summering in Sea of Japan are a separate, inshore Archipelago stock from the western North Pacific stock. There are no separate data reported for the Sea of Japan or East China Sea, however. Therefore, the western North Pacific stock estimate (83,289 animals, CV=0.179) and density estimate (0.0073 animals/km^2) were derived from the Pacific coast of Japan (Miyashita, 1993). This is an order of magnitude larger than that observed in the Hawaii EEZ (0.00097 animals/km^2; Barlow, 2006) and no Risso's dolphins were observed in nearshore Hawaii waters (Mobley et al., 2000) or around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011).

- Common dolphin, short-beaked: Common dolphins have been caught on the Tsushima Islands in the Korea Strait (Kishiro and Kasuya, 1993). There are no data on density or stock estimates (Miyashita, 1993). A gregarious species, it is not unusual to find common dolphins associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. Common dolphins are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour and found in waters of temp 10-28°C (50-82.4°F), occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). The density estimate (0.0860 animals/km^2) and abundance estimate were calculated from Ferguson and Barlow (2003) in the eastern North Pacific at similar latitudes. Without any data on stock or density estimates for the western North Pacific, the population data estimated of 3,286,163 animals and 0.0761 animals/km^2 from the eastern Pacific (Ferguson and Barlow, 2001, 2003) are appropriate

- 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 a separate, inshore Archipelago stock than animals in the western North Pacific. Kishiro and Kasuya (1993) cite Miyashita (1986) as estimating the abundance of the stock in the East China Sea as 35,046. Since these data represent only about one-third of the habitat of bottlenose dolphins in the East China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (105,138 animals). No density estimates are available for this stock; therefore the density estimate (0.0009 animals/km^2) was calculated from Ferguson and Barlow (2003) in the eastern North Pacific at similar latitudes.

- Pantropical spotted dolphin: Miyashita (1993) summarized data from 34 sighting cruises conducted as part of the Japanese drive fishery. There is no discontinuity in sightings to suggest different stocks, though based on data from the ETP, it is possible that multiple populations exist in the western North

Pacific (Miyashita, 1993). Total population size was 438,064 individuals (CV=0,174); density estimate for western North Pacific was 0.0137 animals/km^2. Estimating that the Sea of Japan animals are one-half the abundance of the western North Pacific stock, a stock estimate of 219,032 animals was calculated. This is comparable to those observed in the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

- Spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait and adjacent waters to the north. Species presence is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993); no data on density or stock estimates are available (Miyashita, 1993). Without any data on density estimates for the western North Pacific, it is roughly estimated that estimates (0.00001 animals/km^{2}and 1,015,059 animals) from the ETP (Ferguson and Barlow, 2001, 2003) at a similar latitude are appropriate.

- Pacific white-sided dolphin: Pacific white-sided dolphins have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves, 1983). These pelagic, offshore animals are encountered along or seaward of the 183-m (100-fm) contour, and feed at night on the deep-scattering layer. Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a 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 population, it is roughly estimated that the abundance estimate from the western North Pacific (931,000 animals) and the density estimate (0.0030 animals/km^2) from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Barlow, 2006; Mobley et al., 2000).

- Dall's porpoise: Dall's porpoise are found only in the North Pacific, primarily north of 36°N in the western North Pacific. They are frequently found associated with Pacific white-sided dolphins from 50°N south, and pilot whales from 40°N south. This species has two distinct color morphs: one with a white flank patch that extends forward to the dorsal fin (*dalli* type) and one with a flank patch extending all the way to the front flippers (*truei* type). These morphological differences have been noted between animals from the Pacific coast of Japan (the *truei*-type), the Sea of Japan and Sea of Okhotsk (the *dalli*-type), and the offshore northwestern Pacific and western Bering Sea (the *dalli*-type) (Hayano et al., 2003). Dall's porpoise are present in oceanic waters to at least 100 km (62 mi) from shore and abundant throughout their range (Leatherwood and Reeves, 1983). Hayano et al. (2003) conducted genetic studies on the three populations and found a low, but significant, difference between the Sea of Japan-Okhotsk population and the other two populations. The Sea of Japan population is known to migrate into the Pacific Ocean via the Tsugaru Strait, and into the Sea of Okhotsk through the Soya Strait in the summer (Amano and Kuramochi 1992). Miyashita and Kasuya (1988) estimated a minimum of *dalli*-type individuals wintering in the Sea of Japan at about 46,000 animals. No density estimates were available for the area. Based on surveys off the western U.S., a density estimate of 0.0520 animals/km^{2}and an abundance estimate of 76,720 animals were derived (Ferguson and Barlow, 2003). This density estimate is probably higher than what would be encountered by LFA operations in the Sea of Japan since it includes survey effort in nearshore waters where animals are more often found.

6. Operational Area #6—East China Sea

- Fin whale: Fin whales winter in the East China Sea and Yellow Sea. The East China Sea population is thought to be resident and may represent a distinct population (Evans, 1987). There are limited data on distribution and abundance, however (Mizroch et al., 2009). Density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki, 1977, Ohsumi, 1977, Tillman, 1977). These data are comparable to density estimates in other areas of the ETP (Ferguson and Barlow, 2001, 2003) and around Hawaii (Barlow, 2006).

- 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. The best available population

estimate for the western North Pacific stock is estimated by the IWC as 20,501 whales (IWC, 2009). Ohsumi (1977) reported the most appropriate density estimate of 0.0006 animals/km^2 for the western North Pacific, which is comparable to the Hawaii EEZ (0.00019 animals/km^2; Barlow, 2006), the ETP (0.0009 animals/km^2; Ferguson and Barlow, 2001, 2003) and Guam and the Mariana Islands (0.00041 animals/km^2) (DoN, 2007; Fulling et al., 2011).

- Minke whale: Minke whales have been reported from the East China Sea and the Yellow Sea, and as a cosmopolitan species, they are expected to be present in the study site. Individuals in this area are believed to be from the J-stock (Butterworth et al., 1996; Gong, 1988), migrating into the region in the winter. To be conservative, however, estimates were made for both the "O" stock and the "J" stock, given the limited amount of data. Therefore, an estimate for the "O" stock was derived based on encounter rates in the favored whaling grounds of the western North Pacific and the western North Pacific stock estimate was used (Buckland et al., 1992). These estimates are an order of magnitude higher than any calculated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003).
- Minke whale J-stock: Some of the individuals in this area are believed to be from the J-stock (Butterworth et al., 1996; Gong, 1988). The modeled density estimate (0.0018 animals/km^2) was derived from 40% of the western North Pacific density, as the maximum proportion of J-stock animals reported in this area was 40.3% (Pastene and Goto, 1998). J-stock population size is estimated at 893 (Pastene and Goto, 1998).
- North Pacific right whale: The western North Pacific right whale population is considered distinct from the eastern population, arbitrarily separated by the 180° line of longitude (Best et al., 2001). The Okhotsk Sea, Kuril Islands, and eastern Kamchatka coast represent major feeding grounds for the western population (Brownell et al., 2001) where animals are typically found May through September (Clapham et al., 2004). Various areas have been proposed for breeding and calving grounds, including the Ryukyu Islands, Yellow Sea, Sea of Japan, offshore waters far from land, and the Bonin Islands, but a lack of winter sightings (December-February) makes a definitive assessment impossible (Brownell et al., 2001). Clapham et al. (2004) noted the extensive offshore component to the right whale's distribution in the 19th century data. Movement north in spring (peak months of February-April) and south in fall (peak months September-December) suggest the possibility of two putative sub-populations in the western population that are kept apart by the Japanese islands, though this seems unlikely (Brownell et al., 2001, Clapham et al., 2004). Data from Japanese sighting cruises in the Okhotsk Sea provide an abundance estimate of 922 animals (CV=0.433, 95% CI=404-2,108) (Best et al., 2001) for the western North Pacific population. The western population may be affected by proposed LFA operations in the winter in the East China Sea. 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.
- Gray whale: The exact location of winter breeding grounds for this species is not known, though it is hypothesized that western Pacific gray whales winter 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 they are believed to migrate directly across the East China Sea, which is one of the few times that they leave their shallow, nearshore habitat (Omura, 1988). During this time, they may be found up to 400 nm (741 km) offshore (Weller et al., 2002). A current abundance of 121 gray whales is estimated for the western Pacific stock by the IWC (IWC, 2009). With no density estimate for this rare species available, a minimal density of <0.0001 animals/km^2 was used in analyses for this site to reflect the extremely low potential for this species occurring.
- Sperm whale: 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, animals 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 western North Pacific population of sperm whales, 102,112 individuals (CV=0.155), 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 Mariana Islands (DoN, 2007; Fulling et al., 2011). This density estimate is considered comparable to Mobley's Hawaii

estimate (0.0010 animals/km^2), where sperm whales were generally seen in the outer 5% of survey effort (Mobley et al., 2000).

- *Kogia* spp.: No density or abundance estimates are available. Summing the abundances of *Kogia breviceps, Kogia sima, and Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals is computed in the ETP. At the latitude of this site, *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, 2003), a density estimate of 0.0031 animals/km^2 was modeled. This 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).
- Cuvier's beaked whale: No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best data available are a density estimate from the same latitude around Hawaii (0.0062 animals/km^2) (Barlow, 2006) and an abundance estimate of 90,725 animals (Ferguson and Barlow, 2003).
- Blainville's beaked whale: Miyazaki et al. (1987) did not report any strandings of *M. densirostris* from the East China Sea. This is probably a separate population from that of the offshore western North Pacific, but no data are available. Without any data on abundance or density estimates for the western North Pacific, it is roughly estimated that the data from the ETP (Ferguson and Barlow, 2001, 2003) and around Hawaii (Barlow 2006) are appropriate. The *Mesoplodon densirostris* ETP abundance estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032 animals. The density estimate (0.0012 animals/km^2) is the same as that for Blainville's beaked whales in the main Hawaiian Islands (0.0012 animals/km^2; Mobley et al., 2001), and comparable to the mean predicted density estimate for the *Mesoplodon* spp. in the ETP (0.0003 animals/km^2; Ferguson et al., 2006b).
- Ginkgo-toothed beaked whale: Miyazaki et al. (1987) reported no strandings of *M. ginkgodens* in the East China Sea. This is probably a separate population from that of the offshore western North Pacific, but no data are available. Since no data on density or stock estimates are available for this species, it was roughly estimated that the density (0.0005 animals/km^2) and abundance estimates (22,799 animals) for *Mesoplodon* spp. at the same latitude in the eastern Pacific (Ferguson and Barlow, 2001, 2003) are appropriate. 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., 2006b).
- False killer whale: Miyashita (1993) suggested that animals summering in the Sea of Japan are probably from a separate, inshore Archipelago stock than animals offshore in the western North Pacific, 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. Since these data represent only about one-third of the habitat of false killer whales in the East China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (9,777 animals). There are no data on density estimates for the East China Sea. The best available density estimate (0.00111 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of magnitude larger than the density estimate (0.0001 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006) and comparable to nearshore Hawaii waters (0.0017 animals/km^2) during the spring, summer, and fall (Mobley et al., 2000).
- Pygmy killer whale: Leatherwood and Reeves (1983) state that the pygmy killer whale cannot be described as abundant anywhere, but animals are widely distributed in tropical waters. This species is seen relatively frequently in the tropical Pacific, especially near Hawaii and off Japan. 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 (0.00014 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to the density estimate (0.00039 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ

(Barlow, 2006). No pygmy killer whales were seen in nearshore aerial during the spring, summer and fall (Mobley et al., 2000).

- Melon-headed whale: The first record of melon-headed whales in Korean waters occurred in January 2009 with the stranding of an adult male on the southeast corner of the country (Kim et al., 2010). 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 in the colder waters of the East China Sea. The best available density estimate (0.00428 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; 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 (Barlow, 2006) and in nearshore Hawaii waters (0.0021 animals/km^2) during the spring, summer and fall (Mobley et al., 2000). An abundance estimate in the eastern North Pacific (36,770 animals) (Ferguson and Barlow, 2003) was used.
- Short-finned pilot whale: Kishiro and Kasuya (1993) reported that short-finned pilot whales are uncommon in the East China Sea, and that insufficient information exists from which to determine whether the southern or northern form occurs in this region. Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 animals, CV=0.224). Kasuya et al. (1988) suggested that there might be more than one stock of short-finned pilot whales off the Pacific coast of Japan and Taiwan, since there is a southern form found south of the Kuroshio Current front (south of 35°N) and a northern form found between the Kuroshio Current front and the Oyashio Current front (from approximately 35-43°N). However, the northern form has not been harvested by Japanese drive fisheries (Kishiro and Kasuya, 1993); and therefore, it was not included in the above analyses (Miyashita, 1993). The best available density estimate (0.00159 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to the density estimate (0.0036 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006) 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).
- 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). He suggested, by analogy to bottlenose dolphins and Pacific white-sided dolphins, that animals summering in Sea of Japan are a separate, inshore Archipelago stock from the western North Pacific stock. However, there are no separate data reported for the Sea of Japan or East China Sea. Consequently, data from the western North Pacific for stock estimate (83,289 animals, CV=0.179) and density estimate (0.0106 animals/km^2) derived for the southeast Pacific coast of Japan/east of Taiwan (Miyashita, 1993) were used. For comparison, no density estimates were available from Mobley et al. (Mobley et al., 2000) and DoN (2007), and an estimate of 0.0010 animals/km^2 was reported in the offshore waters of Hawaii (Barlow, 2006).
- Common dolphin, short-beaked: Common dolphin have been caught off Goto Island in the East China Sea (Kishiro and Kasuya, 1993). This gregarious species, not unusual to find associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds, consist of pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour. They are found in waters of temperatures 10-28°C (50-82.4°F), and are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Common dolphins have not been sighted by Barlow (2006) or Mobley et al. (2000) in Hawaii surveys or by the DoN (2007) during surveys around Guam and the Mariana Islands. There are no data on density or stock estimates (Miyashita, 1993). Without any data on stock or density estimates for the central or western North Pacific, the abundance, 3,286,163 animals, and density, 0.0461 animals/km^2 from the same latitude in the ETP (Ferguson and Barlow, 2001, 2003) are appropriate.
- Fraser's dolphin: Highly gregarious, groups of a hundred to a thousand have been observed; occasionally found mixed in herds of spotted dolphins, and observed in company of false killer whales, sperm whales, striped dolphins, and spinner dolphins (Leatherwood and Reeves, 1983). Kishiro and Kasuya (1993) reported catches off the Pacific coast of Japan in drive fisheries. Dolar et

al. (2003) reported Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Without any data on stock or density estimates for the western North Pacific, the population estimates (0.0040 animals/km^2 and 220,789 animals) from the ETP (Ferguson and Barlow, 2001, 2003) are most appropriate for application to this area. This is comparable to that observed in the Hawaii EEZ (0.00417 animals/km^2; Barlow, 2006).

- 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, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (105,138 animals). No density estimates were available for this stock; therefore, a density estimate was derived from the southeast Pacific coast of Japan/east of Taiwan (Miyashita, 1993). This is appropriate since bottlenose dolphins were sighted in the East China Sea survey effort (Miyashita, 1993). This density estimate is comparable to the Mobley et al. (2000) estimate around Hawaii (0.0103 animals/km^2); an order of magnitude more than Barlow (2006) (0.0013 animals/km^2).

- 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. There was no discontinuity in sightings to suggest different stocks, though based on data from the ETP, it is possible that multiple populations exist in the western North Pacific (Miyashita, 1993). Total population size was 438,064 animals (CV=0.174); density estimate for western North Pacific was 0.0137 animals/km^2. One-half the abundance of the western North Pacific stock (219,032 individuals) was estimated with the same density estimate of 0.0137/km^2. This is comparable to those observed in the Hawaii EEZ (0.00366/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

- 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. There is the potential for three distinct populations (one in the area south of 30°N, one inshore north of 30°N, and one offshore north of 30°N, east of 145°E). 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 inshore Archipelago stock, as analogy from bottlenose dolphins (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 animals, CV=0.186). One-half of the density estimate off southern Japan/east Taiwan was used for this site (0.0164 animals/km^2). This is an order of magnitude greater than the density estimates from the Hawaii EEZ (0.00536 animals/km^2; Barlow, 2006), from nearshore Hawaii (0.0016 animals/km^2; Mobley et al., 2000), and from Guam and the Mariana Islands (0.00616 animals/km^2; DoN, 2007; Fulling et al., 2011).

- Spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait and adjacent waters to the north. No spinner dolphin sightings were reported from the East China Sea. They are not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and there are no data on density or stock estimates (Miyashita, 1993). The best available density estimate (0.00314 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00137 animals/km^2; Barlow, 2006) and an order of magnitude less than that observed in nearshore waters of Hawaii (0.0443 animals/km^2; Mobley et al., 2000). The best data available abundance estimate for spinner dolphins is (1,015,059 animals) from the ETP (Ferguson and Barlow, 2003).

- Pacific white-sided dolphin: Pacific white-sided dolphins have a primarily temperate distribution, found north of tropical waters and south of arctic waters (Leatherwood and Reeves, 1983). These pelagic, offshore animals are encountered along or seaward of the 100-fm contour, and feed at night on the deep-scattering layer. Recent research on genetic differentiation suggests that animals found in coastal Japanese waters and the Sea of Japan belong to a 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 population, it is roughly estimated that the abundance estimate from the western North Pacific (931,000 animals) and the density estimate (0.0028 animals/km^2) from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Barlow, 2006; Mobley et al., 2000).

- Rough-toothed dolphin: Distribution is primarily pelagic, in tropical to warm temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied ETP. There are no data on stock or density estimates for the western North Pacific; therefore, a density estimate from similar latitudes in the eastern North Pacific (0.0059 animals/km^2) was used. This 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) and an order of magnitude larger than that observed around Guam and the Mariana Islands (0.00029 animals/km^2; DoN, 2007; Fulling et al., 2011).

7. Operational Area #7—South China Sea

- Fin whale: De Boer (2000) conducted a research cruise in the Indian Ocean Sanctuary and the South China Sea from 29 March to 17 April, 1999. Sightings of fin whales and a sperm whale west of the Balabac Strait suggest a possible migration route of these species between the South China Sea and the Sulu Sea. De Boer's cruise is the first record of fin whales in the South China Sea. The East China Sea population is thought to be resident and may represent a distinct population (Evans, 1987; Mizroch et al., 2009). Without any data on stock or density estimates for the South China Sea, it is roughly estimated that the data from the western North Pacific are appropriate. Density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki, 1977, Ohsumi, 1977, Tillman, 1977). These data are comparable to density estimates in other areas of the ETP (Ferguson and Barlow, 2001, 2003) and around Hawaii (Barlow, 2006).

- Bryde's whale: Yoshida and Kato (1999) identified 3 stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia stock (mainly Philippine waters and the Gulf of Thailand), East China Sea, and offshore western North Pacific. Animals found in this area are considered part of the southeast Asia stock of Bryde's whales, which includes waters of the Philippine Sea and Gulf of Thailand (Yoshida and Kato, 1999) and which is separate from both the East China Sea and western North Pacific populations. Animals in this region are the offshore form of *Balaenoptera edeni*. De Boer (2000) sighted Bryde's whales during his cruise. No data specific to this stock were reported. The Ohsumi (1977) western North Pacific density estimate is most appropriate; comparable to DoN (2007) (0.00041 animals/km^2), Barlow (2006) (0.00019 animals/km^2) and Ferguson and Barlow (2001, 2003) for the ETP. The IWC provides the best available population estimate, 20,501 whales, for the western North Pacific Bryde's whale stock (IWC, 2009).

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

- North Pacific right whale: There has been a limited search effort in the South China Sea, but no observations of right whales have ever been reported in the area (Clapham et al., 2004). In addition, right whales migrate further north during the spring, summer, and fall, and are not expected in the area at this time of year. The only possibility of a right whale encounter would be during the winter season. To account for the limited possibility of this species occurring during winter in this site, an abundance estimate of 922 animals derived from Japanese sighting cruises in the Okhotsk Sea (Best

et al., 2001) was used. 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.

- Gray whale: Gray whales would only be expected to be in this area during the winter season. Exact wintering grounds of this species are not known, though believed to winter in the South China Sea, in the vicinity of Korea and China (Evans, 1987; Omura, 1988). Presumably they maintain a shallow water/nearshore affinity throughout the southern portion of their range. The exact migration route is not known, but they are believed to migrate directly across the East China Sea, which is one of the few times that they leave their shallow, nearshore habitat (Omura ,1988). During this time, they may be found up to 400 nm (741 km) offshore (Weller et al., 2002). Currently, IWC reports an abundance estimate of 121 animals for the western Pacific stock (IWC, 2009). With no density estimate for this rare species available, a minimal density of <0.0001 animals/km^2 was used in analyses for this site to reflect the extremely low potential for this species occurring.

- Sperm whale: 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 for density or stock estimates were derived from either study. The only available abundance estimate for the western North Pacific 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 (DoN, 2007; Fulling et al., 2011). This density is comparable to the sperm whale density, 0.0010 animals/km^2, derived from Hawaiian surveys, where sperm whales were generally seen in the outer 5% of the survey effort (Mobley et al., 2000).

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

- Cuvier's beaked whale: De Boer (2000) sighted Cuvier's beaked whales during his cruise through the South China Sea. No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best available data are a density estimate from the same latitude in the eastern Pacific (0.0003 animals/km^2) and an abundance estimate of 90,725 animals (Ferguson and Barlow, 2003). This is comparable to that estimated for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- Blainville's beaked whale: Miyazaki et al. (1987) did not report any strandings of *M. densirostris* from the South China Sea. De Boer (2000) and Miyashita et al. (1996) did not observe any *M. densirostris* during their research cruises. Without any data on stock or density estimates for the western North Pacific, the data from the ETP (Ferguson and Barlow, 2001, 2003) are most appropriate for this region. The *Mesoplodon densirostris* estimate added to one-fifth of the *Mesoplodon* spp. abundance estimate is 8,032 animals and the *Mesoplodon* spp. density estimate, 0.0005/km^2, are 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 (0.00117 animals/km^2; Barlow 2006), 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., 2006b).

- Ginkgo-toothed beaked whale: Miyazaki et al. (1987) report no strandings of *M. ginkgodens* from the South China Sea. De Boer (2000) and Miyashita et al. (1996) did not observe *M. ginkgodens* during their research cruises. Since no data on density or stock estimates are available for this species, it

was roughly estimated that the density (0.0005 animals/km^2) and abundance estimates (22,799 animals) for *Mesoplodon* spp. at the same latitude in the eastern Pacific (Ferguson and Barlow, 2001, 2003) are appropriate. 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., 2006b).

- False killer whale: Miyashita (1993) suggested that animals summering in the Sea of Japan are probably from a separate, inshore Archipelago stock, by analogy of Pacific white-sided dolphins, than animals from the western North Pacific 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 South China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (9,777 individuals). False killer whales are sighted infrequently in the South China Sea (De Boer, 2000; Miyashita et al., 1996; Smith et al., 1997). There are no data on density estimates for the South China Sea. The best available density estimate (0.00111 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of magnitude larger than the density estimate (0.0001 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006) and comparable to nearshore Hawaii waters (0.0017 animals/km^2) during the spring, summer, and fall (Mobley et al., 2000).

- Pygmy killer whale: Leatherwood and Reeves (1983) stated that this species is not abundant in any particular area, but is widely distributed in tropical waters. Pygmy killer whales are seen relatively frequently in the ETP, especially near Hawaii. Pygmy killer whales were seen by De Boer (2000) during his research cruise through the South China Sea, known from historical "whale temples" (Smith et al., 1997), but not seen by Miyashita et al. (1996). No mention of these animals exists in Japanese whaling records (Kishiro and Kasuya, 1993). There are no data on density or stock estimates off Japan or Taiwan (Miyashita, 1993), or nearshore Hawaii (Mobley et al., 2000). The best available density estimate (0.00014 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to the density estimate (0.00039 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). An abundance estimate (30,214 animals) from the eastern Pacific (Ferguson and Barlow, 2003) was used.

- Melon-headed whale: Leatherwood and Reeves (1983) stated that melon-headed whales are rare except in the Philippine Sea. Distributed in tropical and subtropical waters, preferring equatorial water masses, they have been observed in the South China Sea (De Boer, 2000) and in "whale temples" on islands surrounding the South China Sea (Smith et al., 1997). However, they were not observed by Miyashita et al. (1996). The best available density estimate (0.00428 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; 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 (Barlow, 2006) and in nearshore Hawaii waters (0.0021 animals/km^2) during the spring, summer and fall (Mobley et al., 2000). An abundance estimate in the eastern North Pacific (36,770) (Ferguson and Barlow, 2003) was used.

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

density estimate (0.00159 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to the density estimate (0.0036 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006) 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).

- 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 animals summering in Sea of Japan are a separate, inshore Archipelago stock from the western North Pacific stock. There have been no separate data reported for the Sea of Japan, East China Sea, or South China Sea, though. Therefore, the western North Pacific stock estimate (83,289 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. This is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003) and higher than those around Hawaii (not observed by Mobley et al. (2000) or DoN (2007); 0.0010 animals/km^2 Barlow, 2006).

- Common dolphin, short-beaked: Common dolphin has been found in "whale temples" in nations along the South China Sea (Smith et al., 1997). There are no data on density or stock estimates (Miyashita, 1993). This is a gregarious species, not unusual to find associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. These dolphins are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and found in waters of temperature 10-28°C (50-82.4°F). They are very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on density or stock estimates for the western North Pacific, estimates from the ETP of 0.0461 animals/km^2 and 3,286,163 animals (Ferguson and Barlow, 2001, 2003) were used, respectively. Common dolphins were not sighted around Hawaii in recent surveys (Barlow, 2006; Mobley et al., 2000) or around Guam or the Mariana Islands (DoN, 2007; Fulling et al., 2011).

- Fraser's dolphin: Highly gregarious groups of a hundred to a thousand dolphins have been observed, and occasionally have been found mixed in herds of spotted dolphins. Fraser's dolphins have also been observed in the company of false killer whales, sperm whales, striped dolphins, and spinner dolphins. Their diet consists of squid, crustaceans, and deep-sea fish (Leatherwood and Reeves, 1983). Comparing the feeding ecology of spinner and Fraser's dolphins, spinner dolphins feed primarily in upper 200 m (656 ft), but maybe as deep as 400 m (1312 ft), whereas Fraser's are more diverse, feeding from the surface to as deep as 600 m (1968 ft). Kishiro and Kasuya (1993) report catches off the Pacific coast of Japan in drive fisheries. Dolar et al. (2003) report Fraser's and spinners found together in the eastern Sulu Sea, Philippines. Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that the estimates (0.0040 animals/km^2 and 220,789 animals) from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. This is comparable to that observed in the Hawaii EEZ (0.00417 animals/km^2; Barlow, 2006).

- 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, inshore Archipelago stock than animals in the western North Pacific. Kishiro and Kasuya (1993) cite Miyashita (1986) as estimating the abundance of the stock in the East China Sea as 35,046. Since these data represent only about one-third of the habitat of bottlenose dolphins in the East China Sea, the population estimate is multiplied by 3 for the inshore Archipelago stock estimate (105,138 animals). It is assumed that animals found in the Sea of Japan, East China Sea, and South China Sea are of the same stock. No density estimates are available for this stock; therefore, a density estimate was derived from the southeast Pacific coast of Japan/east of Taiwan (Miyashita, 1993) (0.0146 animals/km^2). This is within the range of densities estimated in the eastern North Pacific (Ferguson and Barlow, 2001, 2003) and higher than those around Hawaii, 0.0103 animals/km^2 (Mobley et al. 2000), 0.0013 animals/km^2 (Barlow, 2006), and around Guam and the Mariana Islands, 0.00021 animals/km^2 (DoN, 2007; Fulling et al., 2011).

- Pantropical spotted dolphin: These animals have been reported during the De Boer (2000) research cruise, observed in winter (Jan-Feb) in South China Sea (Miyashita et al., 1996), and reported from historical "whale temples" (Smith et al., 1997). Gilpatrick et al. (1987) summarized one report from west of Taiwan in the northern portion of the South China Sea. Miyashita (1993) summarized data from 34 sighting cruises conducted as part of the Japanese drive fishery. There is no discontinuity in sightings to suggest different stocks, though based on data from the ETP, it is possible that multiple populations exist in the western North Pacific (Miyashita, 1993). In the western North Pacific, total population size was 438,064 animals (CV=0.174); density estimate was 0.0137 animals/km^2. It was estimated that the population in South China Sea was one-half the abundance of the western North Pacific stock (219,032 animals) with the same density estimate of 0.0137 animals/km^2. This is comparable to those observed in the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

- Striped dolphin: These animals were not reported during the De Boer (2000) research cruise in March-April, but were seen by Miyashita et al. (1996) in the South China Sea during their Jan-Feb cruise. No data on density or abundance estimates for the South China Sea are available. Two concentrations of striped dolphin are recognized in the western North Pacific: one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for three populations in the area: one south of 30°N, one inshore north of 30°N, one offshore north of 30°N, east of 145°E though the boundaries between these populations have not been resolved and it is possible that the inshore population is connected to the Sea of Japan/East China Sea/South China Sea as an inshore Archipelago stock, as analogy from bottlenose dolphins (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate (570,038 animals, CV=0.186). One-half of the density estimate off southern Japan/east Taiwan for this site (0.0164 animals/km^2) was used. This is an order of magnitude greater than the density estimates from the Hawaii EEZ (0.00536 animals/km^2; Barlow, 2006), from nearshore Hawaii (0.0016 animals/km^2; Mobley et al., 2000), and from Guam and the Mariana Islands (0.00616 animals/km^2; DoN, 2007; Fulling et al., 2011).

- Spinner dolphin: Gilpatrick et al. (1987) reported a high density of sightings in the Korea Strait and adjacent waters to the north, but none were reported from the South China Sea or Philippine Sea. Spinner dolphins were not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), reported during the De Boer (2000) research cruise, or encountered in historical "whale temples" (Smith et al., 1997). There are no data on density or stock estimates (Miyashita, 1993). The best available density estimate (0.00314 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00137 animals/km^2; Barlow, 2006) and an order 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 is for whitebelly spinner dolphins (1,015,059 animals) from the ETP (Ferguson and Barlow, 2003).

- Rough-toothed dolphin: Rough-toothed dolphins have a primarily pelagic distribution in tropical to warm temperate waters. They are seen from time to time with bottlenose dolphins and short-finned pilot whales, and are reportedly rare off Japan and in the heavily studied ETP. These animals have been found in "whale temples" in South China Sea nations (Smith et al., 1997). The best available data are a density (0.0040 animals/km^2) and abundance estimate (145,729 animals) from eastern Pacific (Ferguson and Barlow, 2001, 2003). This 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) and an order of magnitude larger than that observed around Guam and the Mariana Islands (0.00029 animals/km^2; DoN, 2007; Fulling et al., 2011).

8. Operational Area #8—Offshore Western North Pacific 25º to 40ºN

- Blue whale: Based on vocalization patterns (Stafford et al., 2001; Stafford, 2003), two stocks are recognized in Pacific waters of the U.S. EEZ (Carretta et al., 2011). The eastern North Pacific stock winters off Mexico and Central America and summers off California and the U.S. west coast. The central North Pacific stock, found at this mission area, winters in the western North Pacific and, less frequently, in the central North Pacific, and summers southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska. While Stafford et al. (2001) had 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. Based on these data, it was decided that the best available data on blue whales are from sighting surveys associated with Japanese whaling (Tillman, 1977). Limited data have been reported on blue whales since this species was the initial focus of whaling effort; therefore, data on fin whales are most appropriate to apply to blue whales. These data are comparable to density estimates in offshore areas of the ETP (Ferguson and Barlow, 2001, 2003).

- Fin whale: Fin whales have been reported migrating south in the winter to about 20°N, and are found in the summer from a line near Japan north to the Chukchi Sea and Aleutian Islands (Evans, 1987; Mizroch et al., 2009). Density and stock estimates were derived from encounter rates of Japanese scouting boats in the northwest Pacific (Masaki,1977; Ohsumi, 1977; Tillman, 1977). These data are comparable to density estimates in offshore areas of the ETP (Ferguson and Barlow, 2001, 2003).

- Sei whale: Tillman (1977) derived an abundance estimate of 8,600 individuals for sei/Bryde's whale in the North Pacific from whaling catch statistics. Initial estimates for a portion of the sei whale range off Japan indicate abundance estimates of similar magnitude (7,744 for May-June and 5,406 for July-Sep; Hakamada et al., 2009). The best available density estimate (0.00029 animals/km^2 CV=48.7) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011).

- 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 (0.00041 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This 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 (0.00019 animals/km^2; Barlow, 2006). The IWC provides the best available population estimate, 20,501 whales, for the western North Pacific Bryde's whale stock (IWC, 2009).

- Minke whale: The south coast of Honshu and Shikoku were whaling grounds for this species (Ohsumi, 1978). Animals are migratory from the offshore western North Pacific waters. Buckland et al. (1992) conducted sighting surveys in July and August in the western North Pacific and Sea of Okhotsk. Density estimates were derived from encounter rates and effective search widths for the offshore population (Standard Error (SE) = 0.17). 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 a recent survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011).

- 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. These 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) (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. Therefore, this site (~35°N) in summer is located on the northern edge of the concentration of southwest females. Due to the extreme offshore location of this site, the derived density estimate (0.0003 animals/km^2) from Ferguson and Barlow (2001; 2003) is the best for this region. This density is approximately an order of magnitude lower than the Mobley et al. (2000) estimate (0.0010 animals/km^2) where sperm whales were generally seen in the outer 5% of the survey effort and the density estimate (0.00123 animals/km^2) calculated from the winter/spring survey around Guam and Mariana Islands (DoN, 2007; Fulling et al., 2011).

- *Kogia* spp.: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution; they are not believed to be concentrated anywhere. Around the main Hawaiian Islands, Baird (2005) observed *Kogia* spp. on 18 occasions between 2000 and 2003, in mean water

depths of 1425 m. *Kogia* spp. were also the most commonly stranded animals (18%) between 1937 and 2002 on the main Hawaiian Islands (Maldini et al., 2005). Summing the abundances of *Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals is computed in the ETP. At this northern latitude, only *Kogia breviceps* is expected. Reviewing density estimates calculated in the eastern Pacific Ocean at about 30°N (Ferguson and Barlow, 2003), a density estimate of 0.0049/km^2 was modeled. This 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).

- 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 1000 m. Kasuya (1986) collected aerial survey sighting records over 25 years and shipboard sightings in 1984 off the Pacific coast of Japan. Based on his encounter rate and effective search width, a summer density estimate of 0.0029 animals/km^2 was derived. Kasuya's (1986) abundance estimate of 4,220 animals (CV=0.295) covered the region from about 32-40°N and seaward of the Pacific Japanese coast out to about 150°E. Since his surveys did not include habitat further north or east, the stock estimate is increased to 8,000 to account for unsurveyed areas, and the density estimate (0.0001 animals/km^2) was reduced 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).

- Cuvier's beaked whale: No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best data available are the long-term time series from the ETP (Ferguson and Barlow, 2003): density estimate (0.0017 animals/km^2) and abundance estimate of 90,725 animals. This is comparable to that estimated for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- *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 no data on density or stock estimates are available for this species, it is roughly estimated that the data on *Mesoplodon* spp. from the ETP (Ferguson and Barlow, 2001, 2003) are appropriate. Using the northernmost strata, the density estimate is 0.0005 animals/km^2 and the abundance estimate is 22,799 animals. 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., 2006b).

- False killer whale: Miyashita (1993) estimated abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 animals CV=0.263). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average (0.0036 animals/km^2) was derived for the modeled site. This is within the range of average densities estimated in the eastern North Pacific (0.0027 animals/km^2; Ferguson and Barlow, 2001, 2003)

- Pygmy killer whale: Kishiro and Kasuya (1993) reviewed the historical catches of Japanese drive fisheries. No pygmy killer whales were caught in Taiji fisheries (located on the south coast of Kii Peninsula of Japan), but Leatherwood and Reeves (1983) reported that they were seen relatively frequently in the tropical Pacific off Japan. The best available density estimate (0.00014 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to the density estimate (0.00039 animals/km^2) calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). No pygmy killer whales were seen in nearshore aerial during the spring, summer, and fall (Mobley et al., 2000). An abundance estimate (30,214) was used from the eastern Pacific (Ferguson and Barlow, 2003).

- 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, a density estimate was used from the Hawaii EEZ (0.0012 animals/km^2; Barlow 2006), 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 (DoN, 2007; Fulling et al., 2011); an abundance estimate of 36,770 (Ferguson and Barlow, 2003) was used.

- Short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 animals CV=0.224). He also derived density estimates in 1° latitude by 1° longitude boxes, from which an average density estimate was derived. 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 data. The most appropriate density estimate (0.00005 animals/km^2 for this offshore site is derived from the most offshore survey sites in the eastern North Pacific (Ferguson and Barlow, 2003).

- Risso's dolphin: Miyashita (1993) reports a western North Pacific stock estimate (83,289 animals CV=0.179) and density estimate (0.0097 animals/km^2) derived for the Pacific coast of Japan. Due to the offshore nature of this site, the most appropriate density estimate (0.0010 animals/km^2) was derived from offshore survey sites in the eastern North Pacific (Ferguson and Barlow, 2003) and is of the same magnitude as estimates for the Pacific coast of Japan and the Hawaii EEZ (Barlow, 2006).

- Common dolphin, short-beaked: There are no data on density or stock estimates in the western Pacific (Miyashita, 1993). Common dolphins are a gregarious species, not unusual to find associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and are found in waters of temperature 10-28° C (50-82.4°F). This species is very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on stock or density estimates for the western North Pacific, the data from the ETP, with a derive density estimate of 0.0863 animals/km^2 and an abundance of 3,286,163 animals (Ferguson and Barlow, 2001, 2003). are appropriate for use at this site.

- Bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 animals CV=0.261) and density estimate off the Pacific coast of Japan (0.0171 animals/km^2). Due to the offshore nature of this site, the most appropriate density estimate (0.0005 animals/km^2) was derived from offshore survey sites in the eastern North Pacific (Ferguson and Barlow, 2003) and is a magnitude lower than that of the Pacific coast of Japan. This is comparable to the density estimate around Guam and the Mariana Islands (0.00021 animals/km^2; DoN, 2007; Fulling et al., 2011).

- Pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. Miyashita (1993) reports an abundance estimate (438,064 animals CV=0.174) and density estimate east of Japan (0.0259 animals/km^2). An offshore density estimate (0.0181 animals/km^2) was derived from the eastern Pacific Ocean (Ferguson and Barlow, 2001, 2003) and is comparable to that of Gilpatrick et al. (1987), the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006), and nearshore Hawaii waters (0.0407 animals/km^2; Mobley et al., 2000).

- Striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for three populations in the area: one south of 30°N, one inshore north of 30°N, and one offshore north of 30°N, east of 145°E. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 animals CV=0.186), and a density estimate for the Pacific coast of Japan (0.0111 animals/km^2). An offshore density estimate (0.050 animals/km^2) was derived from the eastern Pacific Ocean (Ferguson and Barlow, 2001, 2003) and is comparable to that of Miyashita (1993). This is an order of magnitude greater than the density estimates from the Hawaii EEZ (0.00536 animals/km^2; Barlow, 2006), from nearshore Hawaii (0.0016 animals/km^2; Mobley et al., 2000), and from Guam and the Mariana Islands (0.00616 animals/km^2; DoN, 2007; Fulling et al., 2011).

- Spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan. This species is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or stock estimates are available (Miyashita, 1993). Without any data on stock or density estimates for the western North Pacific, it is roughly estimated that estimates (0.00001 animals/km^2 and 1,015,059 animals) from the ETP (Ferguson and Barlow, 2001, 2003) at a similar latitude are appropriate.

- Pacific white-sided dolphin: No data on density or stock estimates are available (Miyashita 1993). A gregarious species, pelagic in nature, these offshore creatures are encountered along or seaward of the 183-m (100-fm) contour. Density (0.0048 animals/km^2) and abundance (67,769 animals) estimates from eastern Pacific waters were used for this area (Ferguson and Barlow, 2001, 2003). No sightings of Pacific white-sided dolphins were reported in Hawaii surveys (Mobley et al., 2000; Barlow, 2006).

- Rough-toothed dolphin: Species distribution is primarily pelagic, in tropical to warm temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales. These animals are reportedly rare off Japan and in the heavily studied ETP. The best available density estimate (0.00029 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of magnitude less than those observed in the Hawaii EEZ (0.00355/km^2; Barlow, 2006) and in nearshore Hawaii waters (0.0017 animals/km^2; Mobley et al., 2000). The best available abundance (145,729) estimate is from eastern Pacific waters (Ferguson and Barlow, 2001, 2003).

- Hawaiian monk seal: Hawaiian monk seals are primarily found on the northwest Hawaiian Islands where they occasionally move among islands and atolls. Monk seals are known to haul out on Kure Atoll, the westernmost atoll in the Northwest Hawaiian Islands (Carretta et al., 2011). There is concern that the monk seals from Kure might forage on the Hancock Banks, northwest of Kure Atoll. During a tagging study, five of 33 monk seals dove to depths between 300 and 500 meters (Parrish et al., 2002). This same study cited Abernathy (1999) who reported that monk seals may travel up to 400 km to forage. The Hancock Banks are approximately 300 km northwest of Kure Atoll, and have a single pinnacle that is shallower than 450 meters. 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 distance, and dive to a depth near their maximum recorded depth to access a small potential foraging area. An abundance estimate of 1,161 animals was used for the stock of Hawaiian monk seals at this site (Carretta et al., 2011). Although no density estimates for the very rare Hawaiian monk seal are available, a density estimate is necessary to compute the potential risk to this species. Thus, a density estimate of 0.00001 animals/km^2 was used in the risk analysis for this species to reflect the very low probability of occurrence in this region.

9. Operational Area #9—Offshore Western North Pacific 10º to 25ºN

- Bryde's whale: Yoshida and Kato (1999) identified 3 stocks of Bryde's whales in the western North Pacific: Solomon Islands/Southeast Asia, East China Sea, and offshore western North Pacific. 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 western North Pacific Bryde's whale stock (IWC, 2009). The best available density estimate (0.00041 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to density estimates from offshore areas of the ETP (0.00003/km^2; Ferguson and Barlow, 2001, 2003) and the Hawaii EEZ (0.00019 animals/km^2; Barlow, 2006).

- Sperm whale: Kasuya and Miyashita's (1988) stock estimate of 102,112 animals for the western North Pacific stock was utilized for this site. 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). 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. Therefore, this site (10° to 25°N) in summer is located in the center of the concentration of southwestern females. Due to the extreme offshore location of this site, the derived density estimate (0.0004 animals/km^2) from Ferguson and Barlow's (2001; 2003) ETP data is the most appropriate. This density is approximately an order of magnitude lower than the Mobley et al. (2000) estimate (0.0010 animals/km^2) and the density estimate (0.00123 animals/km^2) calculated from the winter/spring survey around Guam and Mariana Islands (DoN, 2007; Fulling et al., 2011), while an even greater degree of difference exists in the density (0.00282 animals/km^2) calculated from the summer/fall survey off Hawaii in 2002 (Barlow, 2006).

- *Kogia* spp.: Evans (1987) reported records of *Kogia* spp. off the Japanese coast with primarily an oceanic distribution; they are not believed to be concentrated anywhere. Around the main Hawaiian Islands, Baird (2005) observed *Kogia* spp. on 18 occasions between 2000 and 2003, in mean water depths of 1425 m. *Kogia* spp. were also the most commonly stranded animals (18%) between 1937 and 2002 on the main Hawaiian Islands (Maldini et al., 2005). Summing the abundances of *Kogia* spp. in the geographic strata defined by Ferguson and Barlow (2001), an overall abundance of 350,553 animals is computed in the ETP. At the latitude of this site, only *Kogia breviceps* is expected. Reviewing density estimates calculated in the eastern Pacific Ocean at about 20° N (Ferguson and Barlow, 2003), a density estimate of 0.0009 animals/km^2 was modeled. This 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).

- Cuvier's beaked whale: No density or stock estimate data are available for this region. Considering habitat preferences (e.g., water temperature, bathymetry), it was determined that the best data available are the long-term time series from the ETP (Ferguson and Barlow, 2003): density estimate (0.0017 animals/km^2) and abundance estimate of 90,725 animals. This is comparable to that estimated for the Hawaii EEZ (0.00621 animals/km^2; Barlow, 2006) and the mean predicted density estimate for the ETP (0.00455 animals/km^2; Ferguson et al., 2006b).

- False killer whale: Miyashita (1993) estimated abundance of false killer whales from 34 sighting cruises associated with the Japanese drive fishery (16,668 individuals CV=0.263). He also derived density estimates in 1° latitude by 1° longitude boxes from which an average (0.0021 animals/km^2) was derived for the modeled site. This is within the range of average densities estimated in the eastern North Pacific (0.0045 animals/km^2; Ferguson and Barlow, 2001, 2003).

- 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, a density estimate was used from the Hawaii EEZ (0.0012 animals/km^2; Barlow, 2006), 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 (DoN, 2007; Fulling et al., 2011). An abundance estimate of 36,770 (Ferguson and Barlow, 2003) was used.

- Short-finned pilot whale: Miyashita (1993) estimated abundance of short-finned pilot whales from 34 sighting cruises associated with the Japanese drive fishery (53,608 animals CV=0.224). He also derived density estimates in 1° latitude by 1° longitude boxes, from which an average density estimate was derived. 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 data. The most appropriate density estimate for this offshore site is derived from the most offshore survey sites in the eastern North Pacific (0.0009 animals/km^2; Ferguson and Barlow, 2003).

- Risso's dolphin: Miyashita (1993) reports a western North Pacific stock estimate (83,289 animals CV=0.179) and density estimate (0.0097 animals/km^2) derived for the Pacific coast of Japan. Due to the offshore nature of this site, the most appropriate density estimate (0.0026 animals/km^2) was

derived from offshore survey sites in the eastern North Pacific (Ferguson and Barlow, 2003) and is comparable to densities off Hawaii (0.0010 animals/km^2; Barlow, 2006).

- Common dolphin, short-beaked: There are no data on density or stock estimates in the western Pacific (Miyashita, 1993). Common dolphins are a gregarious species, not unusual to find associated with Pacific white-sided dolphins in eastern North Pacific feeding grounds. They are pelagic, offshore creatures encountered along or seaward of the 183-m (100-fm) contour, and are found in waters of temperature 10-28°C (50-82.4°F). This species is very widely distributed, occurring in all oceans to the limits of tropical and warm temperate waters (Leatherwood and Reeves, 1983). Without any data on stock or density estimates for the western North Pacific, the data from the ETP, with a derive density estimate of 0.0863 animals/km^2 and an abundance of 3,286,163 animals (Ferguson and Barlow, 2001, 2003). are appropriate for use at this site.

- Bottlenose dolphin: Miyashita (1993) reports an abundance estimate (168,791 animals CV=0.261) and density estimate off the Pacific coast of Japan (0.0171 animals/km^2). Due to the offshore nature of this site, the most appropriate density estimate (0.0007 animals/km^2) was derived from offshore survey sites in the eastern North Pacific (Ferguson and Barlow, 2003) and is a magnitude lower than that of the Pacific coast of Japan. This is comparable to the density estimate around Guam and the Mariana Islands (0.00021 animals/km^2; DoN, 2007; Fulling et al., 2011).

- Pantropical spotted dolphin: Gilpatrick et al. (1987) cited a known distribution of pantropical spotted dolphins east of Japan. Miyashita (1993) reports an abundance estimate (438,064 animals CV=0.174) and density estimate east of Japan (0.0259 animals/km^2). The best available density estimate (0.00226 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00366 animals/km^2; Barlow, 2006) and an order of magnitude less than that observed in nearshore waters of Hawaii (0.0407 animals/km^2; (Mobley et al., 2000).

- Striped dolphin: Two concentrations exist in the western North Pacific, one south of 30°N and the other in the offshore waters north of 30°N. There is the potential for one population in the area: one south of 30°N. However, the boundaries between these populations have not been resolved (Miyashita, 1993). Therefore, Miyashita (1993) derived a total population estimate of 570,038 animals (CV=0.186), and a density estimate for the Pacific coast of Japan of 0.0111 animals/km^2. An offshore density estimate (0.011 animals/km^2) was derived from the eastern Pacific Ocean (Ferguson and Barlow, 2001, 2003) and is the same as that of Miyashita (1993). This is an order of magnitude greater than the density estimates from nearshore Hawaii (0.0016/km^2; Mobley et al., 2000), and 5 times greater than the Hawaii EEZ (0.00536/km^2; Barlow, 2006) and Guam and the Mariana Islands (0.00616/km^2; DoN, 2007; Fulling et al., 2011).

- Spinner dolphin: Gilpatrick et al. (1987) did not report any sightings from the Pacific coast of Japan. This species is not mentioned in historical Japanese whaling records (Kishiro and Kasuya, 1993), and no data on density or stock estimates are available (Miyashita, 1993). The best available density estimate (0.00314 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is comparable to that observed in the Hawaii EEZ (0.00137 animals/km^2; Barlow, 2006) and an order 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 is for spinner dolphins (1,015,059 animals) from the ETP (Ferguson and Barlow, 2003).

- Rough-toothed dolphin: Species distribution is primarily pelagic, in tropical to warm temperate waters. Rough-toothed dolphins are seen from time to time with bottlenose dolphins and short-finned pilot whales. These animals are reportedly rare off Japan and in the heavily studied ETP. The best available density estimate (0.00029 animals/km^2) is calculated from the winter/spring survey around Guam and the Mariana Islands (DoN, 2007; Fulling et al., 2011). This is an order of magnitude less than 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). The best available abundance estimate (145,729 animals) is from eastern Pacific waters (Ferguson and Barlow, 2001, 2003).

10. Operational Area #10—Hawaii Offshore North

The waters around the Main Hawaiian Islands (MHI) have been systematically surveyed as part of the Acoustic Thermometry of Ocean Climate Marine Mammal Research Program (ATOC MMRP) during the peak humpback season (mid-Feb through mid-April) (Mobley, 2006). The aerial surveys were designed to assess the distribution and abundance of marine mammals and sea turtles within approximately 25 nautical miles (nm) of the MHI, in order to assess the potential effects of the ATOC transmissions. The first systematic shipboard survey of the Hawaii EEZ was conducted from August to November 2002 (Barlow, 2006). Because of the spatial and temporal characteristics of these surveys, the knowledge of marine mammals around the Hawaiian Islands is growing, but still relatively limited, particularly for mysticete whales that migrate seasonally to offshore waters. Much more extensive survey work has been conducted in the ETP (Ferguson and Barlow, 2001, 2003; Ferguson et al., 2006a; Ferguson et al., 2006b), but it is not known whether these animals are part of the same population that occurs around the Hawaiian Islands.

- Blue whale: One of two U.S. stocks of blue whales in the North Pacific, the central North Pacific stock of blue whales includes whales found around the Hawaiian Islands during winter (Carretta et al., 2011). Blue whales occur rarely in the central North Pacific, with few sightings and acoustic detections having been made (Carretta et al., 2011). Four sightings of blue whales around Hawaii have been reported by observers on Hawaii-based longline fishing vessels in recent years (Carretta et al., 2011). Further evidence of their occurrence in the area exists in acoustic recordings. Stafford et al. (2001) show 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 northwest Pacific calls dominating during the winter and northeast Pacific calls dominating during the summer. Other papers on acoustic censusing of blue whales in eastern North Pacific are Moore et al. (1997) and Stafford et al. (1999). Since data are so limited for the blue whale occurrences around Hawaii, no density or abundances have been estimated for this stock. Thus, the density estimate (0.0002 animals/km^2; Ferguson and Barlow, 2001, 2003) and stock abundance (9,250 animals; Tillman, 1977) are considered the optimal data for use in this area's analysis.

- Fin whale: A Hawaiian stock is recognized (Carretta et al., 2011). There has been acoustic evidence for presence in fall and winter (Moore et al., 1998; Thompson and Friedl, 1982) and one sighting in nearshore waters (February) (Mobley et al., 1996). From the five sightings reported during the 2002 summer/fall survey (Barlow, 2003; 2006), a density estimate (0.0001 animals/km^2) and abundance estimate (174 animals (CV=0.72)) were calculated for the Hawaii stock (Carretta et al., 2011). These estimates are conservative because McDonald and Fox (1999) 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–a value an order of magnitude less than what was modeled. The seasonal maximum calling whale density was about three times the average, or 0.081 animals/1000 km^2 (McDonald and Fox, 1999), comparable to the modeled density. Fin whale call densities recorded by McDonald and Fox (1999) were variable, and depending on the chosen methodology and parameters, the call density ranged from 0.011 animals/1,000 km^2 to 0.106 animals/1000 km^2.

- Bryde's whale: The best available density (0.00019 animals/km^2) and abundance (469, animals CV=0.45) estimates are those calculated for the summer/fall surveys in the Hawaii EEZ (Barlow, 2006).

- Minke whale: They are not abundant anywhere in the Pacific except in the Bering and Chukchi seas and in the Gulf of Alaska. IWC identifies three Pacific stocks: Sea of Japan/East China Sea, western Pacific west of 180°, and one east of 180°. A Hawaii stock is recognized that occurs seasonally (November-March) in Hawaiian waters, though no estimate of abundance has been calculated (Carretta et al., 2011). Minke whales were observed and acoustically detected during the 2002 summer/fall survey of the Hawaiian EEZ (Barlow, 2006). A year-long analysis of acoustic recordings made at Station ALOHA (A Long-term Oligotrophic Habitat Assessment) 100 km 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). The best estimate of abundance (25,049 animals) is 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) is from the eastern North Pacific (Ferguson and Barlow, 2001, 2003).

- Humpback whale: Central North Pacific stock identified as individuals that migrate from summer/fall feeding grounds off northern British Columbia and southeast Alaska (Prince William Sound west to Kodiak), to winter/spring breeding and calving grounds off the Hawaiian Islands (Carretta et al., 2011). 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 central North Pacific 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 area during summer. A density estimate of 0.0000 animals/km^2 was derived based on the available data.
- Sperm whale: Sperm whales occur in the deep waters of the Hawaiian Islands. The best available density (0.00282 animals/km^2) and abundance (6,919, CV=0.81) estimates for this site were calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to near-shore Hawaiian waters (0.0010 animals/km^2; Mobley et al., 2000).
- *Kogia* spp.: Hawaii stocks of pygmy and dwarf sperm whales are recognized (Carretta et al., 2011). Mobley et al. (2000) saw 2 pods for a total of 5 individuals during his 1993-1998 survey efforts. No density or abundance estimates were derived. The best available estimates are combined pygmy and dwarf sperm whale density (0.01005 animals/km^2) and abundance (24,657 animals; CV=1.86), calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006).
- Cuvier's beaked whale: The best available density estimate (0.00621 animals/km^2) and abundance estimate (15242 individuals, CV=1.43) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude larger than the density estimate in nearshore Hawaiian waters (0.0008 animals/km^2; Mobley et al., 2000).
- Blainville's beaked whale: The best available density estimate (0.00117 animals/km^2) and abundance estimate (2,872 animals, CV=1.25) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0012 animals/km^2; Mobley et al., 2000).
- Longman's beaked whale: Longman's beaked whale has only recently been identified to species (Dalebout et al., 2003; Pitman et al. ,1999). It is considered one of the rarest and least known cetacean species. The best available density estimate (0.0004 animals/km^2) and abundance estimate (1,007 animals, CV=1.26) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). No other density estimates exist for this species around Hawaii (Mobley et al., 2000).
- Killer whale: Killer whales are considered rare in Hawaii waters with limited sightings being reported (Carretta et al., 2011). The best available density estimate (0.0001 animals/km^2) and abundance estimate (349 animals, CV=0.98) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). Mobley et al. (2000) did not report any sightings in their surveys of waters within 25 nm of the Main Hawaiian Islands.
- False killer whale, Hawaii pelagic stock: There are currently four Pacific Islands Region management stocks of false killer whales (Carretta et al., 2011): the Hawaii insular stock, including animals within 140 km (approximately 75 nm) of the main Hawaiian Islands; the Hawaii pelagic stock, including animals greater than 44 km (approximately 22 nm) of the main Hawaiian Islands; the Palmyra Atoll stock, including animals within the U.S. EEZ of Palmyra Atoll; and the American Samoa stock, including animals within the U.S. EEZ of American Samoa. The best available density estimate (0.00020 animals/km^2) and abundance estimate (484 animals, CV=0.93) for the Hawaii pelagic stock are calculated from the 2002 and 2005 summer/fall surveys in the Hawaii EEZ (Barlow and Rankin, 2007). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0017

animals/km^2; Mobley et al., 2000) and the Palmyra EEZ (0.0038 animals/km^2; Barlow and Rankin, 2007).

- False killer whale, Hawaii insular stock: There are currently four Pacific Islands Region management stocks of false killer whales (Carretta et al., 2011): the Hawaii insular stock, including animals within 140 km (approximately 75 nm) of the main Hawaiian Islands; the Hawaii pelagic stock, including animals greater than 44 km (approximately 22 nm) of the main Hawaiian Islands; the Palmyra Atoll stock, including animals within the U.S. EEZ of Palmyra Atoll; and the American Samoa stock, including animals within the U.S. EEZ of American Samoa. The best available density estimate (0.00020 animals/km^2) and abundance estimate (123 animals, CV=0.93) for the Hawaii insular stock are calculated from the 2002 and 2005 summer/fall surveys in the Hawaii EEZ (Barlow and Rankin, 2007). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000) and the Palmyra EEZ (0.0038 animals/km^2; Barlow and Rankin, 2007).
- 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 waters within 25 nm of the Main Hawaiian Islands. Two sightings were reported during the summer/fall survey in the Hawaii EEZ, resulting in the best available density estimate (0.0004 animals/km^2) and abundance estimate (956 animals, CV=0.83) (Barlow, 2006).
- Melon-headed whale: The best available density estimate (0.0012 animals/km^2) and abundance estimate (2950 whales, CV=1.17) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0021 animals/km^2; Mobley et al., 2000). Recent studies of photo-identification data using mark-recapture techniques suggests there are two populations, a localized resident population around the northwest corner of the island of Hawaii and a larger population (5,794 animals CV = 0.20) distributed throughout the Main Hawaiian Islands (Aschettino, 2010; Baird et al., 2010).
- Short-finned pilot whale: The best available density estimate (0.00362 animals/km^2) and abundance estimate (8870 animals, CV=1.13) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than near-shore Hawaiian waters (0.0237 animals/km^2; Mobley et al., 2000).
- Risso's dolphin: The best available density estimate (0.00097 animals/km^2) and abundance estimate (2372 animals, CV=0.65) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). There were not enough sightings to derive density or abundance estimates in nearshore waters (Mobley et al., 2000). A Hawaii stock is recognized, though they appear to be rare in the area (Carretta et al., 2011). "Based on the locations of interactions with the Hawaiian longline fishery, it is likely that Risso's dolphins primarily occur in pelagic waters tens to hundreds of miles from the main Hawaiian Islands and are only occasionally found nearshore" (Carretta et al., 2011).
- Fraser's dolphin: Fraser's dolphin were first documented in Hawaii waters during a recent summer/fall survey (Barlow, 2006), resulting in the best available density estimate (0.0042 animals/km^2) and abundance estimate (10,226 animals, CV=1.16).
- Bottlenose dolphin, Hawaii pelagic stock: 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., 2011). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath. The best available density estimate (0.00131 animals/km^2) and abundance estimate (3215 animals, CV=0.59) for the pelagic stock are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0103 animals/km^2; Mobley et al., 2000).
- Bottlenose dolphin, Kauai/Niihau stock: 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., 2011). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath. Because of the offshore location of this modeling site, only the more northerly insular stock of Kauai/Niihau is potentially affected. The best available density estimate (0.00131 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The best available abundance estimate (147 animals, CV=0.11) for the Kauai/Niihau stock is calculated from photo-id studies around Kauai and Niihau (Baird et al., 2009). 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).

- Pantropical spotted dolphin: The best available density estimate (0.00366 animals/km^2) and abundance estimate (8978 animals, CV=0.48) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than near-shore Hawaiian waters (0.0407 animals/km^2; Mobley et al., 2000).

- Striped dolphin: The best available density estimate (0.00536 animals/km^2) and abundance estimate (13,143 individuals; CV=0.46) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0016 animals/km^2; Mobley et al., 2000).

- Spinner dolphin: The best available density estimate (0.00137 animals/km^2) and abundance estimate (3351 animals, CV=0.74) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0443 animals/km^2; Mobley et al., 2000).

- Rough-toothed dolphin: The best available density estimate (0.00355 animals/km^2) and abundance estimate (8709 animals, CV=0.45) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000).

- Hawaiian monk seal: Mobley et al. (1999) reported only one sighting of a Hawaiian monk seal during his aerial surveys, but his surveys were not properly designed to focus on monk seal counts. Monk seals primarily occur on the Northwest Hawaiian Islands (NWHI), though a respectable population is beginning to establish itself on Niihau and Kauai, with 113 individuals observed throughout the MHI in 2008 (Carretta et al., 2011). Small amount of interaction between subpopulations, and foraging behavior suggest offshore movement patterns (Parrish et al., 2000; Parrish et al., 2002). An abundance estimate of 1,161 animals was used for the stock of Hawaiian monk seals at this site (Carretta et al., 2011). Although no density for the 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. Operational Area #11—Hawaii Offshore South

- Blue whale: One of two U.S. stocks of blue whales in the North Pacific, the central North Pacific stock of blue whales includes whales found around the Hawaiian Islands during winter (Carretta et al., 2011). Blue whales occur rarely in the central North Pacific, with few sightings and acoustic detections having been made (Carretta et al., 2011). Four sightings of blue whales around Hawaii have been reported by observers on Hawaii-based longline fishing vessels in recent years (Carretta et al., 2011). Further evidence of their occurrence in the area exists in acoustic recordings. Stafford et al. (2001) show 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 northwest Pacific calls dominating during the winter and northeast Pacific calls dominating during the summer. Other papers on acoustic censusing of blue whales in eastern North Pacific are Moore et al. (1997) and Stafford et al. (1999). Since data are so limited for the blue whale occurrences around Hawaii, no density or abundances have been estimated for this stock. Thus, the density estimate (0.0002 animals/km^2; Ferguson and Barlow, 2001, 2003) and stock abundance (9,250 animals; Tillman, 1977) are considered the optimal data for use in this area's analysis.

- Fin whale: A Hawaiian stock is recognized (Carretta et al., 2011). There has been acoustic evidence for presence in fall and winter (Moore et al., 1998; Thompson and Friedl, 1982) and one sighting in

nearshore waters (February) (Mobley et al., 1996). From the five sightings reported during the 2002 summer/fall survey (Barlow, 2003; 2006), a density estimate (0.0001 animals/km^2) and abundance estimate (174 animals (CV=0.72)) were calculated for the Hawaii stock (Carretta et al., 2011). These estimates are conservative because McDonald and Fox (1999) 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–a value an order of magnitude less than what was modeled. The seasonal maximum calling whale density was about three times the average, or 0.081 animals/1000 km^2 (McDonald and Fox, 1999), comparable to the modeled density. Fin whale call densities recorded by McDonald and Fox (1999) were variable, and depending on the chosen methodology and parameters, the call density ranged from 0.011 animals/1,000 km^2 to 0.106 animals/1000 km^2.

- Bryde's whale: The best available density (0.00019 animals/km^2) and abundance (469, animals CV=0.45) estimates are those calculated for the summer/fall surveys in the Hawaii EEZ (Barlow, 2006).
- Minke whale: They are not abundant anywhere in the Pacific except in the Bering and Chukchi seas and in the Gulf of Alaska. IWC identifies three Pacific stocks: Sea of Japan/East China Sea, western Pacific west of 180°, and one east of 180°. A Hawaii stock is recognized that occurs seasonally (November-March) in Hawaiian waters, though no estimate of abundance has been calculated (Carretta et al., 2011). Minke whales were observed and acoustically detected during the 2002 summer/fall survey of the Hawaiian EEZ (Barlow, 2006). A year-long analysis of acoustic recordings made at Station ALOHA (A Long-term Oligotrophic Habitat Assessment) 100 km 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). The best estimate of abundance (25,049 animals) is 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) is from the eastern North Pacific (Ferguson and Barlow, 2001, 2003).
- Humpback whale: Central North Pacific stock identified as individuals that migrate from summer/fall feeding grounds off northern British Columbia and southeast Alaska (Prince William Sound west to Kodiak), to winter/spring breeding and calving grounds off the Hawaiian Islands (Carretta et al., 2011). 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 central North Pacific 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 area during summer. A density estimate of 0.0000 animals/km^2 was derived based on the available data.
- Sperm whale: Sperm whales occur in the deep waters of the Hawaiian Islands. The best available density (0.00282 animals/km^2) and abundance (6,919, CV=0.81) estimates for this site were calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to near-shore Hawaiian waters (0.0010 animals/km^2; Mobley et al., 2000).
- *Kogia* spp.: Hawaii stocks of pygmy and dwarf sperm whales are recognized (Carretta et al., 2011). Mobley et al. (2000) saw 2 pods for a total of 5 individuals during his 1993-1998 survey efforts. No density or abundance estimates were derived. The best available estimates are combined pygmy and dwarf sperm whale density (0.01005 animals/km^2) and abundance (24,657 animals; CV=1.86), calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006).
- Cuvier's beaked whale: The best available density estimate (0.00621 animals/km^2) and abundance estimate (15242 individuals, CV=1.43) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude larger than the density estimate in nearshore Hawaiian waters (0.0008 animals/km^2; Mobley et al., 2000).

- Blainville's beaked whale: The best available density estimate (0.00117 animals/km^2) and abundance estimate (2,872 animals, CV=1.25) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0012 animals/km^2; Mobley et al., 2000).
- Longman's beaked whale: Longman's beaked whale has only recently been identified to species (Dalebout et al., 2003; Pitman et al. ,1999). It is considered one of the rarest and least known cetacean species. The best available density estimate (0.0004 animals/km^2) and abundance estimate (1,007 animals, CV=1.26) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). No other density estimates exist for this species around Hawaii (Mobley et al., 2000).
- Killer whale: Killer whales are considered rare in Hawaii waters with limited sightings being reported (Carretta et al., 2011). The best available density estimate (0.0001 animals/km^2) and abundance estimate (349 animals, CV=0.98) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). Mobley et al. (2000) did not report any sightings in their surveys of waters within 25 nm of the Main Hawaiian Islands.
- False killer whale, Hawaii pelagic stock: There are currently four Pacific Islands Region management stocks of false killer whales (Carretta et al., 2011): the Hawaii insular stock, including animals within 140 km (approximately 75 nm) of the main Hawaiian Islands; the Hawaii pelagic stock, including animals greater than 44 km (approximately 22 nm) of the main Hawaiian Islands; the Palmyra Atoll stock, including animals within the U.S. EEZ of Palmyra Atoll; and the American Samoa stock, including animals within the U.S. EEZ of American Samoa. The best available density estimate (0.00020 animals/km^2) and abundance estimate (484 animals, CV=0.93) for the Hawaii pelagic stock are calculated from the 2002 and 2005 summer/fall surveys in the Hawaii EEZ (Barlow and Rankin, 2007). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000) and the Palmyra EEZ (0.0038 animals/km^2; Barlow and Rankin, 2007).
- False killer whale, Hawaii insular stock: There are currently four Pacific Islands Region management stocks of false killer whales (Carretta et al., 2011): the Hawaii insular stock, including animals within 140 km (approximately 75 nm) of the main Hawaiian Islands; the Hawaii pelagic stock, including animals greater than 44 km (approximately 22 nm) of the main Hawaiian Islands; the Palmyra Atoll stock, including animals within the U.S. EEZ of Palmyra Atoll; and the American Samoa stock, including animals within the U.S. EEZ of American Samoa. The best available density estimate (0.00020 animals/km^2) and abundance estimate (123 animals, CV=0.93) for the Hawaii insular stock are calculated from the 2002 and 2005 summer/fall surveys in the Hawaii EEZ (Barlow and Rankin, 2007). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000) and the Palmyra EEZ (0.0038 animals/km^2; Barlow and Rankin, 2007).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 waters within 25 nm of the Main Hawaiian Islands. Two sightings were reported during the summer/fall survey in the Hawaii EEZ, resulting in the best available density estimate (0.0004 animals/km^2) and abundance estimate (956 animals, CV=0.83) (Barlow, 2006).
- Melon-headed whale: The best available density estimate (0.0012 animals/km^2) and abundance estimate (2950 whales, CV=1.17) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0021 animals/km^2; Mobley et al., 2000). Recent studies of photo-identification data using mark-recapture techniques suggests there are two populations, a localized resident population around the northwest corner of the island of Hawaii and a larger population (5,794 animals CV = 0.20) distributed throughout the Main Hawaiian Islands (Aschettino, 2010; Baird et al., 2010).
- Short-finned pilot whale: The best available density estimate (0.00362 animals/km^2) and abundance estimate (8870 animals, CV=1.13) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than near-shore Hawaiian waters (0.0237 animals/km^2; Mobley et al., 2000).

- Risso's dolphin: The best available density estimate (0.00097 animals/km^2) and abundance estimate (2372 animals, CV=0.65) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). There were not enough sightings to derive density or abundance estimates in nearshore waters (Mobley et al., 2000). A Hawaii stock is recognized, though they appear to be rare in the area (Carretta et al., 2011). "Based on the locations of interactions with the Hawaiian longline fishery, it is likely that Risso's dolphins primarily occur in pelagic waters tens to hundreds of miles from the main Hawaiian Islands and are only occasionally found nearshore" (Carretta et al., 2011).

- Fraser's dolphin: Fraser's dolphin were first documented in Hawaii waters during a recent summer/fall survey (Barlow, 2006), resulting in the best available density estimate (0.0042 animals/km^2) and abundance estimate (10,226 animals, CV=1.16).

- Bottlenose dolphin, Hawaii pelagic stock: 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., 2011). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath. The best available density estimate (0.00131 animals/km^2) and abundance estimate (3215 animals, CV=0.59) for the pelagic stock are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0103 animals/km^2; Mobley et al., 2000).

- Bottlenose dolphin, Oahu stock: 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., 2011). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath. Because of the offshore location of this modeling site, only the more southerly insular stocks of Oahu, 4-Islands Region, and Hawaii Island are potentially affected. The best available density estimate (0.00131 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The best available abundance estimate (594 animals, CV=0.54) for the Oahu stock is calculated from photo-id studies (Baird et al., 2009). 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).Bottlenose dolphin, 4-Islands Region stock: 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., 2011). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath. Because of the offshore location of this modeling site, only the more southerly insular stocks of Oahu, 4-Islands Region, and Hawaii Island are potentially affected. The best available density estimate (0.00131 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The best available abundance estimate (153 animals, CV=0.24) for the 4-Islands Region stock is calculated from photo-id studies (Baird et al., 2009). 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).

- Bottlenose dolphin, Hawaii Island stock: 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., 2011). The boundary between the insular stocks and the pelagic stock is the 1,000-m (3,281-ft) isobath. Because of the offshore location of this modeling site, only the more southerly insular stocks of Oahu, 4-Islands Region, and Hawaii Island are potentially affected. The best available density estimate (0.00131 animals/km^2) is calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The best available abundance estimate (102 animals, CV=0.13) for the Hawaii Island stock is calculated from photo-id studies (Baird et al., 2009). 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).

- Pantropical spotted dolphin: The best available density estimate (0.00366 animals/km^2) and abundance estimate (8978 animals, CV=0.48) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than near-shore Hawaiian waters (0.0407 animals/km^2; Mobley et al., 2000).
- Striped dolphin: The best available density estimate (0.00536 animals/km^2) and abundance estimate (13,143 individuals; CV=0.46) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0016 animals/km^2; Mobley et al., 2000).
- Spinner dolphin: The best available density estimate (0.00137 animals/km^2) and abundance estimate (3351 animals, CV=0.74) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is an order of magnitude less than nearshore Hawaiian waters (0.0443 animals/km^2; Mobley et al., 2000).
- Rough-toothed dolphin: The best available density estimate (0.00355 animals/km^2) and abundance estimate (8709 animals, CV=0.45) are calculated from the summer/fall survey in the Hawaii EEZ (Barlow, 2006). The density estimate is comparable to nearshore Hawaiian waters (0.0017 animals/km^2; Mobley et al., 2000).
- Hawaiian monk seal: Mobley et al. (1999) reported only one sighting of a Hawaiian monk seal during his aerial surveys, but his surveys were not properly designed to focus on monk seal counts. Monk seals primarily occur on the Northwest Hawaiian Islands (NWHI), though a respectable population is beginning to establish itself on Niihau and Kauai, with 113 individuals observed throughout the MHI in 2008 (Carretta et al., 2011). Small amount of interaction between subpopulations, and foraging behavior suggest offshore movement patterns (Parrish et al., 2000; Parrish et al., 2002). An abundance estimate of 1,161 animals was used for the stock of Hawaiian monk seals at this site (Carretta et al., 2011). Although no density for the 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.

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Enclosure (2)
Estimates of Potential Effects to Marine Mammal Stocks for Initial Year LOAs for the Northwestern Pacific Ocean and Hawaii Operational Areas

East of Japan—Operational Area 1 1 Mission						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB [1]**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Blue whale	CNP	9250	0.02	2	0.00	0
Fin whale	WNP	9250	0.02	2	0.00	0
Sei whale	NP	8600	0.07	7	0.00	0
Bryde's whale	WNP	20501	0.03	7	0.00	0
Minke whale	WNP "O" Stock	25049	0.06	16	0.00	0
N. Pacific right whale	WNP	922	0.04	1	0.00	0
Sperm whale	NP	102112	0.01	11	0.00	0
Kogia spp	WNP	350553	0.01	36	0.00	0
Baird's beaked whale	WNP	8000	0.26	21	0.00	0
Cuvier's beaked whale	WNP	90725	0.04	37	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.02	5	0.00	0
Hubbs' beaked whale	NP	22799	0.02	5	0.00	0
False killer whale	WNP	16668	0.19	32	0.00	0
Pygmy killer whale	WNP	30214	0.06	19	0.00	0
Short-finned pilot whale	WNP	53608	0.22	118	0.00	0
Risso's dolphin	WNP	83289	0.11	92	0.00	0
Common dolphin	WNP	3286163	0.02	658	0.00	0
Bottlenose dolphin	WNP	168791	0.08	136	0.00	0
Spinner dolphin	WNP	1015059	0.00	0	0.00	0
Pantropical spotted Dolphin	WNP	438064	0.02	88	0.00	0

East of Japan—Operational Area 1 1 Mission (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Striped dolphin	WNP	570038	0.01	57	0.00	0
Rough-toothed dolphin	WNP	145729	0.03	44	0.00	0
Fraser's dolphin	WNP	220789	0.02	45	0.00	0
Pacific white-sided dolphin	WNP	931000	0.01	94	0.00	0

NP—North Pacific Stock

CNP—Central North Pacific Stock

WNP—Western North Pacific Stock

Note 1: All fractional animals potentially affected have been rounded up to the next whole number.

North Philippine Sea—Operational Area 2 3 Missions						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Bryde's whale	WNP	20501	0.10	21	0.00	0
Minke whale	WNP “O” Stock	25049	1.21	304	0.00	0
N. Pacific right whale	WNP	922	0.02	1	0.00	0
Sperm whale	NP	102112	0.14	143	0.00	0
Kogia spp	WNP	350553	0.08	281	0.00	0
Cuvier's beaked whale	WNP	90725	0.16	146	0.00	0
Blainville's beaked whale	WNP	8032	0.17	14	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.06	14	0.00	0
Killer whale	WNP	12256	0.11	14	0.00	0
False killer whale	WNP	16668	0.64	107	0.00	0
Pygmy killer whale	WNP	30214	0.25	76	0.00	0
Melon-headed whale	WNP	36770	0.12	45	0.00	0
Short-finned pilot whale	WNP	53608	1.54	826	0.00	0
Risso's dolphin	WNP	83289	1.00	833	0.00	0
Common dolphin	WNP	3286163	0.05	1644	0.00	0
Bottlenose dolphin	WNP	168791	0.16	271	0.00	0
Spinner dolphin	WNP	1015059	0.00	0	0.00	0

North Philippine Sea—Operational Area 2 3 Missions (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Pantropical spotted dolphin	WNP	438064	0.13	570	0.00	0
Striped dolphin	WNP	570038	0.24	1369	0.00	0
Rough-toothed dolphin	WNP	145729	0.33	481	0.00	0
Fraser's dolphin	WNP	220789	0.12	265	0.00	0
Pacific white-sided dolphin	WNP	931000	0.05	466	0.00	0

NP—North Pacific Stock
WNP—Western North Pacific Stock

West Philippine Sea—Operational Area 3 3 Missions						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected ≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Fin whale	WNP	9250	0.15	14	0.00	0
Bryde's whale	WNP	20501	0.20	42	0.00	0
Minke whale	WNP “O” Stock	25049	0.56	141	0.00	0
Humpback whale (winter only)	WNP	1107	0.11	2	0.00	0
Sperm whale	NP	102112	0.03	31	0.00	0
Kogia spp	WNP	350553	0.03	106	0.00	0
Cuvier's beaked whale	WNP	90725	0.01	10	0.00	0
Blainville's beaked whale	WNP	8032	0.24	20	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.08	19	0.00	0
False killer whale	WNP	16668	0.78	131	0.00	0
Pygmy killer whale	WNP	30214	0.31	94	0.00	0
Melon-headed whale	WNP	36770	0.15	56	0.00	0
Short-finned pilot whale	WNP	53608	0.40	215	0.00	0
Risso's dolphin	WNP	83289	0.69	575	0.00	0
Common dolphin	WNP	3286163	0.10	3287	0.00	0
Bottlenose dolphin	WNP	168791	0.28	473	0.00	0
Spinner dolphin	WNP	1015059	0.00	0	0.00	0
Pantropical spotted dolphin	WNP	438064	0.07	307	0.00	0

West Philippine Sea—Operational Area 3 3 Missions (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected ≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Striped dolphin	WNP	570038	0.06	343	0.00	0
Rough-toothed dolphin	WNP	145729	0.23	336	0.00	0
Fraser's dolphin	WNP	220789	0.09	20	0.00	0
Pacific white-sided dolphin	WNP	931000	0.06	559	0.00	0

NP—North Pacific Stock
WNP—Western North Pacific Stock

Offshore Guam—Operational Area 4 3 Missions						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Blue whale	CNP	9250	0.03	3	0.00	0
Fin whale	WNP	9250	0.11	11	0.00	0
Sei whale	NP	8600	0.10	9	0.00	0
Bryde's whale	WNP	20501	0.06	13	0.00	0
Minke whale	WNP “O” Stock	25049	0.03	8	0.00	0
Humpback whale (winter only)	CNP	10103	5.74	580	0.00	0
Sperm whale	NP	102112	0.03	31	0.00	0
Kogia spp	WNP	350553	0.11	386	0.00	0
Cuvier's beaked whale	WNP	90725	0.21	191	0.00	0
Blainville's beaked whale	WNP	8032	0.44	36	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.07	16	0.00	0
Longman’s beaked whale	CNP	1007	1.23	13	0.00	0
False killer whale	WNP	16668	0.21	36	0.00	0
Pygmy killer whale	WNP	30214	0.01	4	0.00	0
Melon-headed whale	WNP	36770	0.37	137	0.00	0
Killer whale	CNP	349	1.47	6	0.00	0

Offshore Guam—Operational Area 4 3 Missions (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Short-finned pilot whale	WNP	53608	0.10	54	0.00	0
Risso's dolphin	WNP	83289	0.04	34	0.00	0
Common dolphin	WNP	3286163	0.00	0	0.00	0
Bottlenose dolphin	WNP	168791	0.00	0	0.00	0
Spinner dolphin	WNP	1015059	0.01	102	0.00	0
Pantropical spotted dolphin	WNP	438064	0.13	570	0.00	0
Striped dolphin	WNP	570038	0.03	172	0.00	0
Rough-toothed dolphin	WNP	145729	0.01	15	0.00	0
Fraser’s dolphin	CNP	10226	1.24	127	0.00	0

NP—North Pacific Stock
ENP—Eastern North Pacific
WNP—Western North Pacific Stock
CNP—Central North Pacific Stock

Sea of Japan—Operational Area 5 2 Missions						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Fin whale	WNP	9250	0.47	44	0.00	0
Bryde's whale	WNP	20501	0.02	5	0.00	0
Minke whale	WNP “O” Stock	25049	0.06	16	0.00	0
Minke whale	WNP “J” Stock	893	0.65	6	0.00	0
Gray whale	WNP	121	0.00	0	0.00	0
N. Pacific right whale	WNP	922	0.05	1	0.00	0
Sperm whale	NP	102112	0.04	41	0.00	0
Stejneger's beaked whale	WNP	8000	1.00	80	0.00	0
Baird's beaked whale	WNP	8000	0.22	18	0.00	0
Cuvier's beaked whale	WNP	90725	0.27	245	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.13	30	0.00	0
False killer whale	IA	9777	1.64	161	0.00	0
Melon-headed whale	WNP	36770	0.00	0	0.00	0
Short-finned pilot whale	WNP	53608	0.06	33	0.00	0
Risso's dolphin	IA	83289	0.42	350	0.00	0
Common dolphin	WNP	3286163	0.11	3615	0.00	0
Bottlenose dolphin	IA	105138	0.03	32	0.00	0
Spinner dolphin	WNP	1015059	0.00	0	0.00	0

Sea of Japan—Operational Area 5 2 Missions (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Pantropical spotted dolphin	WNP	219032	0.13	285	0.00	0
Pacific white-sided dolphin	IA	931000	0.01	94	0.00	0
Dall's porpoise	SOJ	76720	1.84	1412	0.00	0

NP—North Pacific Stock
WNP—Western North Pacific Stock
IA—Inshore Archipelago Stock
SOJ—Sea of Japan Stock

East China Sea—Operational Area 6 1 Mission						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Fin whale	ECS	500	0.62	4	0.00	0
Bryde's whale	WNP	20501	0.04	9	0.00	0
Minke whale	WNP “O” Stock	25049	0.23	58	0.00	0
Minke J stock	WNP “J” Stock	893	2.62	24	0.00	0
Gray whale (winter only)	WNP	121	0.30	1	0.00	0
N. Pacific right whale	WNP	922	0.04	1	0.00	0
Sperm whale	NP	102112	0.01	11	0.00	0
Kogia spp	WNP	350553	0.01	36	0.00	0
Cuvier's beaked whale	WNP	90725	0.07	64	0.00	0
Blainville's beaked whale	WNP	8032	0.15	13	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.02	5	0.00	0
False killer whale	IA	9777	0.17	17	0.00	0
Pygmy killer whale	WNP	30214	0.01	4	0.00	0
Melon-headed whale	WNP	36770	0.17	63	0.00	0
Short-finned pilot whale	WNP	53608	0.05	27	0.00	0
Risso's dolphin	IA	83289	0.18	150	0.00	0
Common dolphin	WNP	3286163	0.02	658	0.00	0
Bottlenose dolphin	IA	105138	0.10	106	0.00	0
Spinner dolphin	WNP	1015059	0.00	0	0.00	0

East China Sea—Operational Area 6 1 Mission (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Pantropical spotted dolphin	WNP	219032	0.07	154	0.00	0
Striped dolphin	IA	570038	0.03	172	0.00	0
Rough-toothed dolphin	WNP	145729	0.05	73	0.00	0
Fraser's dolphin	WNP	220789	0.03	67	0.00	0
Pacific white-sided dolphin	IA	931000	0.00	0	0.00	0

NP—North Pacific Stock
WNP—Western North Pacific Stock
IA—Inshore Archipelago Stock
ECS—East China Sea Stock

South China Sea—Operational Area 7 1 Mission						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Fin whale	WNP	9250	0.04	4	0.00	0
Bryde's whale	WNP	20501	0.04	9	0.00	0
Minke whale	WNP “O” Stock	25049	0.17	43	0.00	0
Gray whale (winter only)	WNP	121	0.25	1	0.00	0
N Pac Right whale	WNP	922	0.04	1	0.00	0
Sperm whale	NP	102112	0.01	11	0.00	0
Kogia spp	WNP	350553	0.01	36	0.00	0
Cuvier's beaked whale	WNP	90725	0.00	0	0.00	0
Blainville's beaked whale	WNP	8032	0.08	7	0.00	0
Ginkgo-toothed beaked whale	NP	22799	0.03	7	0.00	0
False killer whale	IA	9777	0.19	19	0.00	0
Pygmy killer whale	WNP	30214	0.01	4	0.00	0
Melon-headed whale	WNP	36770	0.19	70	0.00	0
Short-finned pilot whale	WNP	53608	0.04	22	0.00	0
Risso's dolphin	IA	83289	0.21	175	0.00	0
Common dolphin	WNP	3286163	0.02	658	0.00	0
Bottlenose dolphin	IA	105138	0.08	85	0.00	0
Spinner dolphin	WNP	1015059	0.32	3249	0.00	0
Pantropical spotted dolphin	WNP	219032	0.06	132	0.00	0
Striped dolphin	IA	570038	0.03	172	0.00	0

South China Sea—Operational Area 7 1 Mission (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Rough-toothed dolphin	WNP	145729	0.05	73	0.00	0
Fraser's dolphin	WNP	220789	0.03	67	0.00	0

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

Offshore Japan 25-40ºN—Operational Area 8 1 Mission						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Blue whale	CNP	9250	0.11	11	0.00	0
Fin whale	WNP	9250	0.05	5	0.00	0
Sei whale	NP	8600	0.17	15	0.00	0
Bryde's whale	WNP	20501	0.10	21	0.00	0
Minke whale	WNP “O” Stock	25049	0.05	13	0.00	0
Sperm whale	NP	102112	0.01	11	0.00	0
Kogia spp	WNP	350553	0.06	211	0.00	0
Baird's beaked whale	WNP	8000	0.03	3	0.00	0
Cuvier's beaked whale	WNP	90725	0.04	37	0.00	0
Mesoplodon spp	WNP	22799	0.07	16	0.00	0
False killer whale	WNP	16668	0.70	117	0.00	0
Pygmy killer whale	WNP	30214	0.02	7	0.00	0
Melon-headed whale	WNP	36770	0.11	41	0.00	0
Short-finned pilot whale	WNP	53608	0.00	0	0.00	0
Risso's dolphin	WNP	83289	0.04	34	0.00	0
Common dolphin	WNP	3286163	0.11	3615	0.00	0
Bottlenose dolphin	WNP	168791	0.01	17	0.00	0
Spinner dolphin	WNP	1015059	0.00	0	0.00	0
Pantropical spotted dolphin	WNP	438064	0.07	307	0.00	0

Offshore Japan 25-40ºN—Operational Area 8 1 Mission (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Striped dolphin	WNP	570038	0.15	856	0.00	0
Rough-toothed dolphin	WNP	145729	0.01	15	0.00	0
Pacific white-sided dolphin	WNP	67769	0.15	102	0.00	0
Hawaiian monk seal	Hawaii	1161	0.01	1	0.00	0

NP—North Pacific Stock
WNP—Western North Pacific Stock
Hawaii—Hawaii Stock

Offshore Japan 10-25ºN—Operational Area 9 1 Mission						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Bryde's whale	WNP	20501	0.04	9	0.00	0
Sperm whale	NP	102112	0.00	0	0.00	0
Kogia spp	WNP	350553	0.00	0	0.00	0
Cuvier's beaked whale	WNP	90725	0.02	19	0.00	0
False killer whale	WNP	16668	0.20	34	0.00	0
Melon-headed whale	WNP	36770	0.05	19	0.00	0
Short-finned pilot whale	WNP	53608	0.04	22	0.00	0
Risso's dolphin	WNP	83289	0.05	42	0.00	0
Common dolphin	WNP	3286163	0.05	1644	0.00	0
Bottlenose dolphin	WNP	168791	0.01	17	0.00	0
Spinner dolphin	WNP	1015059	0.01	102	0.00	0
Pantropical spotted dolphin	WNP	438064	0.09	395	0.00	0
Striped dolphin	WNP	570038	0.03	172	0.00	0
Rough-toothed dolphin	WNP	145729	0.00	0	0.00	0

NP—North Pacific Stock
WNP—Western North Pacific Stock

Hawaii North—Operational Area 10 2 Missions						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Blue whale	CNP	9250	0.08	8	0.00	0
Fin whale	Hawaii	174	3.22	6	0.00	0
Bryde's whale	Hawaii	469	2.37	12	0.00	0
Minke whale	Hawaii	25049	0.03	8	0.00	0
Humpback whale	Hawaii	10103	0.90	91	0.00	0
Sperm whale	Hawaii	6919	1.05	73	0.00	0
Kogia spp	Hawaii	24657	2.05	506	0.00	0
Cuvier's beaked whale	Hawaii	15242	1.34	205	0.00	0
Blainville's beaked whale	Hawaii	2872	1.34	39	0.00	0
Longman's beaked whale	Hawaii	1007	1.31	14	0.00	0
Killer whale	Hawaii	349	1.57	6	0.00	0
False killer whale	Hawaii Pelagic	484	1.75	9	0.00	0
False killer whale	Hawaii Insular	123	6.89	9	0.00	0
Pygmy killer whale	Hawaii	956	1.77	17	0.00	0
Melon-headed whale	Hawaii	2950	1.72	51	0.00	0
Short-finned pilot whale	Hawaii	8870	0.74	66	0.00	0
Risso's dolphin	Hawaii	2372	1.82	44	0.00	0
Bottlenose dolphin	Hawaii Pelagic	3178	6.05	193	0.00	0
Bottlenose dolphin	Kauai/Niihau	147	0.08	1	0.00	0

Hawaii North—Operational Area 10 2 Missions (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Spinner dolphin	Hawaii	3351	0.47	16	0.00	0
Pantropical spotted dolphin	Hawaii	8978	0.47	43	0.00	0
Striped dolphin	Hawaii	13143	0.47	62	0.00	0
Rough-toothed dolphin	Hawaii	8709	1.88	164	0.00	0
Fraser's dolphin	Hawaii	10226	1.52	156	0.00	0
Hawaiian monk seal	Hawaii	1161	0.28	4	0.00	0

CNP—Central North Pacific Stock
WNP—Western North Pacific Stock
Hawaii—Hawaii Stock

Hawaii South—Operational Area 11 2 Missions						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Blue whale	CNP	9250	0.04	4	0.00	0
Fin whale	Hawaii	174	1.51	3	0.00	0
Bryde's whale	Hawaii	469	1.11	6	0.00	0
Minke whale	Hawaii	25049	0.02	6	0.00	0
Humpback whale	Hawaii	10103	0.00	0	0.00	0
Sperm whale	CNP	6919	0.68	48	0.00	0
Kogia spp	Hawaii	24657	1.04	257	0.00	0
Cuvier's beaked whale	Hawaii	15242	0.80	122	0.00	0
Blainville's beaked whale	Hawaii	2872	0.80	23	0.00	0
Longman's beaked whale	Hawaii	1007	0.78	8	0.00	0
Killer whale	Hawaii	349	0.76	3	0.00	0
False killer whale	Hawaii Pelagic	484	0.93	5	0.00	0
False killer whale	Hawaii Insular	123	3.64	5	0.00	0
Pygmy killer whale	Hawaii	956	0.94	9	0.00	0
Melon-headed whale	Hawaii	2950	0.91	27	0.00	0
Short-finned pilot whale	Hawaii	8870	0.71	63	0.00	0
Risso's dolphin	Hawaii	2372	0.95	23	0.00	0
Bottlenose dolphin	Hawaii Pelagic	3178	0.76	25	0.00	0
Bottlenose dolphin	Oahu	594	0.03	1	0.00	0
Bottlenose dolphin	4-Island	153	0.27	1	0.00	0

Hawaii South—Operational Area 11 2 Missions (Continued)						
Animal	**Stock**	**Number Animals in Stock**	**% Affected120-180 dB**	**Number Animals Affected 120-180 dB**	**% Affected≥ 180 dB**	**Number Animals Affected ≥ 180 dB**
Bottlenose dolphin	Hawaii Island	102	2.32	3	0.00	0
Spinner dolphin	Hawaii	3351	0.59	20	0.00	0
Pantropical spotted dolphin	Hawaii	8978	0.59	53	0.00	0
Striped dolphin	Hawaii	13143	0.59	78	0.00	0
Rough-toothed dolphin	Hawaii	8709	0.99	87	0.00	0
Fraser's dolphin	Hawaii	10226	0.81	83	0.00	0
Hawaiian monk seal	Hawaii	1161	0.20	3	0.00	0

CNP—Central North Pacific Stock
WNP—Western North Pacific Stock
Hawaii—Hawaii Stock