Navy Marine Species Density Database

for the

Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar Systems

Technical Report

September 2024

U.S. Navy Marine Species Density Database for the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar Systems

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ACRONYMS AND ABBREVIATIONS

˚C	degrees Celsius
˚F	degrees Fahrenheit
CI	confidence interval
CNMI	Commonwealth of the Northern Mariana Islands
CV	Coefficient of Variation
DASBR	Drifting Acoustic Spar Buoy Recorder
DPS	Distinct Population Segment
E	East
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
HCTT	Hawaii-California Training and Testing
IWC	International Whaling Commission
km	kilometer(s)
km^2	square kilometer(s)
LFA	Low Frequency Active
m	meter(s)
MITT	Mariana Islands Training and Testing
MMPA	Marine Mammal Protection Act
N	North
Navy	U.S. Department of the Navy
NM	nautical mile(s)
NMFS	National Marine Fisheries Service
NMSDD	Navy Marine Species Density Database
PIFSC	Pacific Islands Fisheries Science Center
RES	Relative Environmental Suitability
S	South
SEIS	Supplemental Environmental Impact Statement
SOEIS	Supplemental Overseas Environmental Impact Statement
SURTASS	Surveillance Towed Array Sensor System
SWFSC	Southwest Fisheries Science Center
U.S.	United States
W	West

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1 INTRODUCTION

1.1 BACKGROUND

The United States (U.S.) Department of the Navy (Navy) uses Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) systems onboard U.S. Navy surveillance ships for training and testing activities conducted under the authority of the Secretary of the Navy in the western and central North Pacific and eastern Indian oceans. A detailed description of SURTASS LFA and associated Navy training and testing activities is provided in the Supplemental Environmental Impact Statement/Supplemental Overseas Environmental Impact Statement (SEIS/SOEIS) for SURTASS LFA Sonar (U.S. Department of the Navy, 2019) and the Draft SEIS/SOEIS that is currently in development (U.S. Department of the Navy, In Prep.).

To ensure compliance with U.S. regulations, including the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the National Environmental Policy Act, and Executive Order 12114 (*Environmental Effects Abroad of Major Federal Actions*), the Navy takes responsibility for reviewing and evaluating the potential environmental impacts of conducting at-sea training and testing. The MMPA provides protection for all marine mammal species, and some species receive additional protection under the ESA. As stipulated by the MMPA and ESA, information on the species and numbers of protected marine species is required to estimate the number of animals that might be affected by a specific activity. The Navy performs quantitative analyses to estimate the number of marine mammals that could be affected by at-sea training and testing activities. A key element of this quantitative impact analysis is knowledge of the abundance (number of animals) of the species in specific areas where those activities would occur. The most appropriate unit of metric for this type of analysis is density, which is the number of animals present per unit area (typically expressed as the number of animals per square kilometer [km^2]).

The purpose of the Navy's Marine Species Density Database (NMSDD) Technical Report is to document the best available sources of density data for marine mammal species occurring in the western and central North Pacific and eastern Indian ocean areas where the SURTASS LFA systems are operated, and to provide a summary of species-specific and area-specific density estimates incorporated into the NMSDD. Fifteen representative modeling sites covering the spatial extent of the study area have been selected to provide representative regional coverage (Figure 1.1-1). Three of the SURTASS modeling sites overlap the Navy's "Phase IV" study areas (i.e., the fourth implementation of the Navy's at-sea environmental planning process, which consists of a comprehensive, integrated process to preserve access to and use of Navy at-sea training ranges, testing ranges, and operating areas by addressing encroachment and environmental compliance issues). Two of the SURTASS modeling sites (10 and 11) overlap the Hawaii portion of the Navy's Hawaii-California Training and Testing (HCTT) Phase IV Study Area, and SURTASS modeling site #4 is encompassed within the Navy's Mariana Islands Training and Testing (MITT) Phase IV Study Area (Figure 1.1-1). Marine mammal density estimates used for the recent Phase IV HCTT (U.S. Department of the Navy, 2024) and MITT (U.S. Department of the Navy, *In Prep*.) environmental planning analyses were also used for these three SURTASS modeling sites as they represent the best available density data for these regions.

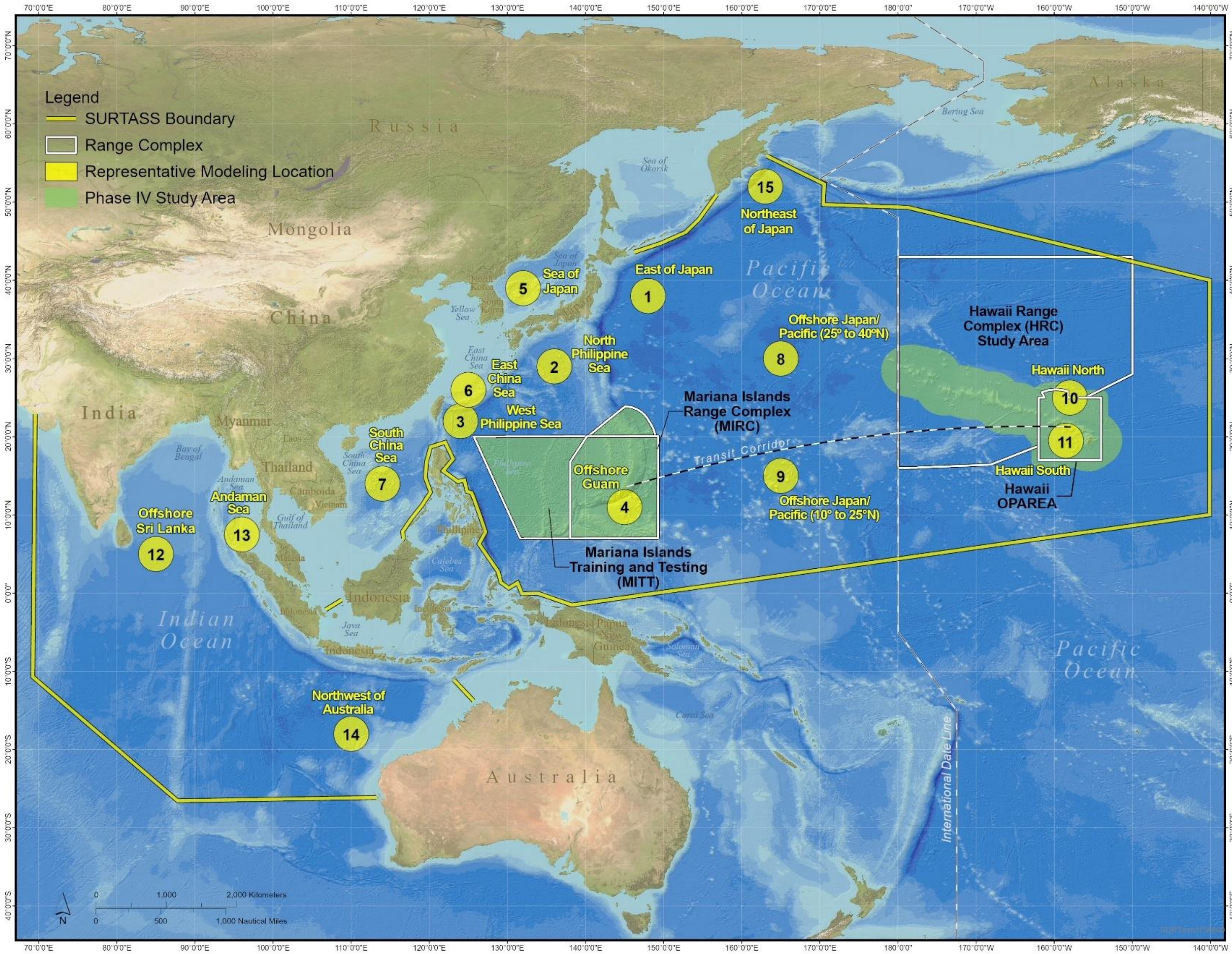


Figure 1.1-1: Study Area for SURTASS LFA Sonar in the Western and Central North Pacific and Eastern Indian Oceans, Including the 15 Modeling Sites

For most cetacean species, abundance is estimated using line-transect analyses (Barlow, 2016; Barlow & Forney, 2007; Bradford et al., 2021); mark-recapture studies (Calambokidis et al., 2008); or more recently, habitat-based density models or species distribution models (Becker et al., 2020; Becker et al., 2016; Becker et al., 2022a; Becker et al., 2018; Forney et al., 2015). Species distribution models estimate cetacean density as a continuous function of habitat variables (e.g., sea surface temperature, water depth), allowing density estimates to be made on finer spatial and temporal scales that are more useful for impact assessments. The methods used to estimate pinniped at-sea densities are typically different than those used for cetaceans, because pinnipeds are not limited to the water and spend a significant amount of time on land (e.g., during breeding). Pinniped abundance is generally estimated via shore counts of animals on land at known haul-out sites or by counting the number of pups weaned at rookeries and applying a correction factor to estimate the abundance of the population. With the Navy's analysis focused on in-water acoustic impacts, an in-water abundance for pinniped species must be inferred from the shore-based abundance when actual in-water survey data are not available. To calculate an in-water density, the species' region-specific abundance is calculated and divided by a defined distribution area.

For all marine mammals, a significant amount of effort is required to collect and analyze data to produce a density estimate. The Navy has been a leader in funding research aimed specifically at increasing our understanding of marine mammal species density and distribution patterns, including supporting systematic surveys, tagging and acoustic studies, and improvements to methods used to derive density estimates. Ideally, density data would be available for all marine species throughout all the Navy's study areas year round, in order to best estimate the potential impacts of Navy activities. However, there is no single source of density data for every area, species, and season because of the fiscal costs, resources, and effort involved in providing enough survey coverage to sufficiently estimate density.

Unfortunately, the majority of the world's oceans have not been surveyed in a manner that supports the derivation of quantitative marine mammal density estimates (Kaschner et al., 2012). In the absence of survey data, information on species occurrence and known or inferred habitat associations have been used to predict densities using model-based approaches. These habitat suitability models include Relative Environmental Suitability (RES) models (also known as Environmental Envelope or Habitat Suitability Index models). Habitat suitability models can be used to understand the possible extent and relative expected concentration of a marine species distribution. These models are derived from an assessment of the species occurrence in association with evaluated environmental explanatory variables that results in defining the RES. A fitted model that quantitatively describes the relationship of occurrence with the environmental variables can be used to estimate occurrence in conjunction with known habitat suitability (Kaschner et al., 2006). By defining a population measure (e.g., assumed total number of a species in the world's oceans), abundance can thus be estimated for each RES value, providing a means to estimate density for areas that have not been surveyed.

Given the extent of the Navy's SURTASS LFA Study Area, available density estimates ranged from spatially explicit values derived from habitat models developed from multiple years of systematic survey data, e.g., waters within the Hawaiian Islands Exclusive Economic Zone [EEZ] (Becker et al., 2022b), to density estimates inferred from RES models for the eastern Indian Ocean areas (Kaschner et al., 2006), where survey data are extremely limited (Kaschner et al., 2012). Therefore, to characterize marine species density for these large oceanic regions, the Navy needed to review, critically assess, and prioritize existing density estimates from multiple sources, requiring the development of a systematic method for selecting the most appropriate density estimate for each combination of species, area, and season. The resulting compilation and structure of the selected marine species density data resulted in the NMSDD, a Geographic Information System (GIS)-based inventory of the best available marine species density data for each of the Navy's study areas. The Navy's protocol for selecting the best available density estimates is based on an established hierarchal approach that is described in detail in past density technical reports (U.S. Department of the Navy, 2015, 2017).

The density data selection process ensures that the best available estimate is used for each species considered and that there is only one representative density value for each geographic location. The hierarchical ranking process is applied on a species-by-species basis since available data sources often vary by species. The results are species-specific density data files that are compilations of density data from potentially multiple sources, are defined seasonally where possible, and provide density values for each geographic area of interest. NMSDD GIS files for the SURTASS LFA Study Area are currently stratified by four seasons (Winter: December–February; Spring: March–May; Summer: June–August; Fall: September–November), although density data were rarely available at this temporal scale.

Uncertainty in published density estimates is typically large because of the low number of sightings available for their derivation. Uncertainty is typically expressed by the coefficient of variation (CV) of the estimate, which is derived using standard statistical methods and describes the amount of variation with respect to the population mean. It is expressed as a fraction or sometimes a percentage and can range upward from zero, indicating no uncertainty, to high values. When the CV exceeds 1.0, the estimate is very uncertain. For example, a CV of 0.85 would indicate high uncertainty in the mean density estimate. As used in this report, uncertainty is an indication of variation in an estimate that is unique to each data source and is dependent on how the values were derived. Each source of data may use different methods to estimate density, of which uncertainty in the estimate can be directly related to the method applied. In some cases, measures of uncertainty were not derived for the available density estimates (e.g., for the RES-derived density estimates).

NOTE: The density data are organized by species in Section 2 of this report and within the individual species sections, density estimates are presented for each of the 15 modeling sites. The species sections are presented in groups of related taxa. Information on which species are found within a 250 km buffer around the center of each of the 15 representative modeling sites is provided in Table 1.1-1. The 250 km buffer includes the areas where the majority of impacts is likely to occur (see Section 2 of this report).

Table 1.1-1: Species with SURTASS LFA Study Area Density Estimates Within Each 250 km Buffer

Marine Mammal Species	***Scientific Name***	***Occurrence in Modeling Sites (within a 250 km buffer)***
Baleen Whales (Mysticeti)		
Common minke whale	*Balaenoptera acutorostrata*	All sites
Sei whale	*Balaenoptera borealis*	1, 4, 8, 9, 10, 11, 14, 15
Antarctic minke whale	*Balaenoptera bonaerensis*	14
Bryde's whale	*Balaenoptera edeni*	All sites except 15
Blue whale/Pygmy blue whale	*Balaenoptera musculus*	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14,15
Omura's whale	*Balaenoptera omurai*	2, 3, 4, 5, 6, 7, 9, 12, 13, 14
Fin whale	*Balaenoptera physalus*	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,14, 15
North Pacific right whale	*Eubalaena japonica*	1, 15
Humpback whale	*Megaptera novaeangliae*	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 14, 15
Toothed Whales (Odontoceti)		
Sperm Whales (Family Physeteridae [sperm whale] and Family Kogiidae [pygmy and dwarf sperm whale])		
Sperm whale	*Physeter macrocephalus*	All sites
Pygmy sperm whale	*Kogia breviceps*	All sites except 15
Dwarf sperm whale	*Kogia sima*	All sites except 15
Dolphins (Family Delphinidae)		
Common dolphin	*Delphinus delphis*	1, 2, 3, 5, 6, 8
Pygmy killer whale	*Feresa attenuata*	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14
Short-finned pilot whale	*Globicephala macrorhynchus*	All sites except 15
Risso's dolphin	*Grampus griseus*	All sites except 15
Fraser's dolphin	*Lagenodelphis hosei*	2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	1, 2, 5, 6, 8, 15
Northern right whale dolphin	*Lissodelphis borealis*	1, 8, 15
Indo-Pacific finless porpoise	*Neophocaena phocaenoides*	13
Irrawaddy dolphin	*Orcaella brevirostris*	13
Killer whale	*Orcinus orca*	All sites
Melon-headed whale	*Peponocephala electra*	All sites except 15
False killer whale	*Pseudorca crassidens*	All sites except 15
Indo-Pacific humpback dolphin	*Sousa chinensis*	13
Pantropical spotted dolphin	*Stenella attenuata*	All sites except 15
Striped dolphin	*Stenella coeruleoalba*	All sites except 15
Spinner dolphin	*Stenella longirostris*	All sites except 15
Rough-toothed dolphin	*Steno bredanensis*	All sites except 15
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	13
Common bottlenose dolphin	*Tursiops truncatus*	All sites except 15
Porpoises (Family Phocoenidae)		
Dall's porpoise (*dalli* and *truei*)	*Phocoenoides dalli dalli* and *Phocoenoides dalli truei*	1, 5, 8, 15
Beaked Whales (Family Ziphiidae)		

Baird's beaked whale	*Berardius bairdii*	1, 5, 8, 15
Longman's beaked whale	*Indopacetus pacificus*	2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14
Hubbs' beaked whale	*Mesoplodon carlshubbsi*	1, 8
Blainville's beaked whale	*Mesoplodon densirostris*	2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14
Ginkgo-toothed beaked whale	*Mesoplodon ginkgodens*	1, 2, 3, 4, 6, 7, 8, 9, 12, 13
Deraniyagala's beaked whale	*Mesoplodon hotaula*	3, 4, 7, 9, 12, 13
Stejneger's beaked whale	*Mesoplodon stejnegeri*	1, 5, 8, 15
Cuvier's beaked whale/Goose-beaked whale	*Ziphius cavirostris*	All sites
Pinnipeds (Pinnipedia)		
Northern fur seal	*Callorhinus ursinus*	1, 5, 15
Hawaiian monk seal	*Neomonachus schauinslandi*	10, 11
Spotted seal	*Phoca largha*	5
Ribbon seal	*Histriophoca fasciata*	15
Sirenians (Order Sirenia, Family Dugongidae)		
Dugong	*Dugong dugon*	13

1.2 MAIN SOURCES OF DENSITY DATA

The majority of density estimates used in the NMSDD come from peer-reviewed publications cited in this report. When density estimates for a particular species are not specifically provided by published sources, they are derived based on information included in the scientific literature. The sources and methods used to derive the estimates are summarized in this report, and the main sources of density data incorporated into the NMSDD and used for the Navy's SURTASS LFA analyses are described below.

1.2.1 CETACEANS

The data used to provide cetacean density estimates within the SURTASS modeling sites came from a variety of sources, but the majority can be described within four major categories: (1) habitat-based density models and design-based estimates used for the Navy's Phase IV HCTT and MITT analyses, (2) habitat-based density models and design-based estimates produced by the Japan Fisheries Research and Education Agency from surveys in the western North Pacific and coastal waters of Japan, (3) design-based estimates derived by the Institute of Cetacean Research from surveys in the western North Pacific, and (4) density estimates inferred from RES models for the eastern Indian ocean area. Additional information on each of these main categories is provided below, presented in the order of preference based on the Navy's established hierarchal approach for selecting the best available density data (U.S. Department of the Navy, 2015, 2017).

Navy Phase IV HCTT and MITT Density Data

The majority of cetacean density data used in the Navy's Phase IV analyses for the HCTT and MITT study areas were estimated from systematic line-transect shipboard surveys conducted by the National Marine Fisheries Service (NMFS), Southwest Fisheries Science Center (SWFSC), and Pacific Islands Fisheries Science Center (PIFSC). The SWFSC/PIFSC surveys cover three of the modeling sites relevant to the SURTASS LFA Study Area: (1) the Hawaiian Islands EEZ, which includes waters within the majority of

SURTASS modeling sites 10 and 11; and (2) the Guam and Commonwealth of the Northern Mariana Islands (CNMI) EEZs, which includes waters within SURTASS modeling site 4 (see Figure 1.1-1). Data from these surveys have been used to develop habitat-based density models and to derive design-based density estimates using line-transect analyses.

New survey data collected by NMFS (partially funded by the Navy) within the Hawaiian Islands EEZ during the summer and fall of 2017 and the winter of 2020 supported the derivation of updated cetacean density estimates from both design- and model-based analyses (Becker et al., 2022b; Becker et al., 2021; Bradford et al., 2021). These data are described in more detail in the Navy's Phase IV Marine Species Density Database Technical Report for HCTT (U.S. Department of the Navy, 2024).

New survey data collected by NMFS (partially funded by the Navy) within the Guam and CNMI EEZs in 2015, 2018, and 2021 supported the derivation of updated cetacean density estimates from both design- and model-based analyses (Becker et al., In Prep; Bradford et al., In Prep.). These data are described in more detail in the Navy's Phase IV Marine Species Density Database Technical Report for MITT (U.S. Department of the Navy, *In Prep*.).

Japan Fisheries Research and Education Agency Density Data

Using sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006, (Kanaji et al., 2017) derived spatially explicit abundance estimates for a variety of odontocetes using density surface modeling. Abundance, distribution, and species diversity were estimated for an area spanning a longitude range of 120° East (E) —120° West (W) and a latitude range of the equator to 60° North (N), with the exception of the eastern Bering Sea and the Gulf of Alaska (east of 170°E and north of 50°N) and the Eastern Tropical Pacific (west of 160°W and south of 20°N), where survey data were not available. Model predictions for an example species, pantropical spotted dolphin, provide a clear picture of the waters included in the study area (Figure 1.2-1). Areas with water depth shallower than 200 m were also excluded from the analysis. Density and measures of variance were estimated for grid cells at a spatial resolution of 1 x 1° for 14 species in the Delphinidae and Phocoenidae families: short-beaked common dolphin, short-finned pilot whale, Risso's dolphin, Pacific white-sided dolphin, northern right whale dolphin, killer whale, melon-headed whale, false killer whale, pantropical spotted dolphin, striped dolphin, spinner dolphin, rough-toothed dolphin, common bottlenose dolphin, and Dall's porpoise. These density data cover all the SURTASS LFA modeling sites in the Western North Pacific (modeling sites 1, 2, 4, 8, 9, 10, 11, and 15), as well as the West Philippine Sea (site 3), the East China Sea (site 6), and the Sea of Japan (site 5).

Institute of Cetacean Research Density Data

The Institute of Cetacean Research has conducted sighting surveys in the Western North Pacific since 1994 to collect data necessary to estimate the abundance of baleen whale species. The main survey areas include the Pacific side of Japan east to 170°E, north of 35°N, and south of the Russian and U.S. EEZs, as well as the Sea of Japan and Okhotsk Sea (Takahashi et al., 2022). Surveys were also conducted in 2021 in an additional research area located between 30°N–53°N and 150°E–155°W (Figure 1.2-2). Sighting data collected during these surveys have been used to produce design-based estimates for minke, sei, Bryde's, blue, fin, humpback, and North Pacific right whales (Hakamada & Matsuoka, 2016a;

Hakamada & Matsuoka, 2016b; Katsumata & Matsuoka, 2022; Katsumata et al., 2021; Takahashi et al., 2022). These data include waters within SURTASS LFA modeling sites 1, 8, and 15.

Density Data Derived from Relative Environmental Suitability Models

Based on a synthesis of existing observations about the relationships between basic environmental conditions and species presence, Kaschner et al. (2006) used RES models to predict the average annual range of a marine mammal species on a global level. Habitat preferences were based on sea surface temperature, bathymetry, and distance to nearest land or ice edge. These data were then used to characterize species distribution and relative concentration on a global oceanic scale at 0.5° grid cell resolution. To transform the RES values (probability of occurrence) to density estimates, population measures (e.g., assumed total number of a species in the world's oceans) were defined so that abundance could be estimated for each RES value, thus providing density estimates for areas of the ocean that have not been surveyed. For the SURTASS modeling sites in the eastern Indian Ocean and South China Sea (modeling sites 7, 12, 13, and 14) where survey data are extremely limited (Kaschner et al., 2012), density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available.

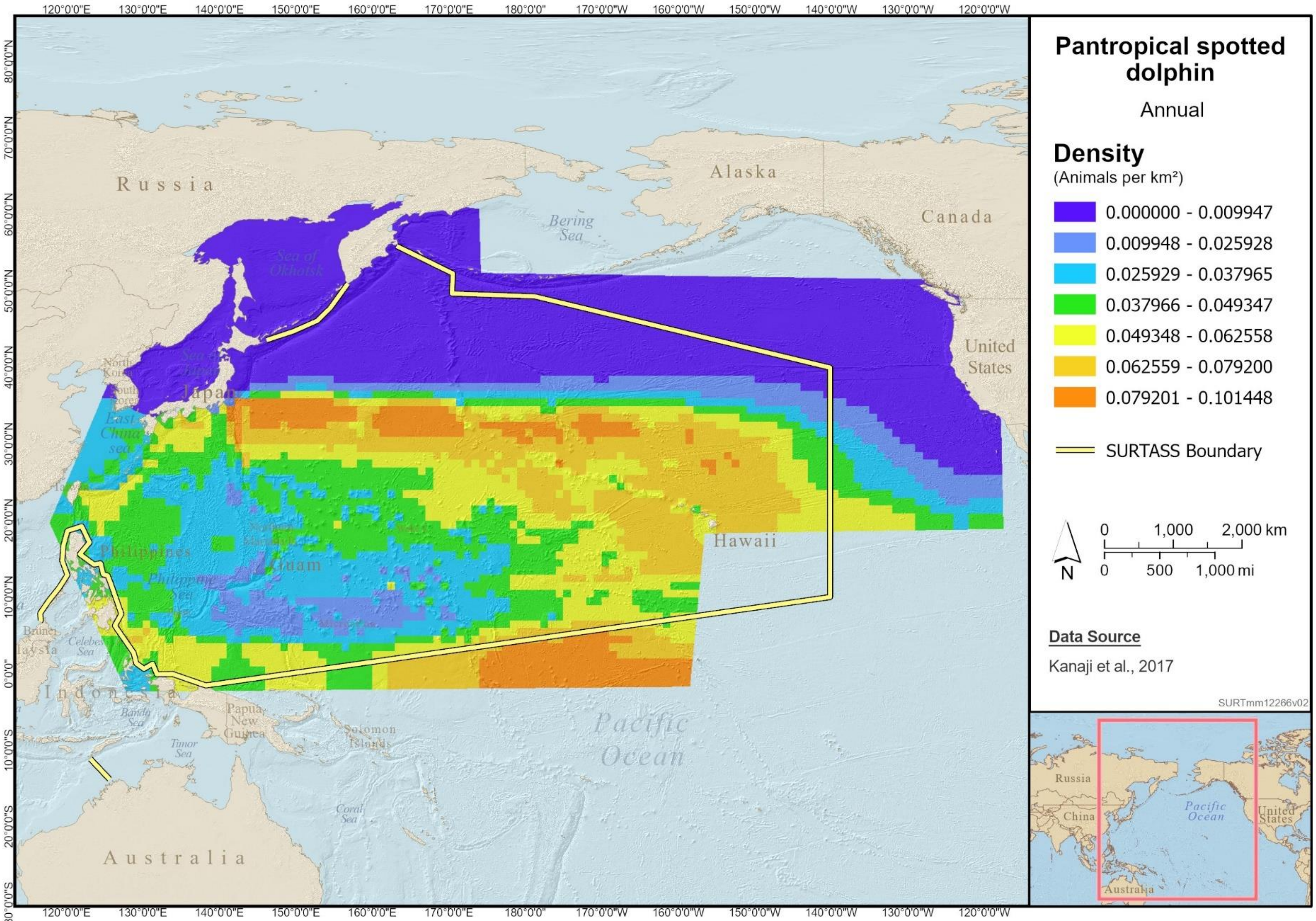


Figure 1.2-1: Example Density Plot from Kanaji et al. (2017)

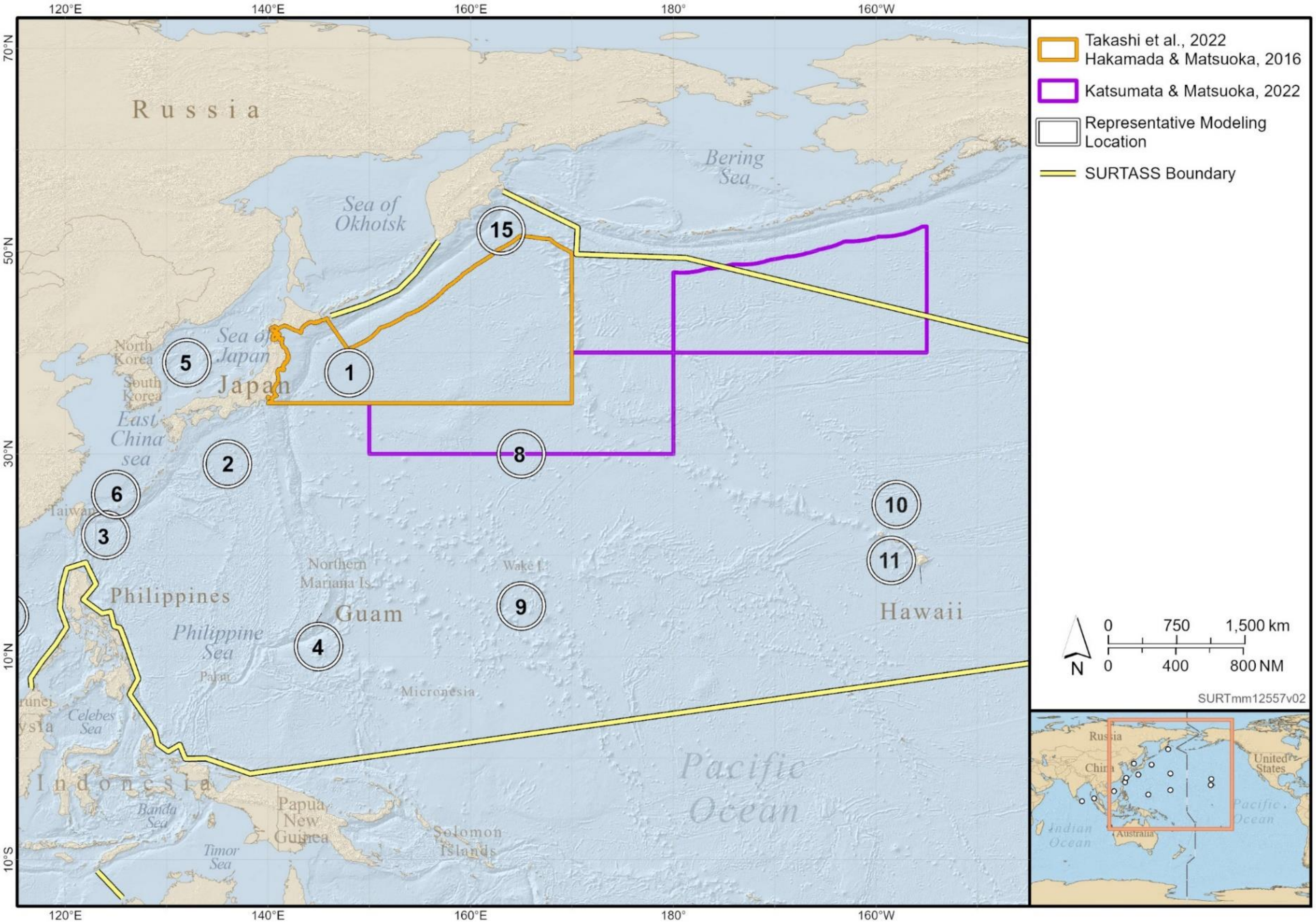


Figure 1.2-2: Institute of Cetacean Research Study Areas

1.2.2 PINNIPEDS AND DUGONG

Density estimates for pinnipeds and the dugong are not model based and are essentially calculated as an in-water abundance divided by an area. Densities for pinnipeds and the dugong relied on published data on the abundance, occurrence, and distribution of the species, including data from telemetry studies if available, that enabled the Navy to define spatial strata with greater precision and to better represent species' distribution than in previous analyses.

Except for Hawaiian monk seal, pinniped occurrence in the Study Area is only likely at or near the more northerly sites (1, 2, 5, 8, and 15). Furthermore, the offshore distribution of several pinniped species with potential occurrence at the northern sites is limited to areas over the continental shelf or is closely tied to the sea ice front and its seasonal progression in the Bering Sea and Sea of Okhotsk. As such, occurrence inside the 250-kilometer (km) buffer defining each site is unlikely or considered extralimital for some species that may occur at the same latitude but inshore of a particular site. For example, spotted seals have a range that extends as far south as Japan (Boveng et al., 2009) and approaches the latitude of site 2; however, their distribution is limited to waters over the continental shelf closer to shore and they are not expected to occur inside the 250 km buffer defining site 2.

Chernook et al. (2018) derived spatially explicit densities and estimated abundances for four ice-associated seals off the Kamchatka Peninsula, Russia located west of site 15. The seals, ringed, ribbon, spotted, and bearded, haulout on sea ice in winter and spring when the ice extent is farthest south for pupping, breeding, and molting, depending on the species. Once the ice breaks up and recedes northward, some species haulout on land, others become pelagic in the Bering Sea and Aleutian Islands, and some follow the ice north and remain in the northern Bering Sea and Arctic region. The distribution of seals occupying the Kamchatka Peninsula and nearshore waters in winter and spring remain over the shelf and slope extending from shore to about the 1,000 m depth contour, which is shoreward of the 250 km buffer at site 15. Thus, while the densities derived by Chernook et al. (2018) are informative, they are not applicable to site 15. Once the sea ice recedes northward in summer, only ribbon seals are expected to be pelagic and occurring within site 15.

The dugong prefers warm tropical waters and is only likely to occur in the southern part of the Study Area. Due to its preference for shallow, coastal habitat, the dugong would not occur offshore and is only expected to occur at site 13, which intersects coastal habitat in the Andaman Sea.

Temporal variations in species-specific distribution patterns were incorporated into density estimates to more accurately match pinniped migration and haul-out behaviors that are unique to each species. This resulted in some species' in-water distributions varying by breeding and non-breeding seasons instead of the traditional winter, spring, summer, and fall seasons. Spatial strata to represent the species' seasonal distribution in the density calculation were developed for each species based on published data on habitat preferences and species range maps. The primary factors used to define spatial strata were bathymetry and distance from shore.

2 DENSITY DATA

The remainder of this document describes the density data that were incorporated into the NMSDD and are being used by the Navy for modeling the potential exposure of each species to Navy sound sources in the SURTASS LFA Study Area. Species are presented in groups of related taxa: baleen whales, sperm whales, delphinids, porpoises, beaked whales, and pinnipeds. Within each group, species are presented in alphabetical order by their scientific name; hence, the scientific names are presented before the common names. This organization scheme keeps closely related species together. Within each section, species-specific density data are provided for each of the 15 modeling sites. Information on which species are found in each of the SURTASS LFA modeling sites was provided in Table 1.1-1. Maps of estimated species density within each of the modeling sites are presented for the entire SURTASS LFA Study Area to enable comparisons between the modeling sites.

Given that substantial acoustic effects such as permanent threshold shift or auditory injury would occur closest to the SURTASS LFA sound source, the Navy applied a 250 km buffer around the center of each modeling site to focus on the areas where the most serious impacts and likely the majority of less serious impacts (e.g., temporary threshold shift, behavioral) would occur. This assumption is based on the 2,000-yard (1.8 km) LFA mitigation zone presented in the 2019 SURTASS SEIS/SOEIS (U.S. Department of the Navy, 2019), which is intended to encompass the range to PTS effects for all species. The data presented in this technical report thus include density estimates within a 250 km radius buffer around each of the 15 modeling sites. To ensure a conservative analysis, the Navy plans to evaluate potential effects out to a 500 km radius, and possibly a 1,000 km radius buffer, depending on the results of propagation modeling at each of the 15 sites. To facilitate these analyses, density values from the 250 km radius buffer will be extrapolated out to the largest radius determined appropriate based on propagation modeling and species-specific auditory thresholds.

2.1 *BALAENOPTERA ACUTOROSTRATA*, COMMON MINKE WHALE

Common minke whale is not an ESA-listed species. Common minke whale is listed by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as a species of Least Concern (Cooke, 2018a).

Common minke whales have a cosmopolitan distribution in tropical and temperate waters to the ice edges in the northern and southern hemispheres, and generally occupy waters over the continental shelf, including inshore bays and even occasionally estuaries (Jefferson et al., 2015). However, records from whaling catches and research surveys worldwide indicate there may be an open-ocean component to the minke whale's habitat (Jefferson et al., 2015; Perrin & Brownell, 2009). Three subspecies of common minke whale are currently recognized: the North Atlantic minke whale (*B.a. acutorostrata*), the North Pacific minke whale (*B.a. scammoni*), and the currently unnamed dwarf minke whale that occurs predominantly in the southern hemisphere (Jefferson et al., 2015). In the summer, common minke whales are likely absent from low-productivity tropical waters (Jefferson et al., 2015; Perrin et al., 2009a).

Three stocks of minke whales are recognized by the International Whaling Commission (IWC) in the North Pacific Ocean: (1) Sea of Japan – Yellow Sea – East China Sea (the "J" stock); (2) Okhotsk Sea – West Pacific (west of 180°, the "O" stock); and (3) "Remainder" (east of 180°). Recently there have been studies focused on delineating the range of the "J" stock, currently thought to include the nearshore waters off the Pacific coast of Japan out to approximately 20 km from shore. Based on data collected in 2003, the abundance estimate for the "O" stock was 20,000 whales, with a 95 percent confidence interval of 13,000–70,000 (International Whaling Commission, 2024). The "J" stock abundance estimate, based on data collected between 2004 and 2006, was 4,200 animals, with a 95 percent confidence interval of 2,700–6,300 whales (International Whaling Commission, 2024).

For the MMPA stock assessment reports, NMFS recognizes three stocks within the Pacific U.S. EEZ: a Hawaiian stock, a California/Oregon/Washington stock, and an Alaskan stock (Carretta et al., 2023). Of these three stocks, only the Hawaiian stock would occur within the SURTASS LFA Study Area within modeling sites 10 and 11. The most recent abundance estimate for the Hawaiian stock of minke whales is 438 animals, with a 95 percent confidence interval of 81–2,372 whales (Bradford et al., 2021).

The IWC also recognizes a Southern Hemisphere minke whale stock, although their distribution in these waters is not well known and it is likely that some animals migrate to Antarctic waters during the austral summer (Jefferson et al., 2015). The most recent abundance estimate for the Southern Hemisphere population of common minkes whales was based on data collected between 1991 and 2004 and totaled 515,000 whales, with a 95 percent confidence interval of 360,000–730,000 animals (International Whaling Commission, 2024). Data are not sufficient to estimate an abundance specific to the Indian Ocean population of minke whales.

Seasonal density estimates for common minke whale are available for all of the SURTASS modeling sites, although in some sites they are only seasonally present, as described below. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.1-1, following the modeling site descriptions. Figures 2.1-1 to 2.1-4 , which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.1.1 Modeling Site 1 – East of Japan

Density estimates for common minke whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022), and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). The winter/spring density estimate of 0.00075 animals/km^2 was based on a total abundance estimate of 2,112 minke whales (CV = 0.371) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00108 animals/km^2 was based on a total abundance estimate of 3,080 minke whales (CV = 0.677) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2. The abundance estimates included a correction factor for animals missed directly on the trackline (i.e., g(0)) of 0.798) (Takahashi et al., 2022).

2.1.2 Modeling Site 2 – North Philippine Sea

Density estimates for common minke whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the northwest of modeling site 2, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00075 animals/km^2 was based on a total abundance estimate of 2,112 minke whales (CV = 0.371) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00108 animals/km^2 was based on a total abundance estimate of 3,080 minke whales (CV = 0.677) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2. The abundance estimates included a correction factor for animals missed directly on the trackline (i.e., g(0)) of 0.798) (Takahashi et al., 2022).

2.1.3 Modeling Site 3 – West Philippine Sea

Sighting data collected during Japan and Korea surveys from 2000 to 2009 in the southern Sea of Japan were used to derive abundance estimates for the "J" stock of common minke whales that are known to occur in this region as well as the East China Sea and Pacific coast of Japan (Kitakado et al., 2010). Although the survey area is located to the north of modeling site 3, these density data represent the best available for this region. A log-linear model was used to provide an updated abundance estimate for minke whale, reflecting the addition of a correction factor of 0.798 to account for animals missed directly on the trackline (i.e., g(0)). The resulting abundance estimate of 4,094 whales (CV = 0.412) and a total survey area of 617,455 km^2 yielded a density estimate of 0.00663 animals/km^2. Given a lack of seasonal data for this region, the Navy applied this density estimate year round.

2.1.4 Modeling Site 4 – Offshore Guam

Minke whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area and were based on line-transect analyses of acoustic detections collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Norris et al., 2017). During this survey, sea states were typically high and there were no sightings of minke whales. However, the survey included passive acoustic monitoring using a towed array system and resulted in 30 unique acoustic detections of minke whales (Norris et al., 2017). Line-transect analyses of these acoustic detections resulted in a minimum density estimate of 0.00015 animals/km^2 (CV = 0.34). These data were used to characterize minke whale density in fall, winter, and spring. Minke whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2008b; Perrin et al., 2009b); therefore, a density of zero is used for that season.

2.1.5 Modeling Site 5 – Sea of Japan

Sighting data collected during Japan and Korea surveys from 2000 to 2009 in the southern Sea of Japan were used to derive abundance estimates for the "J" stock of common minke whales (Kitakado et al., 2010). The survey area included waters within the entire 250 km buffer of modeling site 5. A log-linear model was used to provide an updated abundance estimate for minke whale, reflecting the addition of a correction factor of 0.798 to account for animals missed directly on the trackline (i.e., g(0)). The resulting abundance estimate of 4,094 whales (CV = 0.412) and a total survey area of 617,455 km^2 yielded a density estimate of 0.00663 animals/km^2. Given a lack of seasonal data for this region, the Navy applied this density estimate year round.

2.1.6 Modeling Site 6 – East China Sea

Sighting data collected during Japan and Korea surveys from 2000 to 2009 in the southern Sea of Japan were used to derive abundance estimates for the "J" stock of common minke whales that are known to occur in this region as well as the East China Sea and Pacific coast of Japan (Kitakado et al., 2010). Although the survey area is located to the north of modeling site 6, these density data represent the best available for this region. A log-linear model was used to provide an updated abundance estimate for minke whale, reflecting the addition of a correction factor of 0.798 to account for animals missed directly on the trackline (i.e., g(0)). The resulting abundance estimate of 4,094 whales (CV = 0.412) and a total survey area of 617,455 km^2 yielded a density estimate of 0.00663 animals/km^2. Given a lack of seasonal data for this region, the Navy applied this density estimate year round.

2.1.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. Predictions from the RES model indicate that minke whales are not expected to occur in the South China Sea from June through November (i.e., summer and fall as defined in this document).

2.1.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for common minke whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the north of modeling site 8, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00075 animals/km^2 was based on a total abundance estimate of 2,112 minke whales (CV = 0.371) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00108 animals/km^2 was based on a total abundance estimate of 3,080 minke whales (CV = 0.677) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2. The abundance estimates included a correction factor for animals missed directly on the trackline (i.e., g(0)) of 0.798) (Takahashi et al., 2022).

2.1.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Minke whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. The density estimates were based on line-transect analyses of acoustic detections collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Norris et al., 2017). During this survey, sea states were typically high, and there were no sightings of minke whales. However, the survey included passive acoustic monitoring using a towed array system and resulted in 30 unique acoustic detections of minke whales (Norris et al., 2017). Line-transect analyses of these acoustic detections resulted in a minimum density estimate of 0.00015 animals/km^2 (CV = 0.34). These data were used to characterize minke whale density in fall, winter, and spring. Minke whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2008b; Perrin et al., 2009b); therefore, a density of zero is used for that season.

2.1.10 Modeling Site 10 – Hawaii North

Minke whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). Bradford et al. (2021) reported a uniform density value for minke whales of 0.00018 animals/km^2 (CV = 1.05). In the summer, minke whales are likely absent from low-productivity tropical waters (Jefferson et al., 2015; Perrin et al., 2009a), and based on acoustic data, it is likely that in summer they have migrated north out of Hawaiian waters to feed (Martin et al., 2022). During three separate line-transect surveys of the Hawaii EEZ during summer and fall, minke whales were only seen or acoustically detected during the fall months (Barlow, 2006; Bradford et al., 2017; Bradford et al., 2021). Therefore, a density of zero is used for summer in this modeling site.

2.1.11 Modeling Site 11 – Hawaii South

Minke whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). Bradford et al. (2021) reported a uniform density value for minke whales of 0.00018 animals/km^2 (CV = 1.05). In the summer, minke whales are likely absent from low-productivity tropical waters (Jefferson et al., 2015; Perrin et al., 2009a), and based on acoustic data, it is likely that in summer they have migrated north out of Hawaiian waters to feed (Martin et al., 2022). During three separate line-transect surveys of the Hawaii EEZ during summer and fall, minke whales were only seen or acoustically detected during the fall months (Barlow, 2006; Bradford et al., 2017; Bradford et al., 2021). Therefore, a density of zero is used for summer in this modeling site.

2.1.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and common minke whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. Predictions from the RES model indicate that minke whales are not expected to occur in these waters from June through November (i.e., summer and fall as defined in this document).

2.1.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and common minke whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. Predictions from the RES model indicate that minke whales are not expected to occur in these waters from June through November (i.e., summer and fall as defined in this document).

2.1.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and common minke whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.1.15 Modeling Site 15 – Northeast of Japan

Density estimates for common minke whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). The survey area encompasses the southwest portion of modeling site 15 (see Figure 1.2-2), and these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00075 animals/km^2 was based on a total abundance estimate of 2,112 minke whales (CV = 0.371) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00108 animals/km^2 was based on a total abundance estimate of 3,080 minke whales (CV = 0.677) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2. The abundance estimates included a correction factor for animals missed directly on the trackline (i.e., g(0)) of 0.798) (Takahashi et al., 2022).

Table 2.1-1: Summary of Density Values for Common Minke Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00075	0.00108	0.00108	0.00075
Modeling Site 2	0.00075	0.00108	0.00108	0.00075
Modeling Site 3	0.00663	0.00663	0.00663	0.00663
Modeling Site 4	0.00015	0	0.00015	0.00015
Modeling Site 5	0.00663	0.00663	0.00663	0.00663
Modeling Site 6	0.00663	0.00663	0.00663	0.00663
Modeling Site 7	S	0	0	S
Modeling Site 8	0.00075	0.00108	0.00108	0.00075
Modeling Site 9	0.00015	0	0.00015	0.00015
Modeling Site 10	0.00018	0	0.00018	0.00018
Modeling Site 11	0.00018	0	0.00018	0.00018
Modeling Site 12	S	0	0	S
Modeling Site 13	S	0	0	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00075	0.00108	0.00108	0.00075

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

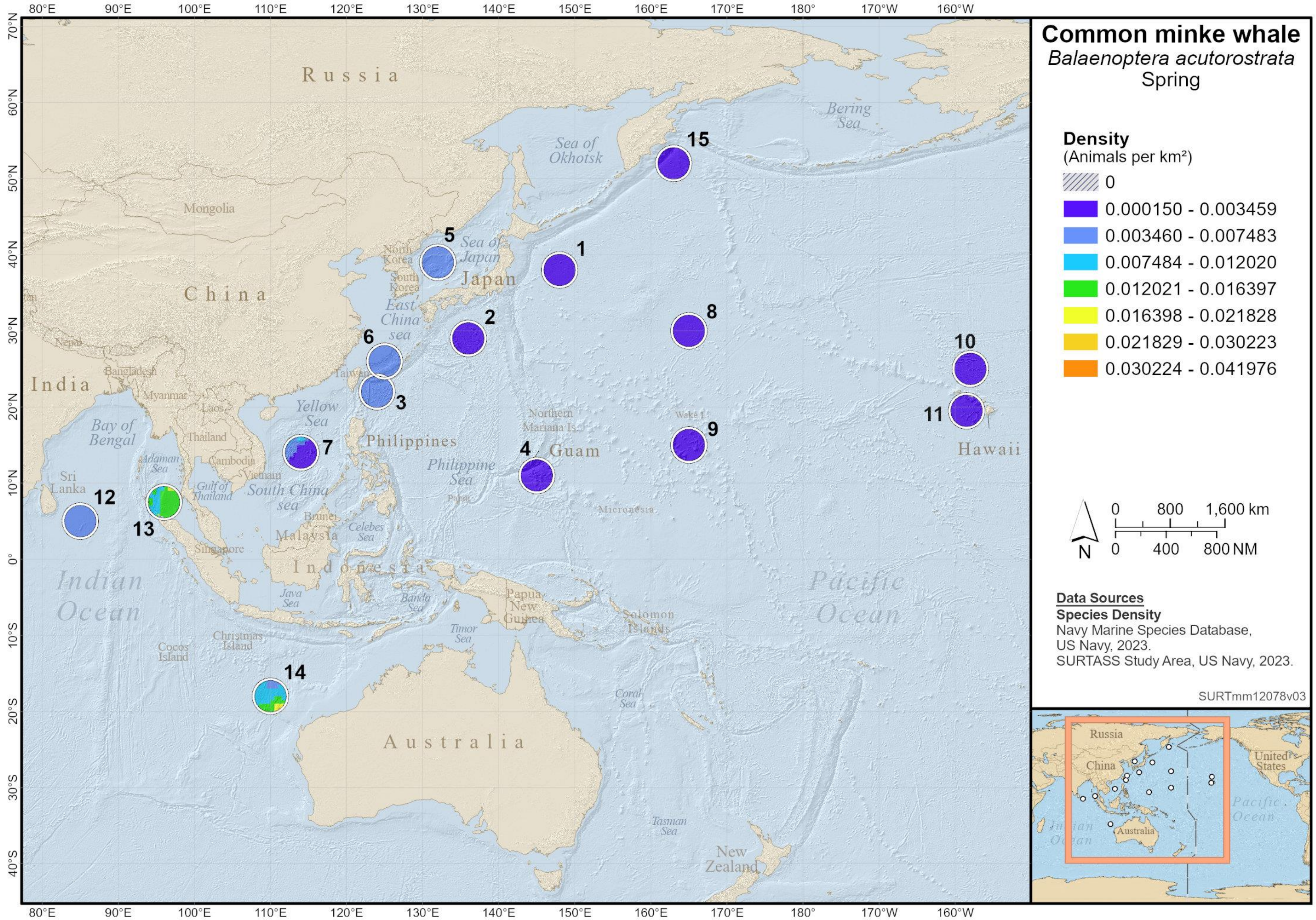


Figure 2.1-1: Spring Distribution of Common Minke Whale in the SURTASS LFA Study Area

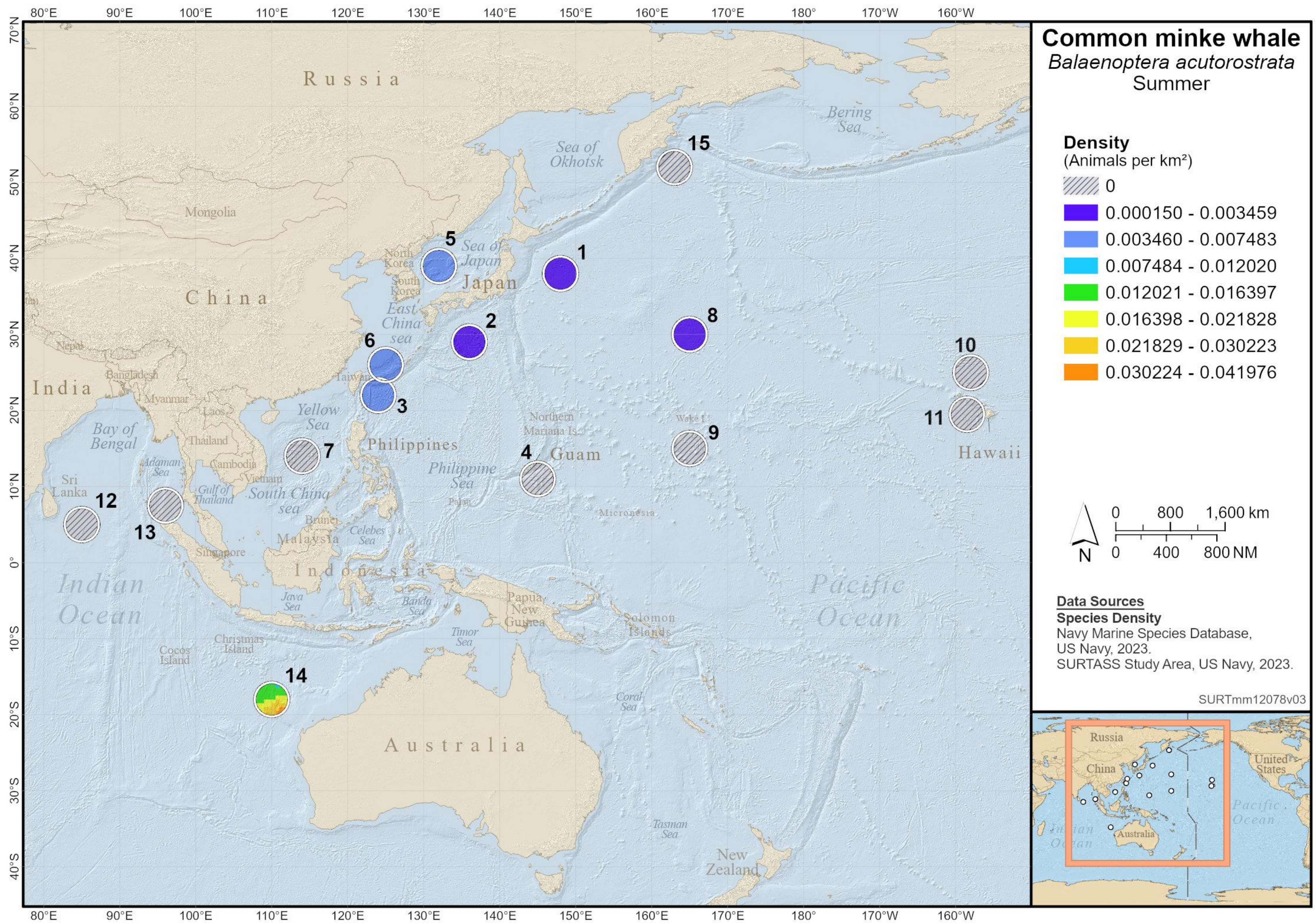


Figure 2.1-2: Summer Distribution of Common Minke Whale in the SURTASS LFA Study Area

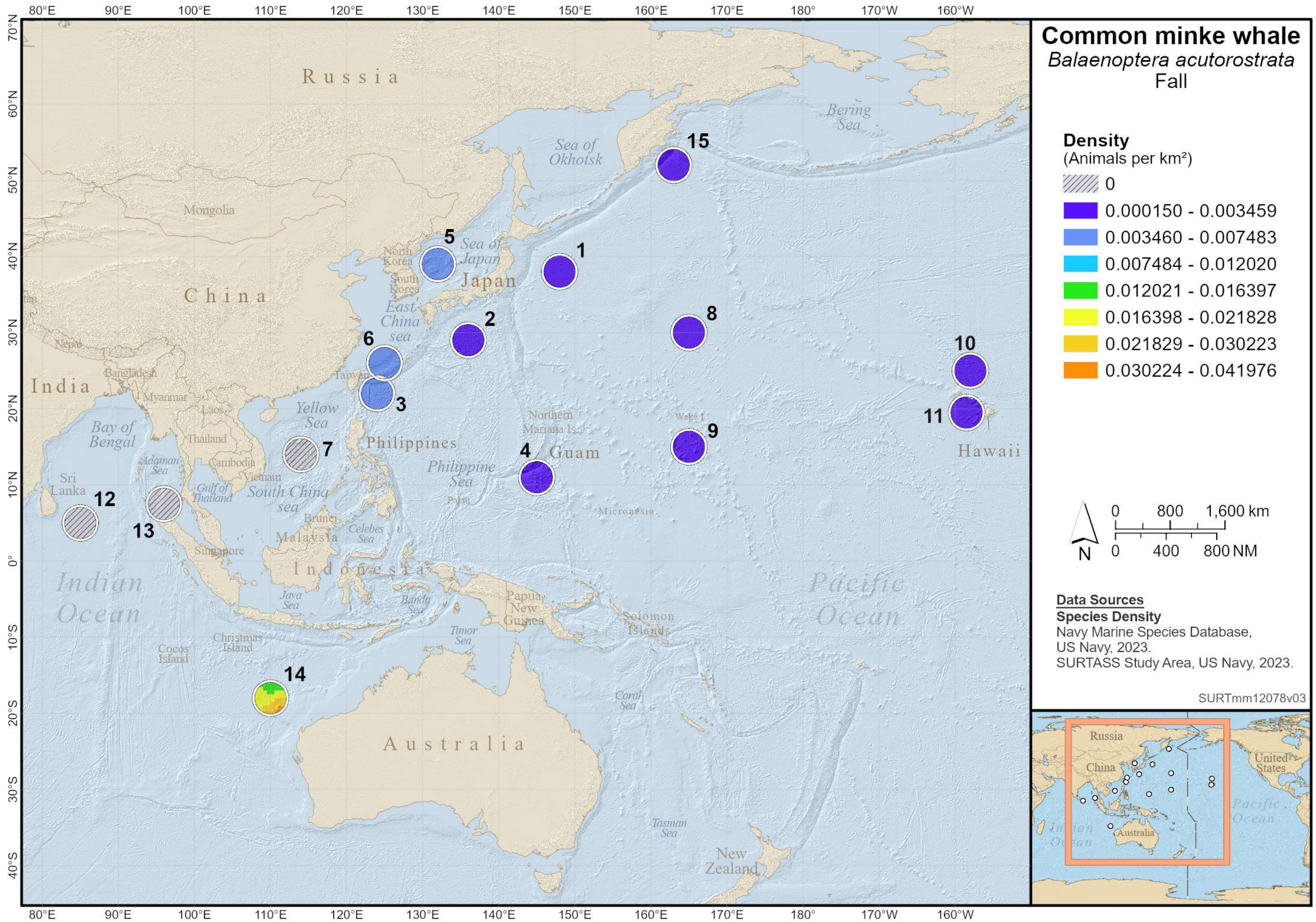


Figure 2.1-3: Fall Distribution of Common Minke Whale in the SURTASS LFA Study Area

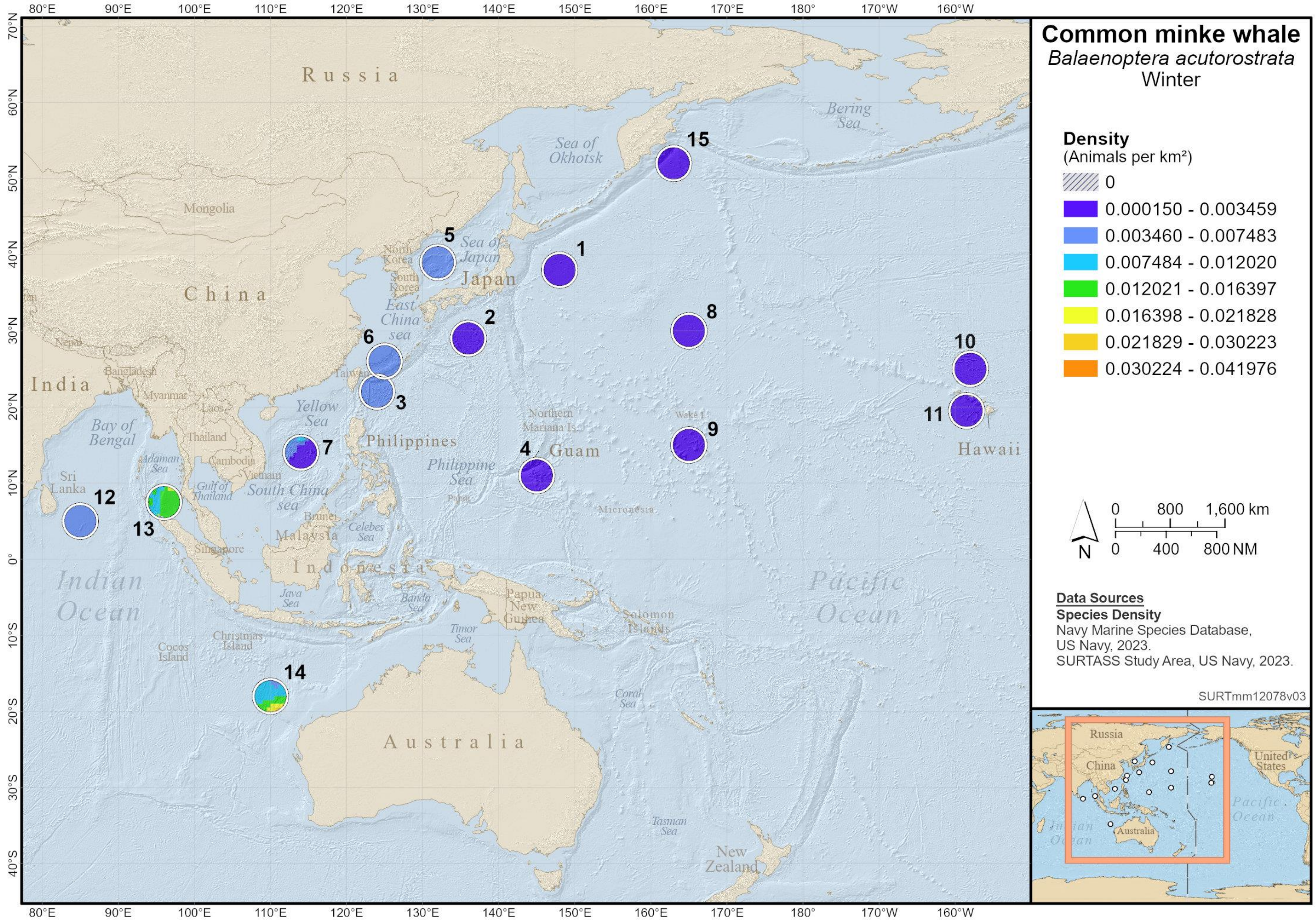


Figure 2.1-4: Winter Distribution of Common Minke Whale in the SURTASS LFA Study Area

2.2 *BALAENOPTERA BOREALIS*, SEI WHALE

The sei whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range. It is also listed as endangered by the IUCN Red List of Threatened Species (Cooke, 2018b).

Sei whales have a worldwide distribution but are found primarily in cold temperate to subpolar latitudes (Jefferson et al., 2015). Although sei whales are considered absent or occurring at very low densities in most equatorial areas, they have been observed south of 20° N in the winter (Fulling et al., 2011; Horwood, 2009; Horwood, 1987). Sei whales are typically found in the open ocean and are rarely observed near the coast (Horwood, 2009). Their distribution patterns are largely unpredictable, as they are known to occur regularly in an area for multiple years, and then largely disappear (Jefferson et al., 2015). There appears to be some seasonal movement between higher latitude summer feeding areas and lower latitude winter calving areas, but these movements are not as extensive as those of many other baleen whale species.

A single stock of sei whales is recognized by the IWC in the North Pacific Ocean. Based on data collected between 2010 and 2012, the abundance estimate for the North Pacific stock was 29,600 whales, with a 95 percent confidence interval of 18,500–47,300 (International Whaling Commission, 2024). For the MMPA stock assessment reports, NMFS recognizes two stocks within the Pacific U.S. EEZ: a Hawaiian stock and a California/Oregon/Washington stock (Carretta et al., 2023). Only the Hawaiian stock would occur within the SURTASS LFA Study Area within modeling sites 10 and 11. The most recent abundance estimate for the Hawaiian stock of sei whales is 401 animals, with a 95 percent confidence interval of 95–1,685 whales (Bradford et al., 2021).

Sei whales occur in the Southern Hemisphere, with a summer (January–February) distribution mainly in the latitude range of 40–55° South (S) in the southern Indian Ocean. There are no confirmed records of sei whales in the northern Indian Ocean (Afsal et al., 2008; Rice, 1998). Similar to other baleen whales, the IWC divides southern hemisphere sei whales into six management areas, but data are not sufficient to estimate an abundance specific to the Indian Ocean population of sei whales.

Sei whales are only expected to occur in eight of the SURTASS modeling sites: Site 1 (East of Japan), Site 4 (Offshore Guam), Site 8 (Offshore Japan/Western North Pacific 25° to 40° N), Site 9 (Offshore Japan/Western North Pacific 10° to 25° N), Site 10 (Hawaii North), Site 11 (Hawaii South), Site 14 (Northwest of Australia), and Site 15 (Northeast of Japan). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.2-1, following the modeling site descriptions. Figures 2.2-1 to 2.2-4, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.2.1 MODELING SITE 1 – EAST OF JAPAN

Density estimates for sei whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022) and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). The winter/spring density estimate of 0.00105 animals/km^2 was based on a total abundance estimate of 2,988 sei whales (CV = 0.304) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00179 animals/km^2 was based on a total abundance estimate of 5,087 sei whales (CV = 0.378) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.2.2 Modeling Site 4 – Offshore Guam

Sei whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area and were based on line-transect analyses of sightings collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Fulling et al., 2011). Prior to this survey, sei whales were considered extralimital in this area. During this survey, there were a total of 16 sei whale sightings, 11 of which were on-effort and supported the derivation of a design-based density estimate of 0.00029 animals/km^2 (CV = 0.49). These data were used to characterize sei whale density in fall, winter, and spring. Sei whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2008b; Perrin et al., 2009b); therefore, a density of zero was used for that season.

2.2.3 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for sei whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the north of modeling site 8, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00105 animals/km^2 was based on a total abundance estimate of 2,988 sei whales (CV = 0.304) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00179 animals/km^2 was based on a total abundance estimate of 5,087 sei whales (CV = 0.378) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.2.4 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Sei whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT study area, given the similar latitude of these sites in the western North Pacific. The density estimates were based on line-transect analyses of sei whale sightings collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Fulling et al., 2011). During this survey, there were a total of 16 sei whale sightings, 11 of which were on-effort and supported the derivation of a design-based density estimate of 0.00029 animals/km^2 (CV = 0.49). These data were used to characterize sei whale density in fall, winter, and spring. Sei whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2008b; Perrin et al., 2009b); therefore, a density of zero was used for that season.

2.2.5 Modeling Site 10 – Hawaii North

Sei whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). Bradford et al. (2021) reported a uniform density value for sei whales of 0.00016 animals/km^2 (CV = 0.84). In the summer, sei whales are likely absent from low productivity tropical waters (Jefferson et al., 2015), and during two separate line-transect surveys of the Hawaiian Islands EEZ during summer and fall, sei whales were only seen during the fall months (Barlow, 2006; Bradford et al., 2017). Therefore, a density of zero is used for summer in this modeling site.

2.2.6 MODELING SITE 11 – HAWAII SOUTH

Sei whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). Bradford et al. (2021) reported a uniform density value for sei whales of 0.00016 animals/km^2 (CV = 0.84). In the summer, sei whales are likely absent from low productivity tropical waters (Jefferson et al., 2015), and during two separate line-transect surveys of the Hawaiian Islands EEZ during summer and fall, sei whales were only seen during the fall months (Barlow, 2006; Bradford et al., 2017). Therefore, a density of zero is used for summer in this modeling site.

2.2.7 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and sei whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates for sei whale were incorporated into the NMSDD for this site.

2.2.8 MODELING SITE 15 – NORTHEAST OF JAPAN

Density estimates for sei whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). The survey area encompasses the southwest portion of modeling site 15 (see Figure 1.2-2), and these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00105 animals/km^2 was based on a total abundance estimate of 2,988 sei whales (CV = 0.304) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00179 animals/km^2 was based on a total abundance estimate of 5,087 sei whales (CV = 0.378) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

Table 2.2-1: Summary of Density Values for Sei Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00105	0.00179	0.00179	0.00105
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0.00029	0	0.00029	0.00029
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.00105	0.00179	0.00179	0.00105
Modeling Site 9	0.00029	0	0.00029	0.00029
Modeling Site 10	0.00016	0	0.00016	0.00016
Modeling Site 11	0.00016	0	0.00016	0.00016
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00105	0.00179	0.00179	0.00105

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

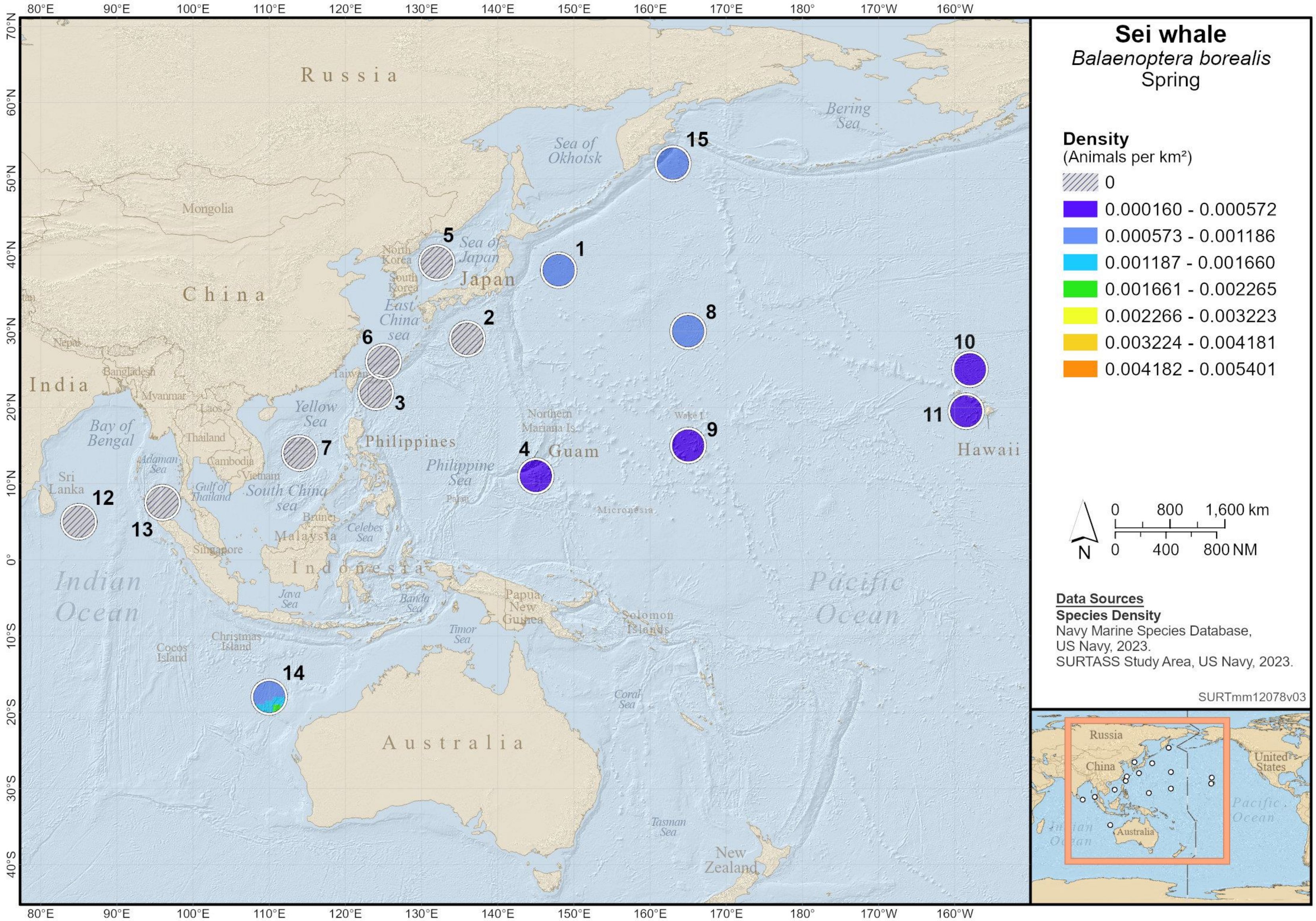


Figure 2.2-1: Spring Distribution of Sei Whale in the SURTASS LFA Study Area

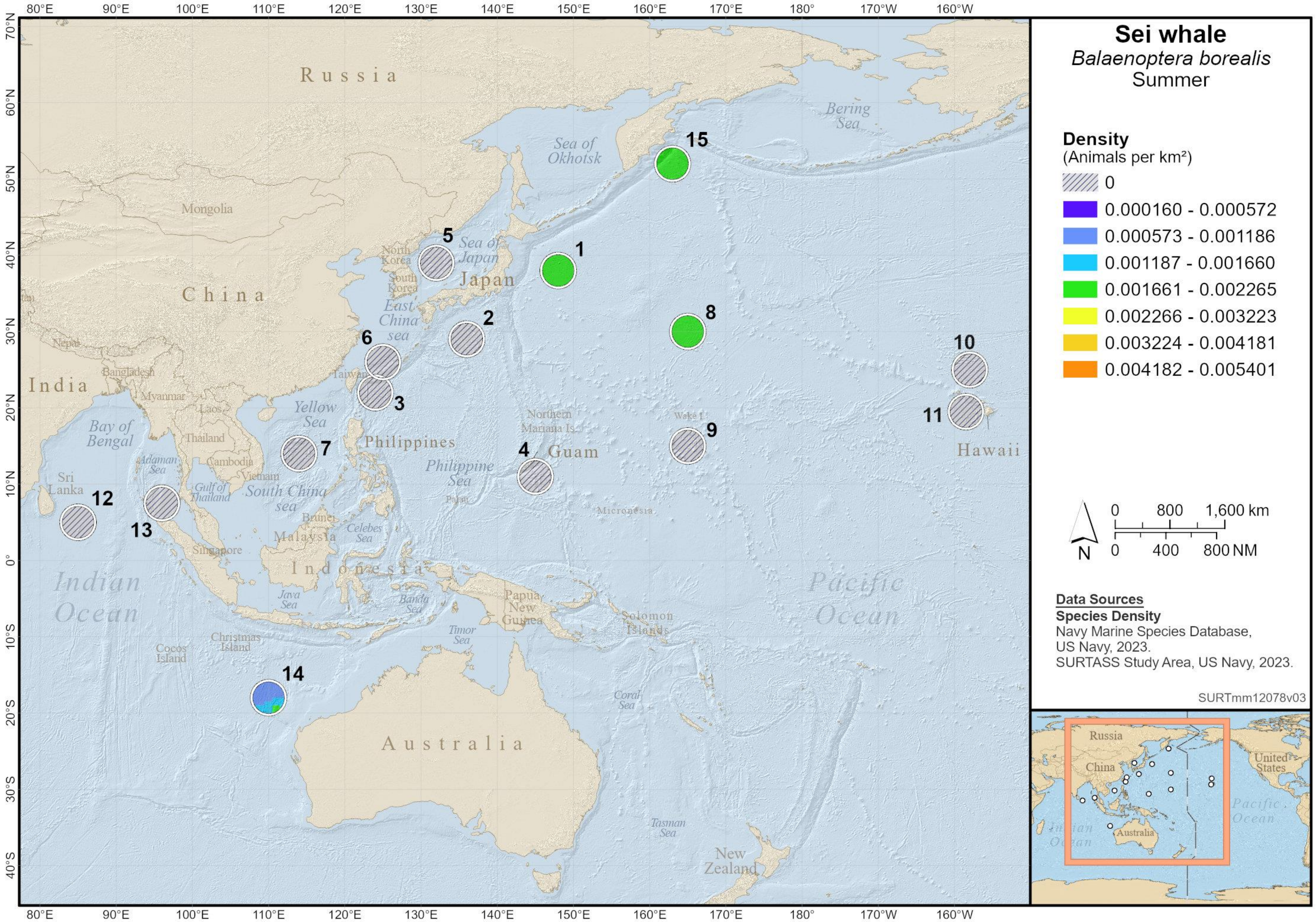


Figure 2.2-2: Summer Distribution of Sei Whale in the SURTASS LFA Study Area

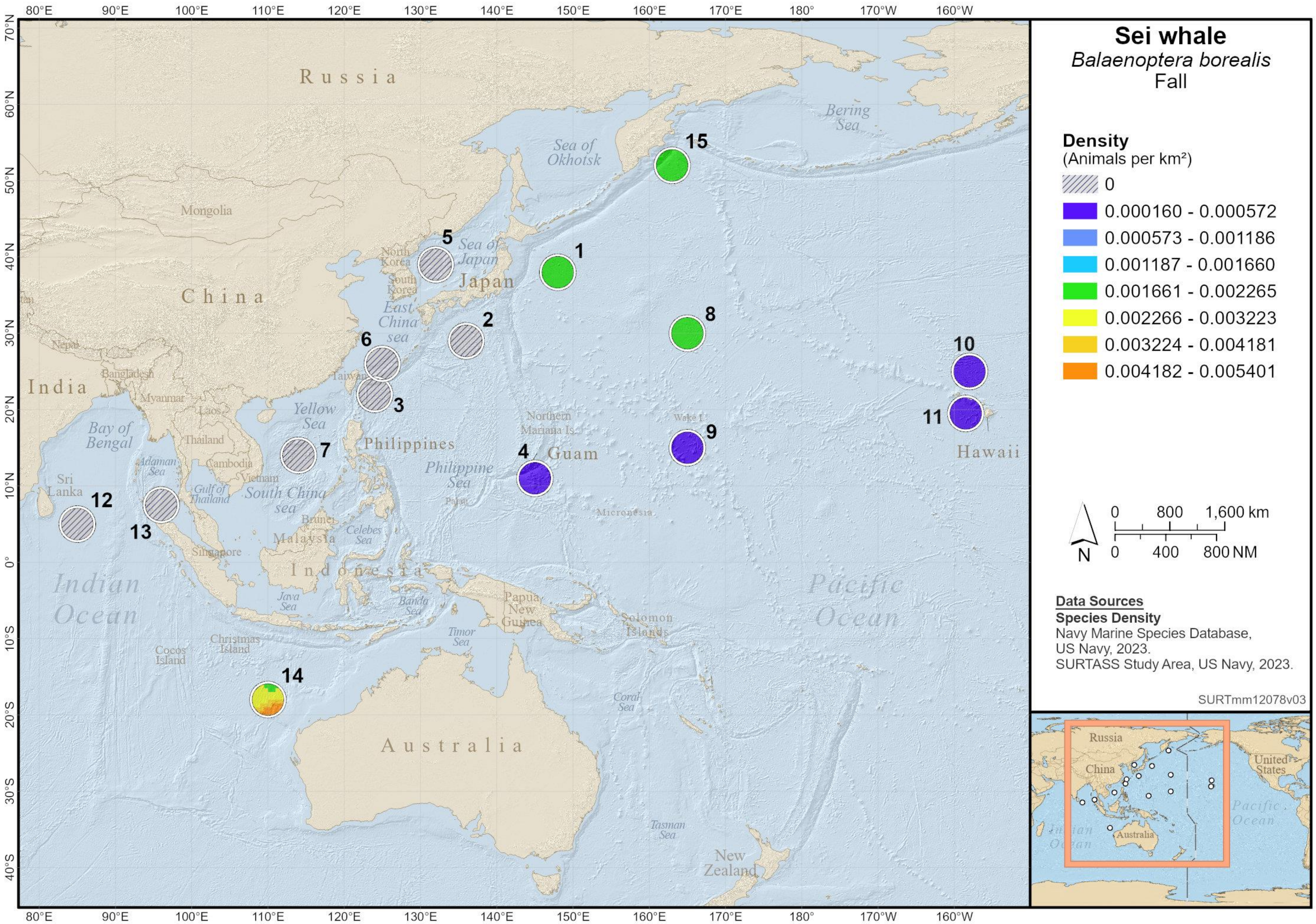


Figure 2.2-3: Fall Distribution of Sei Whale in the SURTASS LFA Study Area

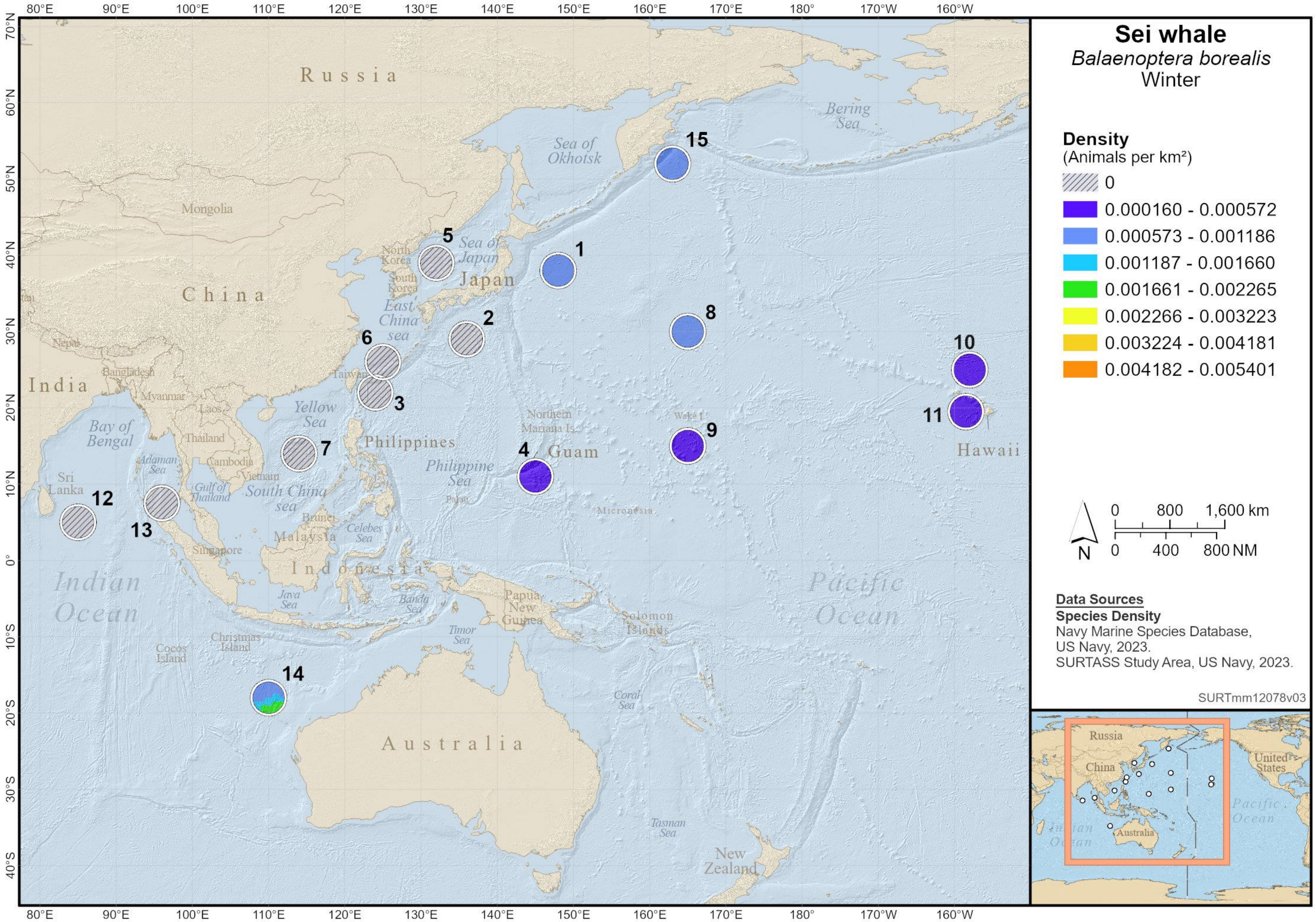


Figure 2.2-4: Winter Distribution of Sei Whale in the SURTASS LFA Study Area

2.3 *BALAENOPTERA BONAERENSIS*, ANTARCTIC MINKE WHALE

The Antarctic minke whale is listed by the IUCN Red List of Threatened Species as Near Threatened (Cooke et al., 2018).

The Antarctic minke whale is considered primarily a Southern Hemisphere species, occurring in both coastal and offshore regions from about 7 degrees south to the ice edges of Antarctica (Jefferson et al., 2015). There appears to be a general northward shift in winter for breeding, but many individuals are known to occur year round in the Antarctic. The IWC has estimated the entire Southern Hemisphere population as 515,000 whales (International Whaling Commission, 2024).

Given their distribution, Antarctic minke whales are only expected to occur in SURTASS modeling site 14 (Northwest of Australia). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.3-1, following the modeling site description. Figure 2.3-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.3.1 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and density estimates for modeling site 14 were not available. Annual density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates for Antarctic minke whale were incorporated into the NMSDD for this site.

Table 2.3-1: Summary of Density Values for Antarctic Minke Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

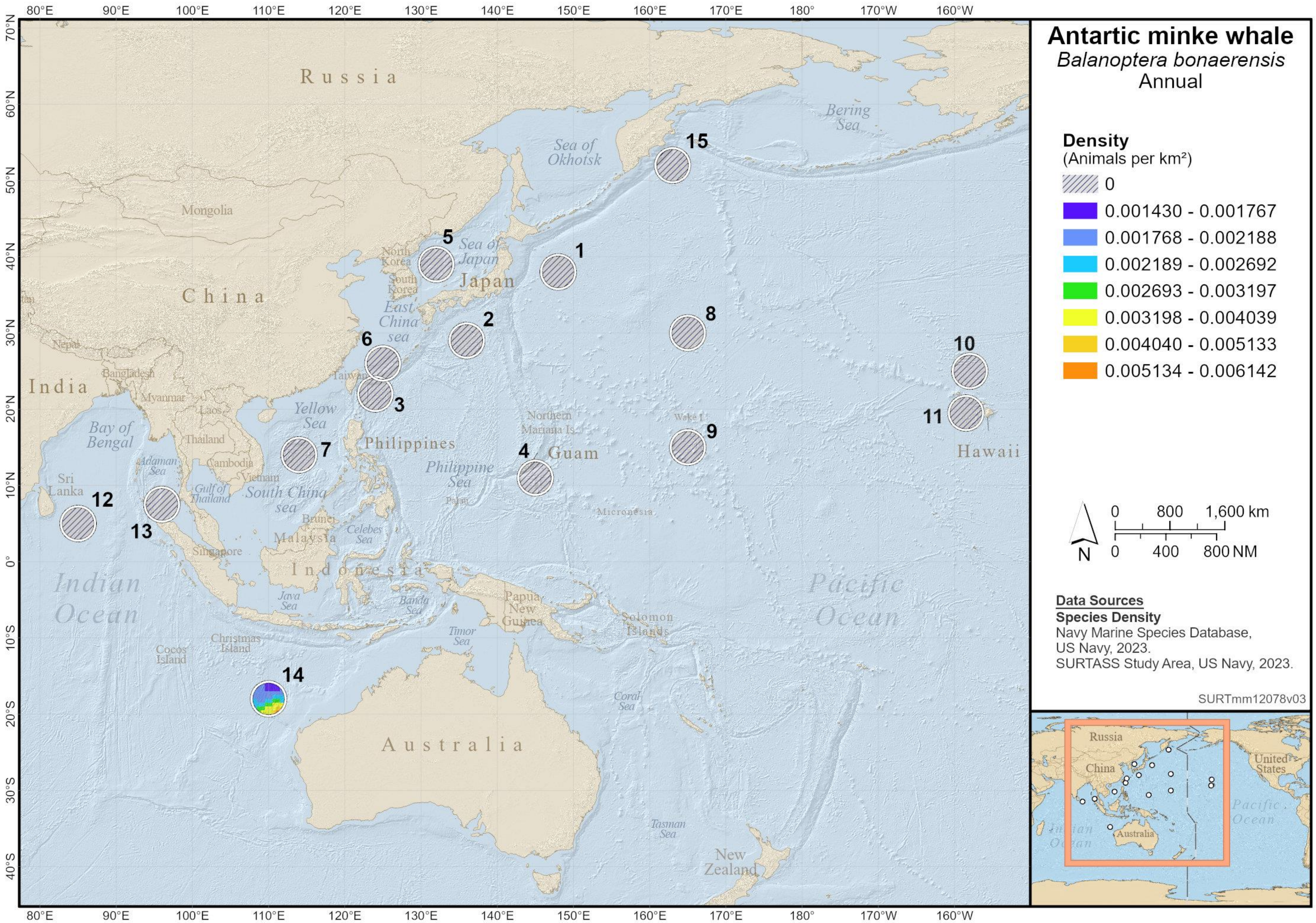


Figure 2.3-1: Annual Distribution of Antarctic Minke Whale in the SURTASS LFA Study Area

2.4 *Balaenoptera edeni*, Bryde's Whale

Bryde's whale is listed by the IUCN Red List of Threatened Species as a species of Least Concern (Cooke & Brownell Jr., 2018).

Bryde's whales occur primarily in offshore oceanic waters of the North Pacific (Hamilton et al., 2009; Jefferson et al., 2015). They typically do not move poleward of 40 degrees in either hemisphere and tend to occur primarily in tropical and subtropical zones, where water temperatures are relatively warm (Jefferson et al., 2015). Data suggest that winter and summer grounds partially overlap in the central north Pacific (Murase et al., 2015; Ohizumi et al., 2002). Long migrations are not typical of Bryde's whales, although limited shifts in distribution toward and away from the equator, in winter and summer, have been observed (Best, 1996; Cummings, 1985).

The IWC recognizes four stocks of Bryde's whales in the North Pacific (eastern, western, East China Sea, and Gulf of California). Based on data collected between 2008 and 2015, the IWC estimated the western North Pacific population of Bryde's whales at 41,000 whales, with a 95 percent confidence interval of 24,000–68,000 (International Whaling Commission, 2024). NMFS recognizes two stocks of Bryde's whales in the U.S. Pacific, the Eastern Tropical Pacific stock (whales found east of 150° W) and the Hawaii stock (Carretta et al., 2023). The most recent abundance estimate for the Hawaiian stock of Bryde's whales is 791 animals, with a 95 percent confidence interval of 456–1,372 whales (Becker et al., 2022b).

The IWC also recognizes Bryde's whale stocks in the Southern Hemisphere, including both Northern and Southern Indian Ocean stocks. There are no recent population abundance estimates available for either of these stocks (International Whaling Commission, 2024).

Given their distribution, Bryde's whales are expected to occur in all of the SURTASS modeling sites except for the northernmost location (site 15, Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.4-1, following the modeling site descriptions. Figures 2.4-1 and 2.4-2, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.4.1 Modeling Site 1 – East of Japan

Density estimates for Bryde's whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022) and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). The winter/spring density estimate of 0.00065 animals/km^2 was based on a total abundance estimate of 1,851 Bryde's whales (CV = 0.413) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00468 animals/km^2 was based on a total abundance estimate of 13,306 Bryde's whales (CV = 0.251) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.4.2 Modeling Site 2 – North Philippine Sea

Density estimates for Bryde's whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the northwest of modeling site 2, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00065 animals/km^2 was based on a total abundance estimate of 1,851 Bryde's whales (CV = 0.413) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00468 animals/km^2 was based on a total abundance estimate of 13,306 Bryde's whales (CV = 0.251) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.4.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for Bryde's whale specific to this area were not available. To provide a representative estimate, recent data derived from a habitat-based density model for the Hawaiian Islands EEZ was used (Becker et al., 2022b), since the latter encompasses the same latitude range in the North Pacific as modeling site 3. Annual model predictions from 2017 to 2020 were used to provide a multi-year average estimate of 0.00030 animals/km^2 (CV = 0.538). Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.4.4 MODELING SITE 4 – GUAM

Bryde's whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area and were based on line-transect analyses of sightings collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Fulling et al., 2011). During this survey, there were a total of 18 Bryde's whale sightings, 16 of which were on-effort and supported the derivation of a design-based density estimate of 0.00041 animals/km^2 (CV = 0.45).

2.4.5 MODELING SITE 5 – SEA OF JAPAN

Density data for Bryde's whale specific to this area were not available. In order to provide representative estimates, density estimates derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 were used (Takahashi et al., 2022). The winter/spring density estimate of 0.00065 animals/km^2 was based on a total abundance estimate of 1,851 Bryde's whales (CV = 0.413) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00468 animals/km^2 was based on a total abundance estimate of 13,306 Bryde's whales (CV = 0.251) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.4.6 MODELING SITE 6 – EAST CHINA SEA

Density data for Bryde's whale specific to this area were not available. In order to provide a representative estimate, recent data derived from a habitat-based density model for the Hawaiian Islands EEZ was used (Becker et al., 2022b), since the latter encompasses the same latitude range in the North Pacific as modeling site 6. Annual model predictions from 2017 to 2020 were used to provide a multi-year average estimate of 0.00030 animals/km^2 (CV = 0.538). Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.4.7 MODELING SITE 7 – SOUTH CHINA SEA

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Bryde's whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.4.8 MODELING SITE 8 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 25° TO 40° N

Density estimates for Bryde's whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the north of modeling site 8, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00065 animals/km^2 was based on a total abundance estimate of 1,851 Bryde's whales (CV = 0.413) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00468 animals/km^2 was based on a total abundance estimate of 13,306 Bryde's whales (CV = 0.251) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.4.9 MODELING SITE 9 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 10° TO 25° N

Bryde's whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT study area, given the similar latitude of these sites in the western North Pacific. The density estimates were based on line-transect analyses of sightings collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Fulling et al., 2011). During this survey, there were a total of 18 Bryde's whale sightings, 16 of which were on-effort and supported the derivation of a design-based density estimate of 0.00041 animals/km^2 (CV = 0.45).

2.4.10 MODELING SITE 10 – HAWAII NORTH

Bryde's whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2020 (Becker et al., 2022b). The Bryde's whale habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on weekly environmental conditions specific to the most recent four years of the study period (i.e., 2017–2020). The separate weekly predictions were then averaged across the full 2017–2020 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.4.11 MODELING SITE 11 – HAWAII SOUTH

Bryde's whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2020 (Becker et al., 2022b). The Bryde's whale habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on weekly environmental conditions specific to the most recent four years of the study period (i.e., 2017–2020). The separate weekly predictions were then averaged across the full 2017–2020 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.4.12 MODELING SITE 12 – OFFSHORE SRI LANKA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Bryde's whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.4.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Bryde's whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.4.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Bryde's whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.4-1: Summary of Density Values for Bryde's Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00065	0.00468	0.00468	0.00065
Modeling Site 2	0.00065	0.00468	0.00468	0.00065
Modeling Site 3	0.00030	0.00030	0.00030	0.00030
Modeling Site 4	0.00041	0.00041	0.00041	0.00041
Modeling Site 5	0.00065	0.00468	0.00468	0.00065
Modeling Site 6	0.00030	0.00030	0.00030	0.00030
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00065	0.00468	0.00468	0.00065
Modeling Site 9	0.00041	0.00041	0.00041	0.00041
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

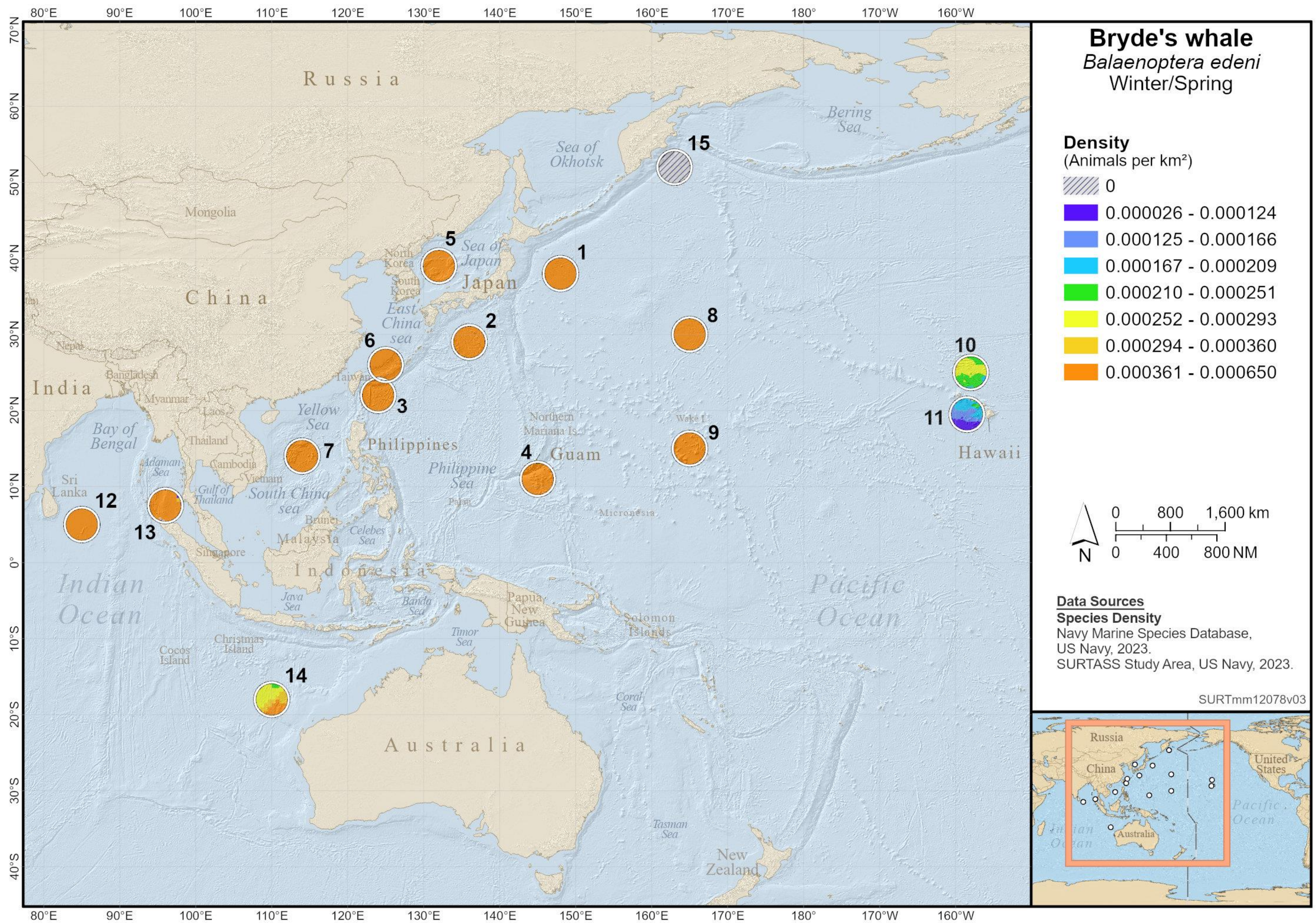


Figure 2.4-1: Winter/Spring Distribution of Bryde's Whale in the SURTASS LFA Study Area

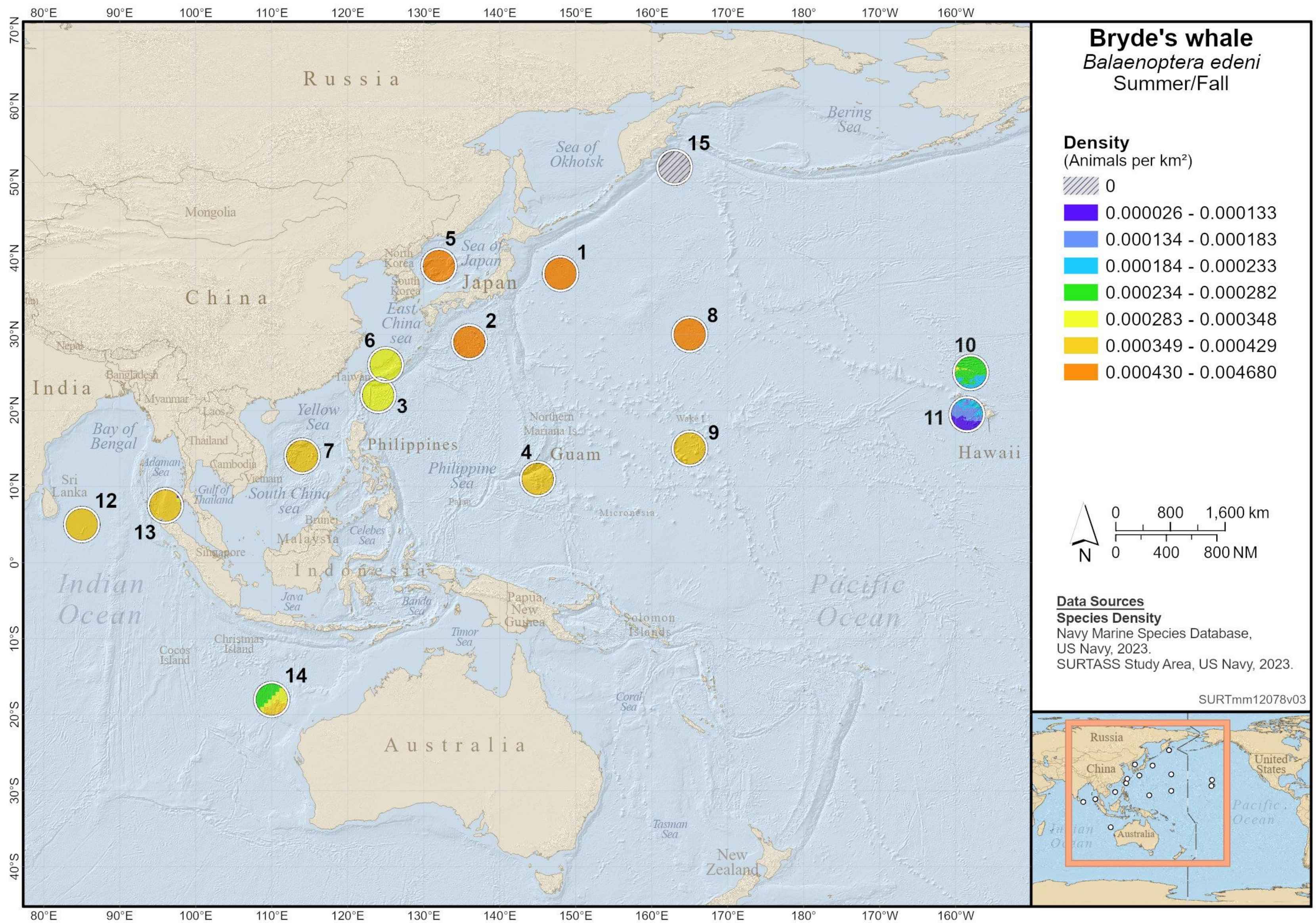


Figure 2.4-2: Summer/Fall Distribution of Bryde's Whale in the SURTASS LFA Study Area

2.5 *Balaenoptera musculus*, Blue Whale and *Balaenoptera musculus brevicauda*, Pygmy Blue Whale

The blue whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range. It is also listed as endangered by the IUCN Red List of Threatened Species (Cooke, 2018c). The pygmy blue whale is listed as Data Deficient by the IUCN Red List of Threatened Species.

The blue whale inhabits all oceans and typically occur near the coast, over the continental shelf, though they are also found in oceanic waters (Stafford et al., 2001). Most baleen whales spend their summers feeding in productive waters near the higher latitudes and winters in the warmer waters at lower latitudes (Širović et al., 2004). The pygmy blue whale is found primarily in the Southern Hemisphere and northern Indian Ocean (Jefferson et al., 2015).

A single stock of blue whales is recognized by the IWC in the North Pacific Ocean. Based on data collected in 2008, the abundance estimate for this stock was 2,500 animals, with a 95 percent confidence interval of 1,700–3,600 whales (International Whaling Commission, 2024). The IWC also recognizes a Southern Hemisphere blue whale stock, although data are not sufficient to estimate an abundance specific to the Indian Ocean population of pygmy blue whales.

For the MMPA stock assessment reports, NMFS recognizes two stocks within the North Pacific: the Eastern North Pacific stock and the Central North Pacific stock. The Eastern North Pacific stock feeds primarily in waters off the U.S. West Coast, where current abundance is estimated at 1,898 (CV = 0.085) whales derived from mark-recapture methods based on photographic identification data (Calambokidis & Barlow, 2020). The Central North Pacific stock includes blue whales that occur in waters within the Hawaiian Islands EEZ. The most recent abundance estimate for blue whales occurring within Hawaiian waters is 137 animals, with a 95 percent confidence interval of 23–796 whales (Bradford et al., 2021). However, this estimate is considered biased low because the sighting data used to derive this estimate were collected in summer and fall, when the majority of blue whales would be expected to be at higher latitude feeding grounds during this this time of year.

Seasonal density estimates for blue whales are available for all of the SURTASS modeling sites, although in some sites they are only seasonally present, as described below. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.5-1, following the modeling site descriptions. Figures 2.5-1 to 2.5-3, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.5.1 Modeling Site 1 – East of Japan

Density estimates for blue whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022) and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). The winter/spring density estimate of 0.00006 animals/km^2 was based on a total abundance estimate of 161 blue whales (CV = 0.461) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00034 animals/km^2 was based on a total abundance estimate of 958 blue whales (CV = 0.474) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.5.2 Modeling Site 2 – North Philippine Sea

Density estimates for blue whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the northwest of modeling site 2, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00006 animals/km^2 was based on a total abundance estimate of 161 blue whales (CV = 0.461) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00034 animals/km^2 was based on a total abundance estimate of 958 blue whales (CV = 0.474) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.5.3 Modeling Site 3 – West Philippine Sea

Density data for blue whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021), since the latter encompasses the same latitude range in the North Pacific as modeling site 3. The most recent estimate of 0.00006 animals/km^2 (CV = 1.12) was based on 2010 survey data. Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.5.4 Modeling Site 4 – Offshore Guam

Blue whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ was used to characterize blue whale density in fall, winter, and spring (Bradford et al., 2021). Blue whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2015); therefore, a density of zero is used for that season.

2.5.5 Modeling Site 6 – East China Sea

Density data for blue whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021), since the latter encompasses the same latitude range in the North Pacific as modeling site 6. The most recent estimate of 0.00006 animals/km^2 (CV = 1.12) was based on 2010 survey data. Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.5.6 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site year round.

2.5.7 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for blue whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the north of modeling site 8, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00006 animals/km^2 was based on a total abundance estimate of 161 blue whales (CV = 0.461) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00034 animals/km^2 was based on a total abundance estimate of 958 blue whales (CV = 0.474) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.5.8 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Blue whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT study area, given the similar latitude of these sites in the western North Pacific. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ of 0.00006 animals/km^2 (CV = 1.12) was used to characterize blue whale density in fall, winter, and spring (Bradford et al., 2021). Blue whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2015); therefore, a density of zero is used for that season.

2.5.9 Modeling Site 10 – Hawaii North

Blue whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on line-transect analyses of sighting data collected in waters within the Hawaiian Islands EEZ in 2010 (Bradford et al., 2021). The uniform density estimate for blue whales of 0.00006 animals/km^2 (CV = 1.12) was used for fall, winter, and spring. In the summer, blue whales are considered absent in Hawaiian waters, and blue whales were not sighted during systematic surveys of the Hawaiian Islands EEZ during summer and fall of 2002 or 2017 (Bradford et al., 2021). During a summer/fall line-transect survey in 2010, blue whales were seen within the Hawaiian Islands EEZ, but only during the fall months (Bradford et al., 2017). Therefore, a density of zero is used for summer in this modeling site.

2.5.10 Modeling Site 11 – Hawaii South

Blue whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on line-transect analyses of sighting data collected in waters within the Hawaiian Islands EEZ in 2010 (Bradford et al., 2021). The uniform density estimate for blue whales of 0.00006 animals/km^2 (CV = 1.12) was used for fall, winter, and spring. In the summer, blue whales are considered absent in Hawaiian waters, and blue whales were not sighted during systematic surveys of the Hawaiian Islands EEZ during summer and fall of 2002 or 2017 (Bradford et al., 2021). During a summer/fall line-transect survey in 2010, blue whales were seen within the Hawaiian Islands EEZ, but only during the fall months (Bradford et al., 2017). Therefore, a density of zero is used for summer in this modeling site.

2.5.11 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and blue whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.5.12 MODELING SITE 13 – ANDAMAN SEA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and blue whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.5.13 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and blue whale density estimates for modeling site 14 were not available. Density data from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.5.14 MODELING SITE 15 – NORTHEAST OF JAPAN

Density estimates for blue whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). The survey area encompasses the southwest portion of modeling site 15 (see Figure 1.2-2), and these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00006 animals/km^2 was based on a total abundance estimate of 161 blue whales (CV = 0.461) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00034 animals/km^2 was based on a total abundance estimate of 958 blue whales (CV = 0.474) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

Table 2.5-1: Summary of Density Values for Blue Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00006	0.00034	0.00034	0.00006
Modeling Site 2	0.00006	0.00034	0.00034	0.00006
Modeling Site 3	0.00006	0.00006	0.00006	0.00006
Modeling Site 4	0.00006	0	0.00006	0.00006
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00006	0.00006	0.00006	0.00006
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00006	0.00034	0.00034	0.00006
Modeling Site 9	0.00006	0	0.00006	0.00006
Modeling Site 10	0.00006	0	0.00006	0.00006
Modeling Site 11	0.00006	0	0.00006	0.00006
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00006	0.00034	0.00034	0.00006

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

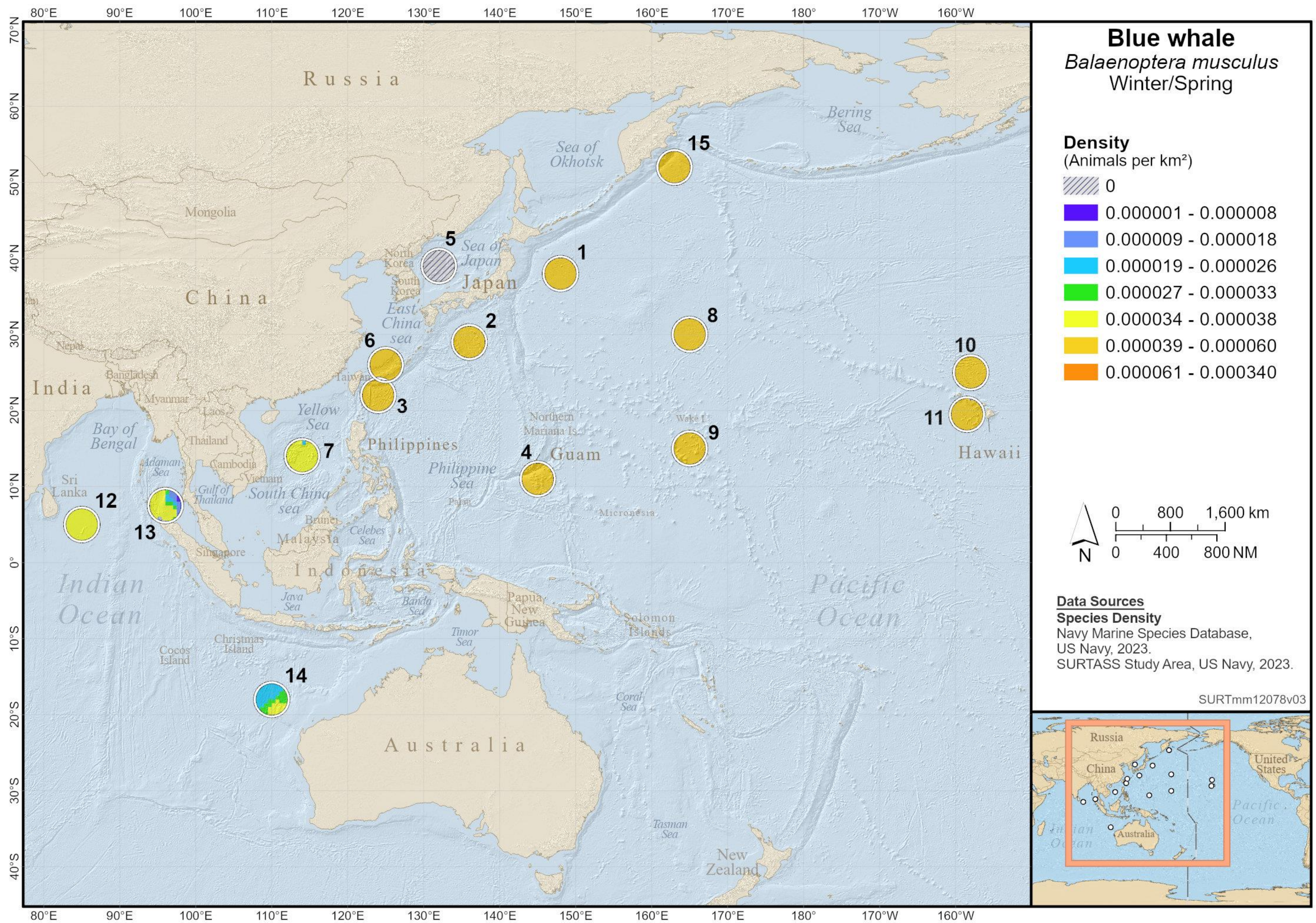


Figure 2.5-1: Winter/Spring Distribution of Blue Whale in the SURTASS LFA Study Area

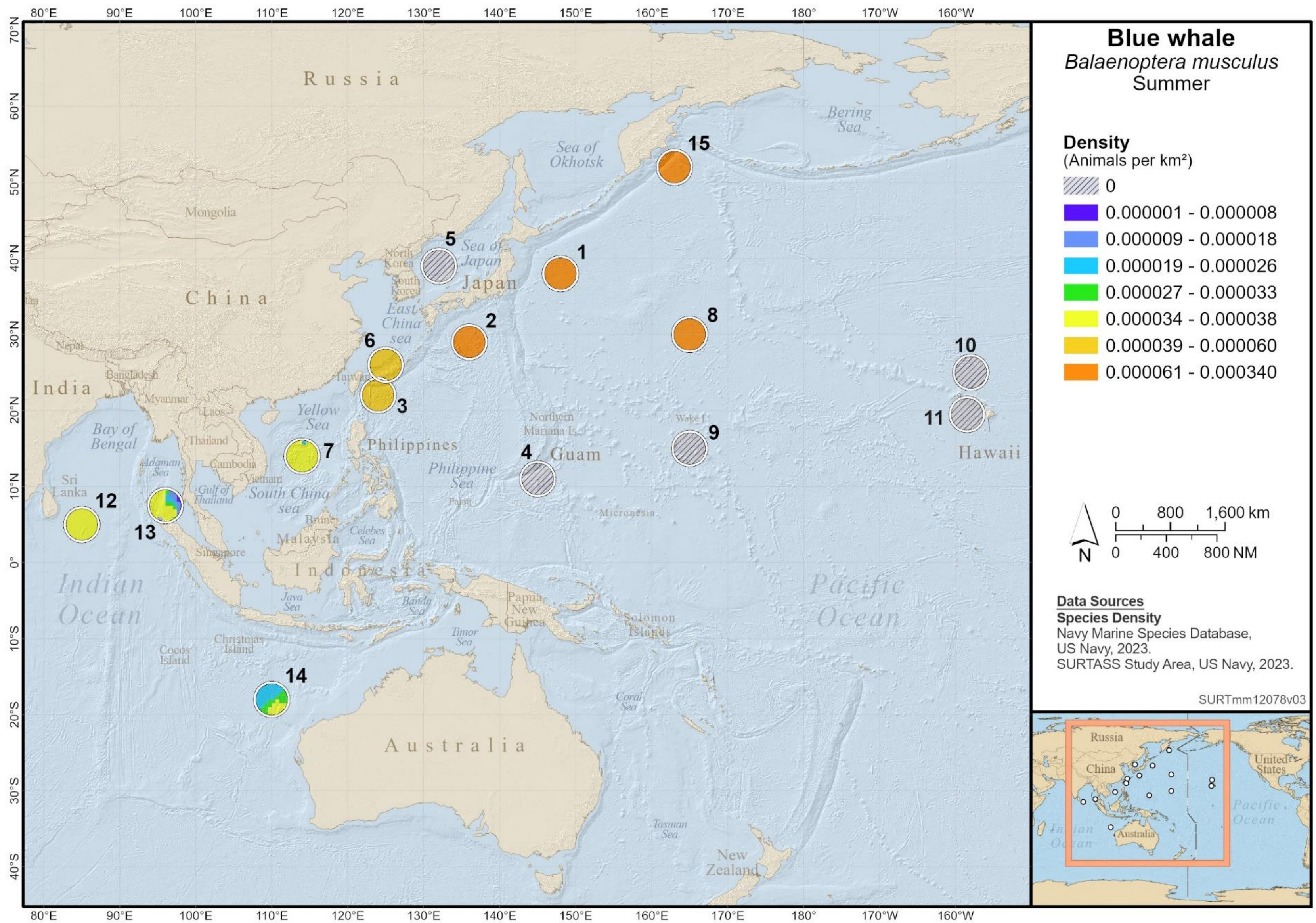


Figure 2.5-2: Summer Distribution of Blue Whale in the SURTASS LFA Study Area

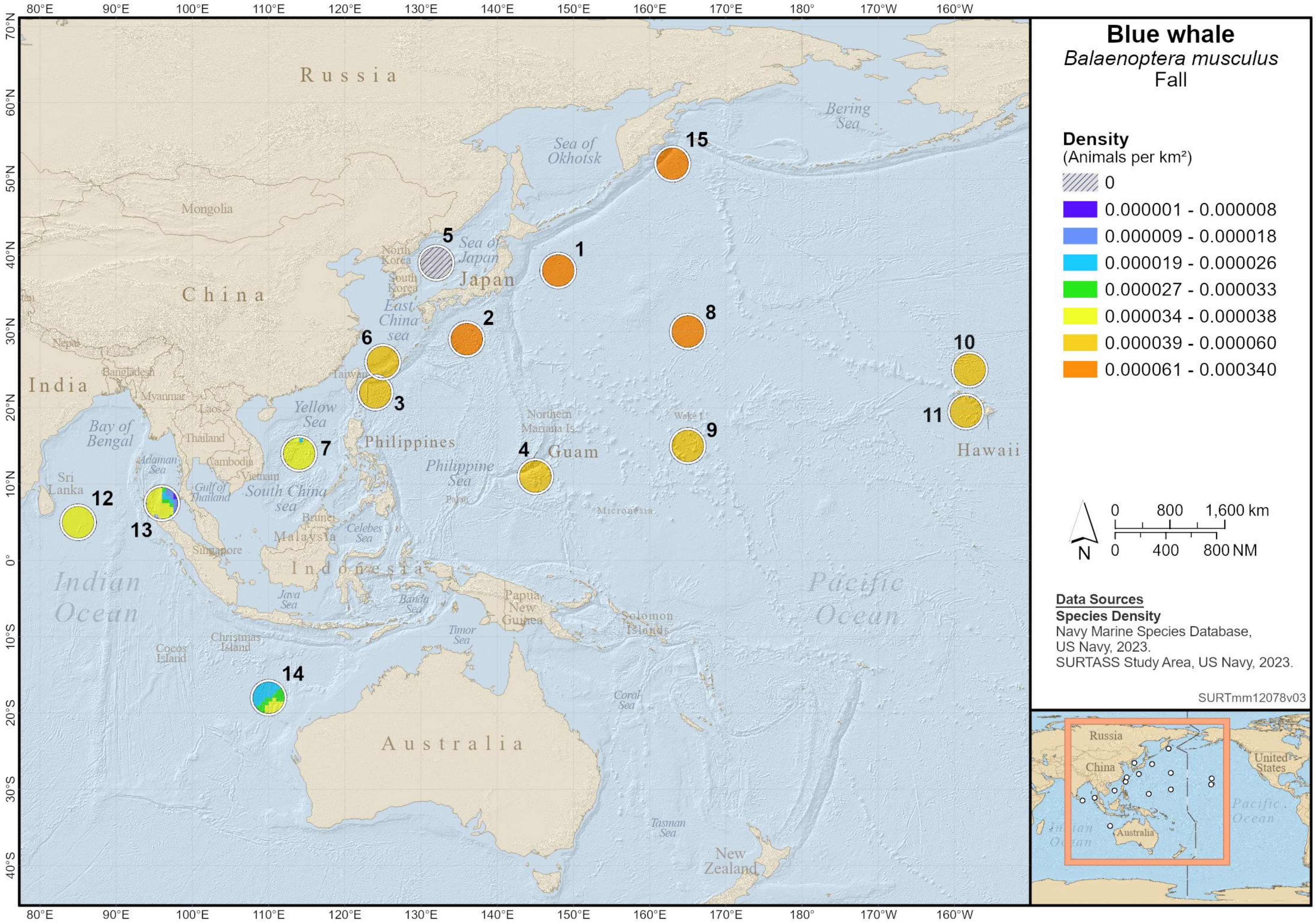


Figure 2.5-3: Fall Distribution of Blue Whale in the SURTASS LFA Study Area

2.6 *BALAENOPTERA OMURAI*, OMURA'S WHALE

Omura's whale is not an ESA-listed species. Omura's whale was first recognized as a species in 2003. They were previously confused as Bryde's whale until molecular genetic studies confirmed that they are a separate species (Jefferson et al., 2015). Omura's whales are not assigned to a stock by NMFS because this species is not known to occur in U.S. waters and is therefore not managed under U.S. jurisdiction. Omura's whale is listed by the IUCN Red List of Threatened Species as Data Deficient (Cooke & Brownell Jr., 2019).

Since this species was only formally recognized in 2003, little population information is known or available for this species. The primary range of Omura's whale is considered the tropical and subtropical waters of the western Pacific and eastern Indian oceans and tends to occur in nearshore waters over the continental shelf (Jefferson et al., 2015).

With so little information available, Omura's whale is assumed to comprise one Western North Pacific stock throughout its range in the western Pacific Ocean.

Given their distribution, Omura's whales are expected to occur in the SURTASS modeling sites located in the tropical and subtropical waters of the western Pacific and eastern Indian oceans, as well as the Sea of Japan. For all the other sites (Site 1, 8, 10, 11, and 15), a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.6-1, following the modeling site descriptions. Figure 2.6-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.6.1 MODELING SITE 2 – NORTH PHILIPPINE SEA

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale average density estimate for this study area was assigned to Omura's whale to provide a representative estimate (see Section 2.4 for a description of the Bryde's whale density estimates). The resulting average density estimate was 0.00027 animals/km^2. Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.6.2 MODELING SITE 3 – WEST PHILIPPINE SEA

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale average density estimate for this study area was assigned to Omura's whale to provide a representative estimate (see Section 2.4 for a description of the Bryde's whale density estimates). The resulting year-round density estimate was 0.00003 animals/km^2.

2.6.3 MODELING SITE 4 – GUAM

Omura's whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area. Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the

Bryde's whale average density estimate for this study area was assigned to Omura's whale to provide a representative estimate (see Section 2.4 for a description of the Bryde's whale density estimates). The resulting year-round density estimate was 0.00004 animals/km^2.

2.6.4 MODELING SITE 5 – SEA OF JAPAN

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale average density estimate for this study area was assigned to Omura's whale to provide a representative estimate (see Section 2.4 for a description of the Bryde's whale density estimates). The resulting average density estimate was 0.00027 animals/km^2. Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.6.5 MODELING SITE 6 – EAST CHINA SEA

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale average density estimate for this study area was assigned to Omura's whale to provide a representative estimate (see Section 2.4 for a description of the Bryde's whale density estimates). The resulting average density estimate was 0.00003 animals/km^2. Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.6.6 MODELING SITE 7 – SOUTH CHINA SEA

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale density estimates for this study area were assigned to Omura's whale to provide representative estimates (see Section 2.4 for a description of the Bryde's whale density estimates). Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and thus data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available for Bryde's whale. For Omura's whale, 10 percent of these spatially explicit estimates were incorporated into the NMSDD for this site.

2.6.7 MODELING SITE 9 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 10° TO 25° N

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale average density estimate for this study area was assigned to Omura's whale to provide a representative estimate (see Section 2.4 for a description of the Bryde's whale density estimates). The resulting year-round density estimate was 0.00004 animals/km^2.

2.6.8 MODELING SITE 12 – OFFSHORE SRI LANKA

Given the lack of any quantitative abundance data for Omura's whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited

Environmental Research Associates, 2008), 10 percent of the Bryde's whale density estimates for this study area were assigned to Omura’s whale to provide representative estimates (see Section 2.4 for a description of the Bryde’s whale density estimates). Survey data are extremely limited in this region (Kaschner et al., 2012), and thus data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available for Bryde’s whale. For Omura’s whale, 10% of these spatially explicit estimates were incorporated into the NMSDD for this site.

2.6.9 MODELING SITE 13 – ANDAMAN SEA

Given the lack of any quantitative abundance data for Omura’s whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale density estimates for this study area were assigned to Omura’s whale to provide representative estimates (see Section 2.4 for a description of the Bryde’s whale density estimates). Survey data are extremely limited in this region (Kaschner et al., 2012), and thus data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available for Bryde’s whale. For Omura’s whale, 10 percent of these spatially explicit estimates were incorporated into the NMSDD for this site.

2.6.10 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Given the lack of any quantitative abundance data for Omura’s whale and consistent with the approach taken to assess a proposed marine geophysical survey in waters of Southeast Asia (LGL Limited Environmental Research Associates, 2008), 10 percent of the Bryde's whale density estimates for this study area were assigned to Omura’s whale to provide representative estimates (see Section 2.4 for a description of the Bryde’s whale density estimates). Survey data are extremely limited in this region (Kaschner et al., 2012), and thus data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available for Bryde’s whale. For Omura’s whale, 10 percent of these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.6-1: Summary of Density Values for Omura's Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.00027	0.00027	0.00027	0.00027
Modeling Site 3	0.00003	0.00003	0.00003	0.00003
Modeling Site 4	0.00004	0.00004	0.00004	0.00004
Modeling Site 5	0.00027	0.00027	0.00027	0.00027
Modeling Site 6	0.00003	0.00003	0.00003	0.00003
Modeling Site 7	S	S	S	S
Modeling Site 8	0	0	0	0
Modeling Site 9	0.00004	0.00004	0.00004	0.00004
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

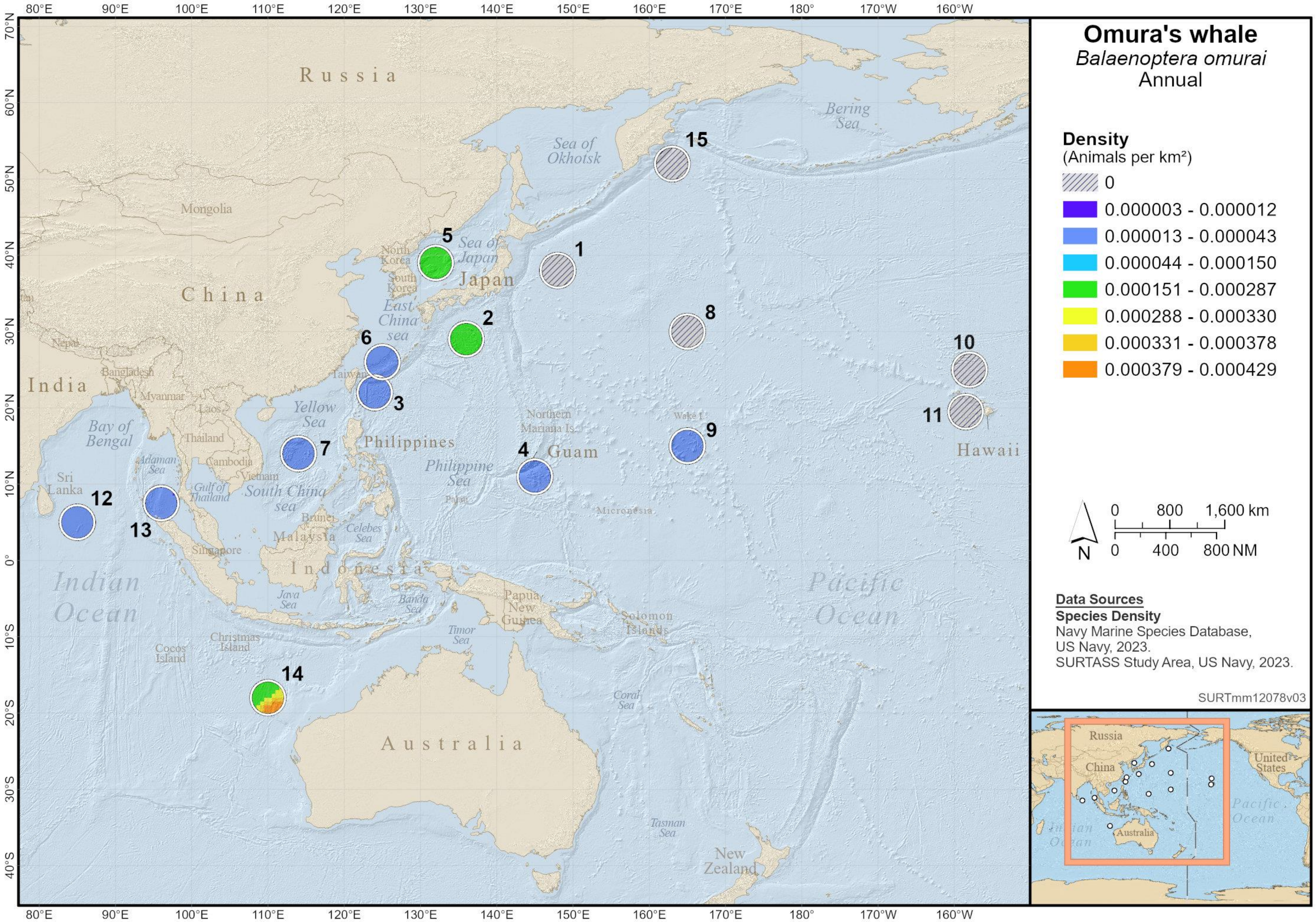


Figure 2.6-1: Annual Distribution of Omura's Whale in the SURTASS LFA Study Area

2.7 *BALAENOPTERA PHYSALUS*, FIN WHALE

The fin whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range. It is also listed as Vulnerable by the IUCN Red List of Threatened Species (Cooke, 2018d).

The fin whale inhabits all oceans but prefers temperate and polar waters and is scarcely seen in warm, tropical waters (Archer et al., 2019; Reeves et al., 2002). Similar to other baleen whales they spend their summers feeding in productive waters near the higher latitudes and winters in the warmer waters at lower latitudes, although their movements do not seem to follow a simple pattern (Jefferson et al., 2015). In some areas there appear to be resident populations of fin whales that show limited north/south movements (Dohl et al., 1983; Forney & Barlow, 1998). Fin whales are highly adaptable and inhabit both oceanic waters as well as waters over the continental shelf, especially when following prey (Azzellino et al., 2008; Panigada et al., 2008; Scales et al., 2017).

In the North Pacific Ocean, the IWC recognizes two stocks of fin whale, an East China Sea stock and a stock that includes the rest of the North Pacific. Based on data collected in 2015, the abundance estimate for the North Pacific stock was 40,800 animals, with a 95 percent confidence interval of 28,000–59,000 whales (International Whaling Commission, 2024). The IWC also recognizes fin whale stocks in the Southern Hemisphere, although recent abundance estimates are not available.

NMFS recognizes three stocks of fin whales in U.S. Pacific waters: the Northeast Pacific stock, the California/Oregon/Washington stock, and the Hawaii stock (Carretta et al., 2023). The most recent abundance estimate for fin whales occurring within Hawaiian waters is 203 animals, with a 95 percent confidence interval of 40–1,028 whales (Bradford et al., 2021).

Seasonal density estimates for fin whales are available for all of the SURTASS modeling sites except sites 12 (Offshore Sri Lanka) and 13 (Andaman Sea), although in some sites they are only seasonally present, as described below. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.7-1, following the modeling site descriptions. Figures 2.7-1 to 2.7-3, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.7.1 MODELING SITE 1 – EAST OF JAPAN

Density estimates for fin whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022) and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). The winter/spring density estimate of 0.00048 animals/km^2 was based on a total abundance estimate of 1,369 blue whales (CV = 0.295) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00139 animals/km^2 was based on a total abundance estimate of 3,957 blue whales (CV = 0.425) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.7.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density estimates for fin whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the northwest of modeling site 2, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00048 animals/km^2 was based on a total abundance estimate of 1,369 blue whales (CV = 0.295) derived from survey data collected in 2011 and

2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00139 animals/km^2 was based on a total abundance estimate of 3,957 blue whales (CV = 0.425) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.7.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for fin whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021), since the latter encompasses the same latitude range in the North Pacific as modeling site 3. The most recent (2017) estimate was 0.00008 animals/km^2. Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.7.4 MODELING SITE 4 – OFFSHORE GUAM

Fin whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ (0.00008 animals/km^2) was used to characterize blue whale density in fall, winter, and spring (Bradford et al., 2021). Fin whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2015); therefore, a density of zero is used for that season.

2.7.1 MODELING SITE 5 – SEA OF JAPAN

Density data for Bryde's whale specific to this area were not available. In order to provide representative estimates, density estimates derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 were used (Takahashi et al., 2022). The winter/spring density estimate of 0.00048 animals/km^2 was based on a total abundance estimate of 1,369 blue whales (CV = 0.295) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00139 animals/km^2 was based on a total abundance estimate of 3,957 blue whales (CV = 0.425) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.7.2 MODELING SITE 6 – EAST CHINA SEA

Density data for fin whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021), since the latter encompasses the same latitude range in the North Pacific as modeling site 6. The most recent (2017) estimate was 0.00008 animals/km^2 (CV = 0.99). Given the lack of seasonal data for this region, the Navy applied this density estimate year round.

2.7.3 MODELING SITE 7 – SOUTH CHINA SEA

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site for winter and spring. The models show no occurrence of fin whale at this site in summer and fall, so a zero density estimate was applied to these seasons.

2.7.4 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for fin whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the north of modeling site 8, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00048 animals/km^2 was based on a total abundance estimate of 1,369 blue whales (CV = 0.295) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00139 animals/km^2 was based on a total abundance estimate of 3,957 blue whales (CV = 0.425) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.7.5 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Fin whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ of 0.00008 animals/km^2 (CV = 0.99) was used to characterize fin whale density in fall, winter, and spring (Bradford et al., 2021). Blue whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2015); therefore, a density of zero is used for that season.

2.7.6 Modeling Site 10 – Hawaii North

Fin whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for fin whales of 0.00008 animals/km^2 (CV = 0.99) was used for fall, winter, and spring. In summer, fin whales are likely absent from Hawaiian waters. During three separate line-transect surveys of waters within the Hawaiian Islands EEZ during summer and fall, fin whales were only seen during the fall months (Barlow, 2006; Bradford et al., 2017). Fin whales were not detected during the summer months of any year from 2011 to 2017 from passive acoustic recordings on an array of 14 hydrophones at the U.S. Navy Pacific Missile Range Facility off Kauai, Hawaii (Guazzo et al., 2021; Helble et al., 2020). Therefore, a density of zero is used for summer in this modeling site.

2.7.7 Modeling Site 11 – Hawaii South

Fin whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for fin whales of 0.00008 animals/km^2 (CV = 0.99) was used for fall, winter, and spring. In summer, fin whales are likely absent from Hawaiian waters. During three separate line-transect surveys of waters within the Hawaiian Islands EEZ during summer and fall, fin whales were only seen during the fall months (Barlow, 2006; Bradford et al., 2017). Fin whales were not detected during the summer months of any year from 2011 to 2017 from passive acoustic recordings on an array of 14 hydrophones at the U.S. Navy Pacific Missile Range Facility off Kauai, Hawaii (Guazzo et al., 2021; Helble et al., 2020). Therefore, a density of zero is used for summer in this modeling site.

2.7.8 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and fin whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. The models show no occurrence of fin whale at this site in winter or spring, so a zero density estimate was applied to these seasons.

2.7.9 Modeling Site 15 – Northeast of Japan

Density estimates for fin whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). The survey area encompasses the southwest portion of modeling site 15 (see Figure 1.2-2), and these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00048 animals/km^2 was based on a total abundance estimate of 1,369 blue whales (CV = 0.295) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00139 animals/km^2 was based on a total abundance estimate of 3,957 blue whales (CV = 0.425) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

Table 2.7-1: Summary of Density Values for Fin Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00048	0.00139	0.00139	0.00048
Modeling Site 2	0.00048	0.00139	0.00139	0.00048
Modeling Site 3	0.00008	0.00008	0.00008	0.00008
Modeling Site 4	0.00008	0	0.00008	0.00008
Modeling Site 5	0.00048	0.00139	0.00139	0.00048
Modeling Site 6	0.00008	0.00008	0.00008	0.00008
Modeling Site 7	S	0	0	S
Modeling Site 8	0.00048	0.00139	0.00139	0.00048
Modeling Site 9	0.00008	0	0.00008	0.00008
Modeling Site 10	0.00008	0	0.00008	0.00008
Modeling Site 11	0.00008	0	0.00008	0.00008
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	S	S	0
Modeling Site 15	0.00048	0.00139	0.00139	0.00048

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

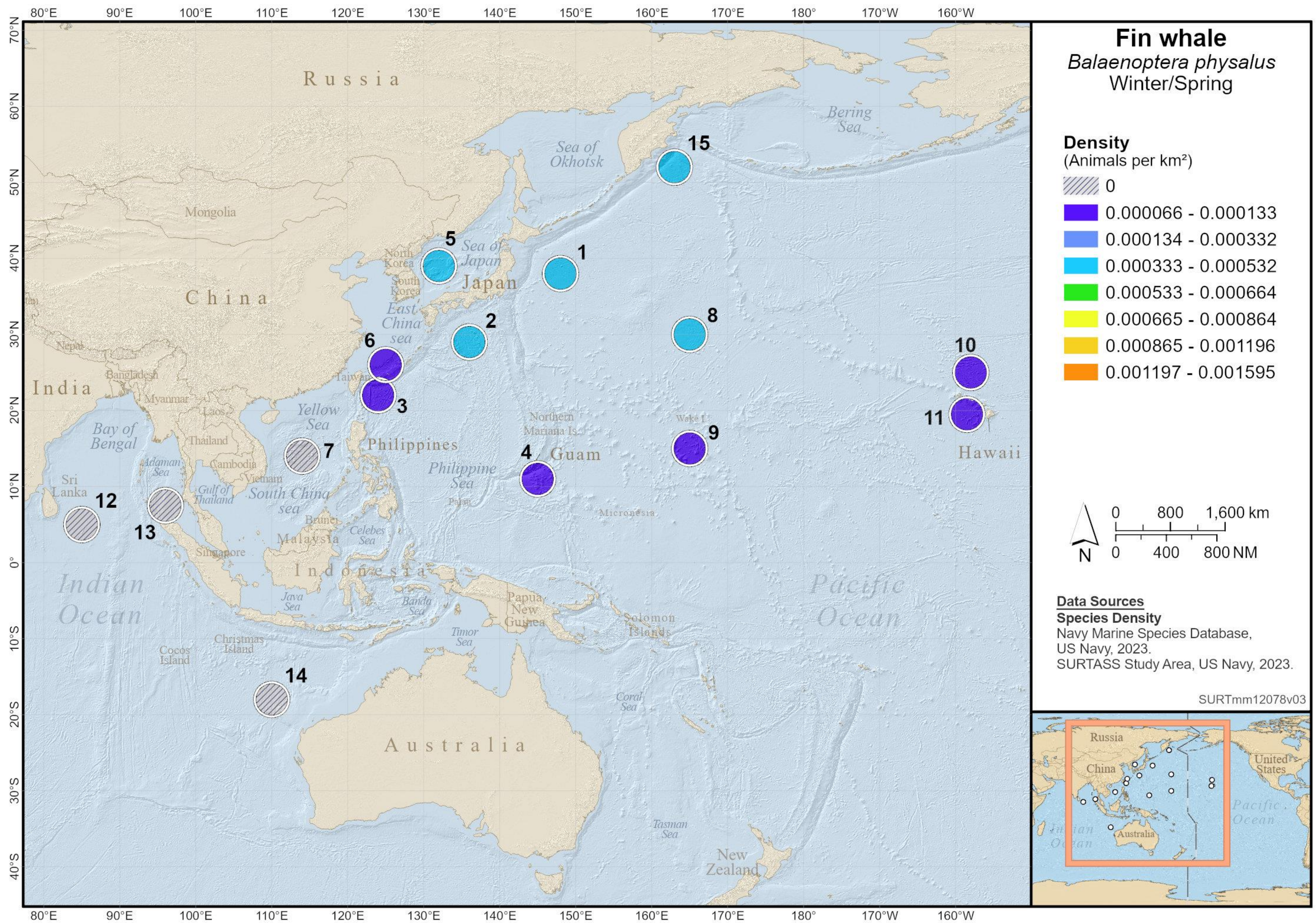


Figure 2.7-1: Winter/Spring Distribution of Fin Whale in the SURTASS LFA Study Area

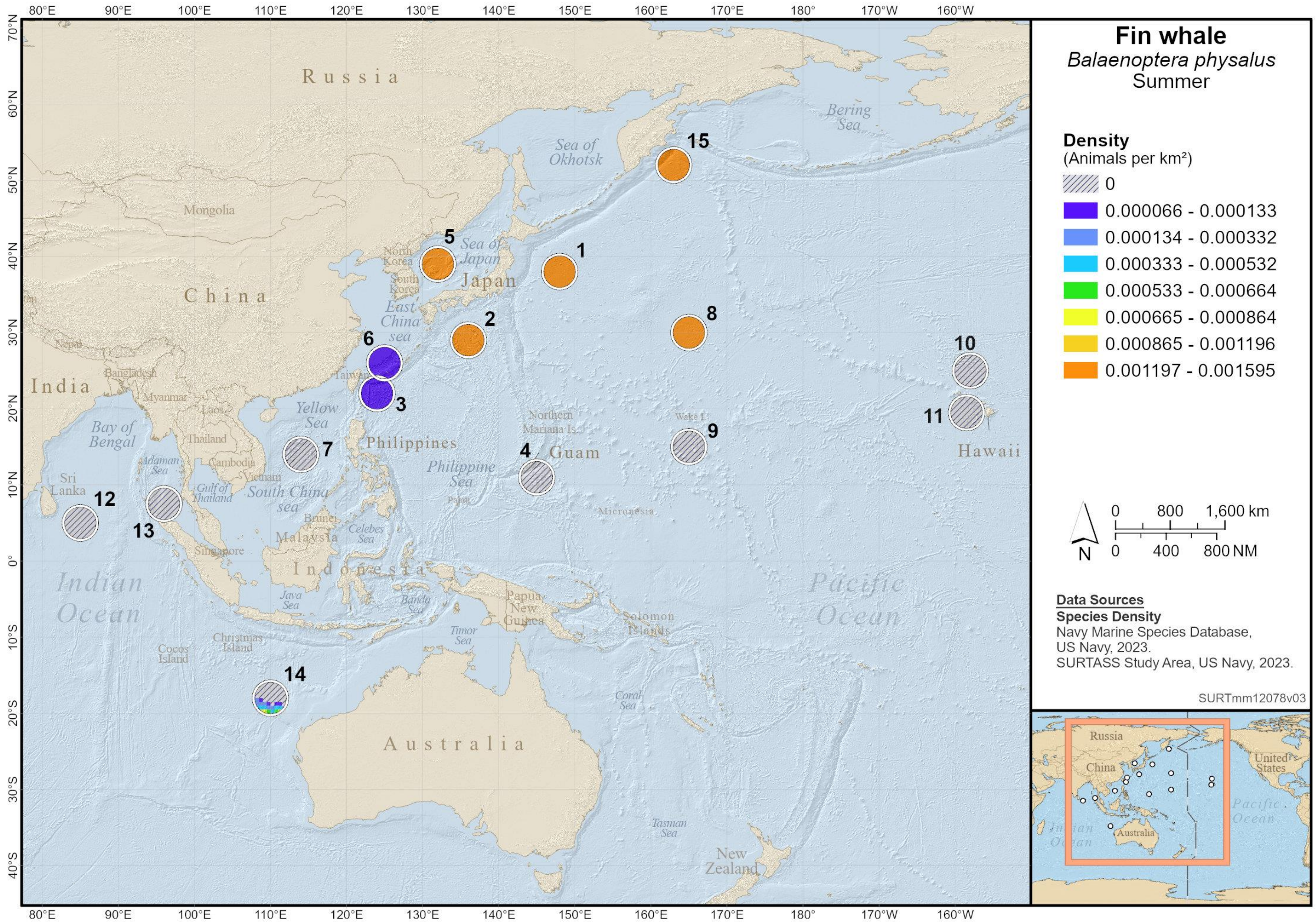


Figure 2.7-2: Summer Distribution of Fin Whale in the SURTASS LFA Study Area

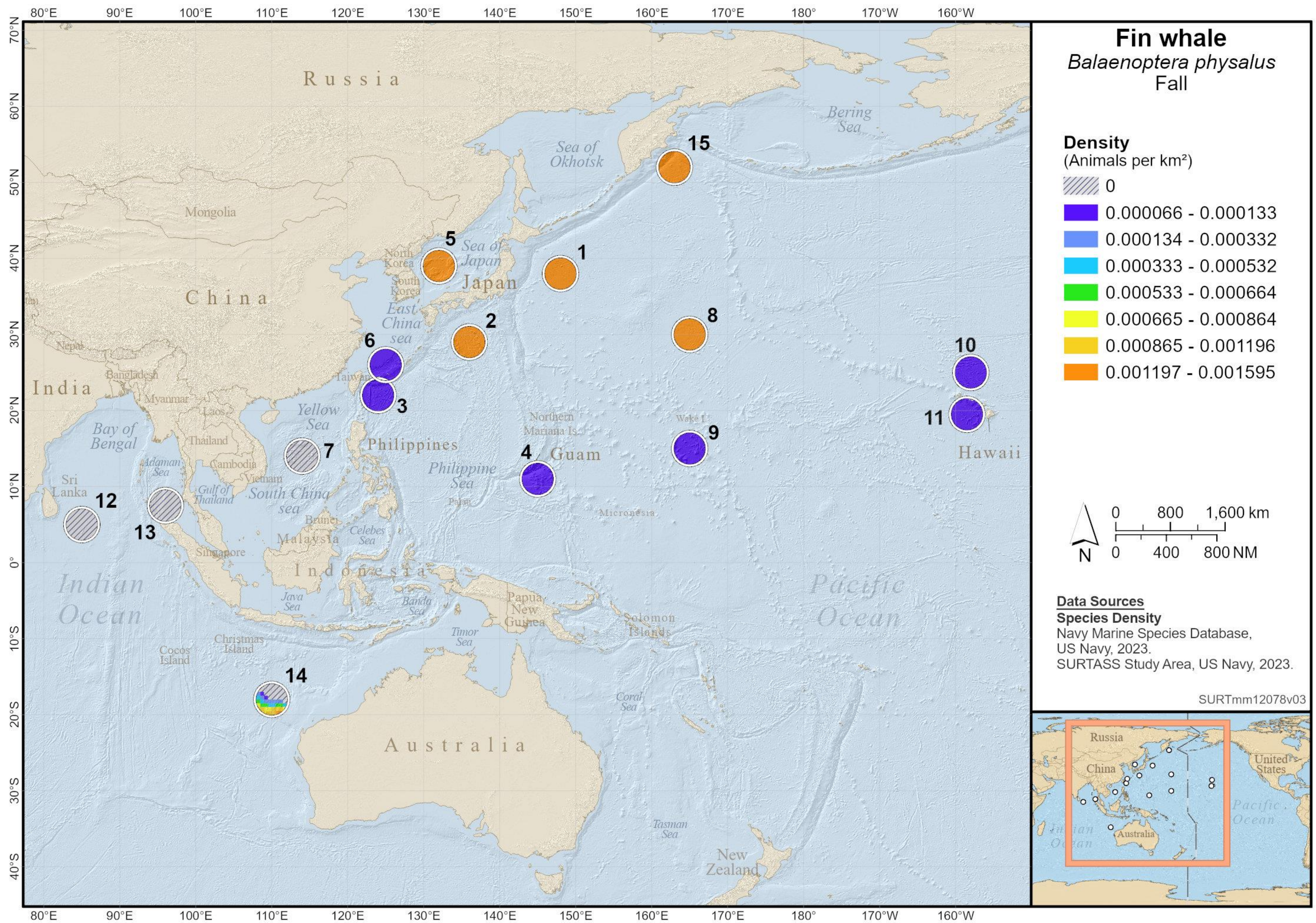


Figure 2.7-3: Fall Distribution of Fin Whale in the SURTASS LFA Study Area

2.8 *EUBALAENA JAPONICA*, NORTH PACIFIC RIGHT WHALE

The North Pacific right whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range. It is also listed as Endangered by the IUCN Red List of Threatened Species (Cooke & Clapham, 2018).

Once distributed throughout the North Pacific and abundant enough to support a whaling industry, the North Pacific right whale is now considered one of the rarest species of marine mammal (Wade et al., 2011). Based on whaling records and genetic analyses, there appears to be two separate populations of North Pacific right whales, an eastern population (with summer feeding grounds primarily in the southeastern Bering Sea) and a western population (with summer feeding grounds primarily in the Sea of Okhotsk) (Brownell et al., 2001). The winter calving grounds of both populations remain largely unknown.

NMFS currently recognizes two stocks of North Pacific right whale: a Western North Pacific stock and an Eastern North Pacific stock (Young, 2023). The most recent population estimate for the Eastern North Pacific stock is between 28 and 31 individuals; although this estimate may be reflective of a Bering Sea subpopulation, the total eastern North Pacific population is unlikely to be much larger (Wade et al., 2011). The IWC also recognizes two stocks of North Pacific right whale, and as of 2023 provides abundance estimates for the Western North Pacific stock as ranging between 400 and 1,100 whales (International Whaling Commission, 2024).

Seasonal density estimates for North Pacific right whales are available for only two of the SURTASS modeling sites, site 1 (East of Japan) and 15 (Northeast of Japan), as described in the following sections. A summary of the density values incorporated into the NMSDD for these modeling sites is provided in Table 2.8-1, following the modeling site descriptions. Figures 2.8-1 and 2.8-2, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.8.1 MODELING SITE 1 – EAST OF JAPAN

Density estimates for North Pacific right whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2014 (Hakamada & Matsuoka, 2016a) and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). Given the assumed very low numbers of remaining North Pacific right whales and the uncertainty about the population status of this stock (Brownell et al., 2001; Wade et al., 2011), the mean abundance estimates were considered biased-high, so for purposes of assigning a density estimate to this modeling site, the lower 95 percent confidence interval (CI) was used (Taylor & Wade 2000). The resulting winter/spring density estimate of 0.00014 animals/km^2 was based on a total abundance estimate (low 95 percent CI) of 396 North Pacific right whales (CV = 0.454) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00004 animals/km^2 was based on a total abundance estimate (low 95 percent CI) of 123 North Pacific right whales (CV = 0.653) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.8.1 MODELING SITE 15 – NORTHEAST OF JAPAN

Density estimates for North Pacific right whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2014 (Hakamada & Matsuoka, 2016a). The survey area encompasses the southwest portion of modeling site 15 (see Figure 1.2-2), and these density data represent the best available for this region of the western North Pacific. Given the assumed very low numbers of remaining North Pacific right whales and the uncertainty about the population status of this stock, the mean abundance estimates were considered biased-high (Tom Jefferson, personal communication 2023), so for purposes of assigning a density estimate to this modeling site, the lower 95 percent confidence interval (CI) was used (Taylor & Wade, 2000). The resulting winter/spring density estimate of 0.00014 animals/km^2 was based on a total abundance estimate (low 95 percent CI) of 396 North Pacific right whales (CV = 0.454) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00004 animals/km^2 was based on a total abundance estimate (low 95 percent CI) of 123 North Pacific right whales (CV = 0.653) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

Table 2.8-1: Summary of Density Values for North Pacific Right Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00014	0.00004	0.00004	0.00014
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.00014	0.00004	0.00004	0.00014

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

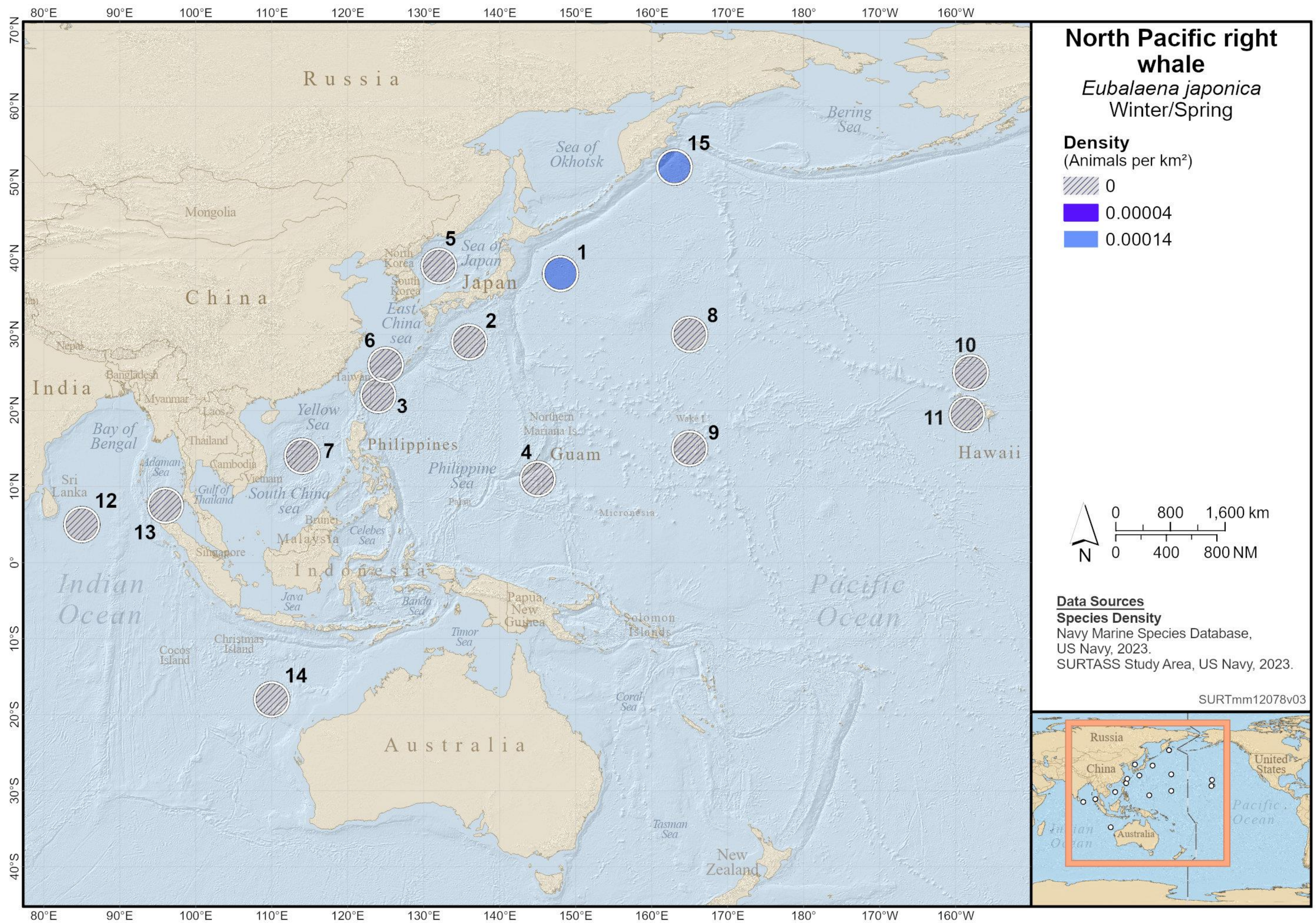


Figure 2.8-1: Winter/Spring Distribution of North Pacific Right Whale in the SURTASS LFA Study Area

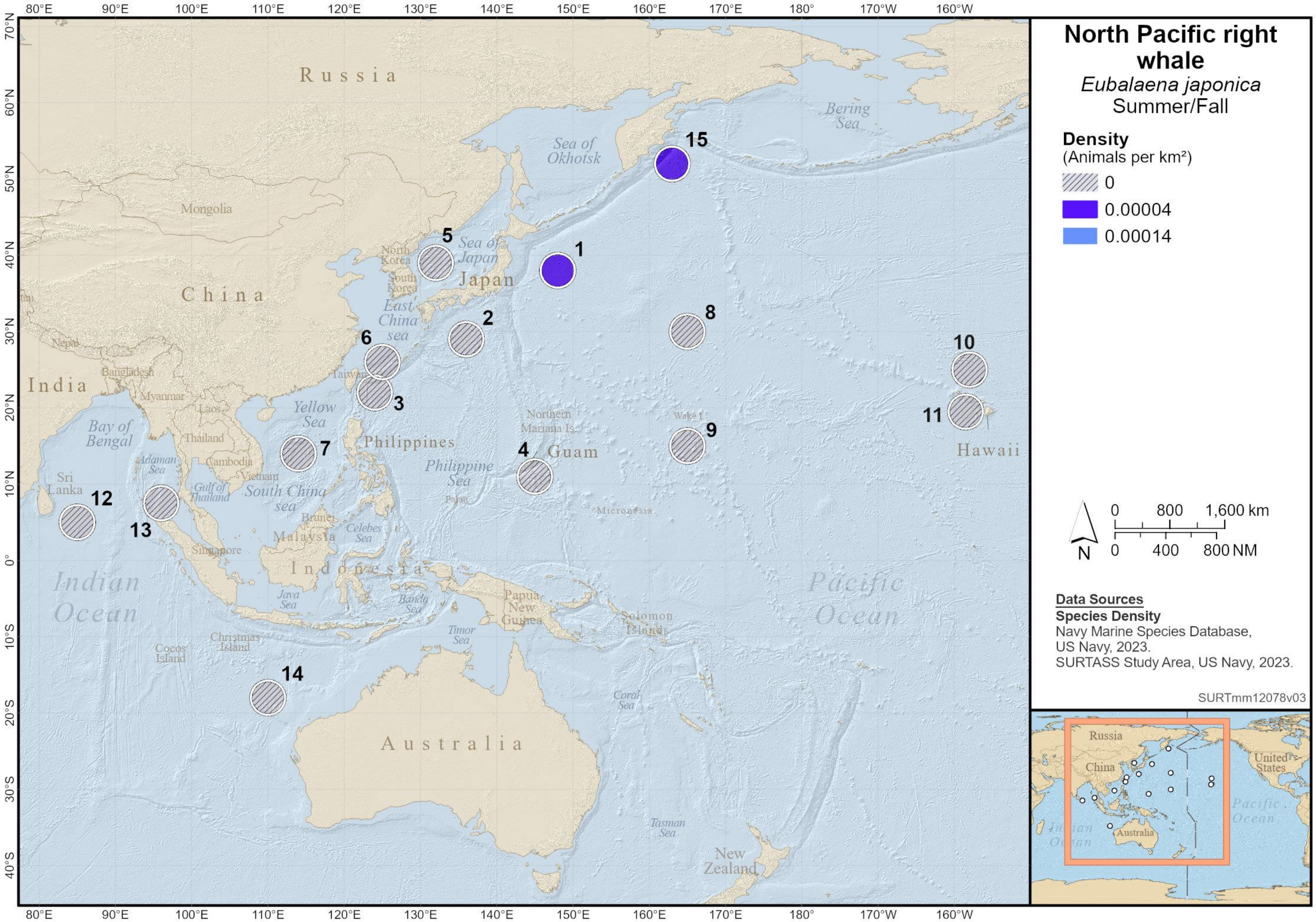


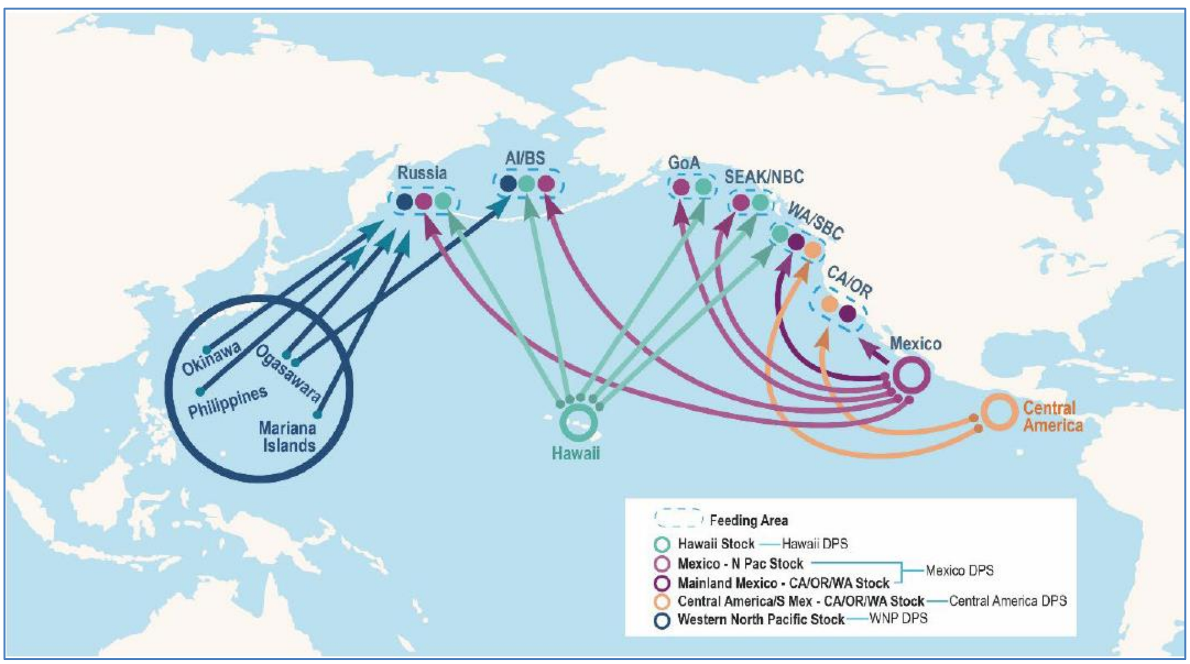
Figure 2.8-2: Summer/Fall Distribution of North Pacific Right Whale in the SURTASS LFA Study Area

2.9 *MEGAPTERA NOVAEANGLIAE*, HUMPBACK WHALE

The global population of humpback whales has been divided into 14 Distinct Population Segments (DPSs), with 5 of the 14 DPSs listed under the ESA (81 Federal Register 62259). NMFS has identified 14 DPSs of humpback whales worldwide, with 4 DPSs occurring in the North Pacific (Carretta et al., 2023). The three previously defined stocks of North Pacific humpback whales did not align with the DPS structure, so NMFS reevaluated the stock structure to incorporate both the locations of foraging and overwintering areas and population demographics. As a result, NMFS defined five stocks in the North Pacific:

1. Central America/Southern Mexico-California-Oregon-Washington stock
2. Mainland Mexico-California-Oregon-Washington stock
3. Mexico-North Pacific stock
4. Hawaii stock
5. Western North Pacific stock

The Hawaii and Western North Pacific stocks occur in the North Pacific portion of the SURTASS LFA Study Area. Humpback whales wintering in Hawaii are identified as the Hawaii DPS and comprise the Hawaii stock. Humpback whales from the Hawaii DPS/stock forage across the North Pacific (Figure 2.9-1).



AI/BS = Aleutian Islands/Bering Sea, GoA = Gulf of Alaska, SEAK/NBC = Southeast Alaska/Northern British Columbia, WA/SBC = Washington/Southern British Columbia, CA/OR = California Oregon. Source: Carretta et al. (2023)

Figure 2.9-1: Humpback Whale Stocks and DPSs Defined in the North Pacific

Humpback whales in the Hawaii DPS are not listed under the ESA, because the population is believed to have fully recovered to its pre-whaling abundance (Barlow et al., 2011; Bettridge et al., 2015; Muto et al., 2017; National Marine Fisheries Service, 2016; Wade et al., 2016). The Western North Pacific DPS is listed as endangered under the under the ESA and as depleted under the MMPA throughout its range. The West Australia DPS of humpback whales is also present in the SURTASS LFA Study Area (site 14) but is not listed under the ESA. The humpback whale is listed as Least Concern by the IUCN Red List of Threatened Species (Cooke, 2018e).

Humpback whales are considered a cosmopolitan species, although they are not typically found in the many equatorial regions or in parts of the high Arctic (Jefferson et al., 2015). They generally migrate from temperate and polar summer feeding grounds to tropical winter breeding grounds. The habitat requirements of wintering humpbacks appear to be controlled by the conditions necessary for calving, such as warm water (75–80° Fahrenheit [24°–28° Celsius]) and relatively shallow, low-relief ocean bottom in protected areas, nearshore, or created by islands or reefs (Clapham, 2000; Craig & Herman, 2000; Smultea, 1994). In breeding grounds, females with calves occur in significantly shallower waters than other groups of whales; and breeding adults use deeper, more offshore waters (Ersts & Rosenbaum, 2003; Smultea, 1994). While most humpback whale sightings are in nearshore and continental shelf waters, humpback whales frequently travel through deep oceanic waters during migration (Calambokidis et al., 2001; Clapham, 2000; Clapham & Mattila, 1990; Mate et al., 1998).

Seasonal density estimates for humpback whales are available for all the SURTASS modeling sites except site 5 (Sea of Japan), site 12 (Offshore Sri Lanka), and site 13 (Andaman Sea), although in some sites they are only seasonally present, as described below. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.9-1, following the modeling site descriptions. Figures 2.9-2 to 2.9-10, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.9.1 MODELING SITE 1 – EAST OF JAPAN

Density estimates for humpback whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022) and included waters within the entire 250 km buffer of modeling site 1 (see Figure 1.2-2). The winter/spring density estimate of 0.00068 animals/km^2 was based on a total abundance estimate of 1,920 humpback whales (CV = 0.318) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00014 animals/km^2 was based on a total abundance estimate of 391 humpback whales (CV = 0.877) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.9.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density estimates for humpback whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the northwest of modeling site 2, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00068 animals/km^2 was based on a total abundance estimate of 1,920 humpback whales (CV = 0.318) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00014 animals/km^2 was based on a total abundance estimate of 391 humpback whales (CV = 0.877) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.9.3 Modeling Site 3 – West Philippine Sea

Density data for humpback whale specific to this area were not available. To provide a representative estimate, density data used to assess a proposed marine geophysical survey in waters of Southeast Asia were used (LGL Limited Environmental Research Associates, 2008). Given the lack of seasonal data for this region, the estimate of 0.00089 animals/km^2 (CV = NA) was applied year round.

2.9.4 Modeling Site 4 – Offshore Guam

Humpback whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. For winter and spring, when humpback whales are most likely to occur in these waters, mark-recapture density estimates for nearshore waters around the islands of Saipan and Tinian were used to reflect the consistent humpback whale use of these areas (Hill et al., 2020a). The mark-recapture estimates were based on data collected during small-boat surveys off Saipan and neighboring islands in the Mariana Archipelago during the winter months of 2015–2019. Based on photo-identification, genetic data, and behavioural observations, these waters are used by humpback whales as a breeding area (Hill et al., 2020b). To capture the highest-use areas off the west side of Saipan and around Marpi Reef, north of Saipan, the mark-recapture density estimate of 0.16 whales/km^2 (CV = 0.213) was used. To the south of Saipan, in nearshore waters around the islands of Tinian and Aguijan, the mark-recapture density estimate of 0.07 whales/km^2 (CV = 0.23) was used (Hill et al., 2020a). Based on input from scientists at PIFSC, this estimate was also applied to waters ≤200 m depth around the island of Pagan. In all other waters within the Guam/CNMI EEZ, a density estimate of 0.0027 whales/km^2 (CV=NA) was used. For waters outside the EEZ, a density estimate of 0.00089 animals/km^2 (CV = NA) derived to assess a proposed marine geophysical survey in waters of Southeast Asia was used (LGL Limited Environmental Research Associates, 2008) to reflect the lower abundance of humpback whales found in these oceanic waters. To characterize humpback whale density in fall, when lower numbers of humpback whales are expected to occur, the estimate of 0.00089 animals/km^2 (CV = NA) was used (LGL Limited Environmental Research Associates, 2008). Humpback whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2015); therefore, a density of zero is used for that season.

2.9.5 Modeling Site 6 – East China Sea

Density data for humpback whale specific to this area were not available. To provide a representative estimate, density data used to assess a proposed marine geophysical survey in waters of Southeast Asia were used (LGL Limited Environmental Research Associates, 2008). Given the lack of seasonal data for this region, the estimate of 0.00089 animals/km^2 (CV = NA) was applied year round.

2.9.6 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site year round.

2.9.7 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for humpback whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). Although the survey area is located to the north of modeling site 8, these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00068 animals/km^2 was based on a total abundance estimate of 1,920 humpback whales (CV = 0.318) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00014 animals/km^2 was based on a total abundance estimate of 391 humpback whales (CV = 0.877) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

2.9.8 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Humpback whale density estimates specific to modeling site 9 were not available. Given the lack of regionally specific density data for this species, a density estimate of 0.00089 animals/km^2 (CV = NA) used to assess a proposed marine geophysical survey in waters of Southeast Asia was used (LGL Limited Environmental Research Associates, 2008). Humpback whales are likely absent from low-productivity tropical waters in the summer (Jefferson et al., 2015); therefore, a density of zero is used for that season.

2.9.9 Modeling Site 10 – Hawaii North

Humpback whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on recent model-based analyses (Becker et al., 2022b). New survey data collected by NMFS within the Hawaiian Islands EEZ during the winter of 2020 enabled the development of a new habitat-based density model for humpback whale that provided monthly density predictions for this species (Becker et al., 2022b). The average monthly density surface maps are generally consistent with documented humpback whale arrival and departure dates in the Hawaiian Islands EEZ, with peak abundance observed in late February through early April (e.g., Craig & Herman, 1997; Johnston et al., 2007; Mobley et al., 2001). The model-based abundance estimates show peak numbers of humpback whales present in the Hawaiian Islands EEZ in March, with few whales present from June through October.

2.9.10 Modeling Site 11 – Hawaii South

Humpback whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on recent model-based analyses (Becker et al., 2022b). New survey data collected by NMFS within the Hawaiian Islands EEZ during the winter of 2020 enabled the development of a new habitat-based density model for humpback whale that provided monthly density predictions for this species (Becker et al., 2022b). The average monthly density surface maps are generally consistent with documented humpback whale arrival and departure dates in the Hawaiian Islands EEZ, with peak abundance observed in late February through early April (e.g., Craig & Herman, 1997; Johnston et al., 2007; Mobley et al., 2001). The model-based abundance estimates show peak numbers of humpback whales present in the Hawaiian Islands EEZ in March, with few whales present from June through October.

2.9.11 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and humpback whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.9.12 MODELING SITE 15 – NORTHEAST OF JAPAN

Density estimates for humpback whale were derived from line-transect analyses of survey data collected in the Western North Pacific from 2008 to 2012 (Takahashi et al., 2022). The survey area encompasses the southwest portion of modeling site 15 (see Figure 1.2-2), and these density data represent the best available for this region of the western North Pacific. The winter/spring density estimate of 0.00068 animals/km^2 was based on a total abundance estimate of 1,920 humpback whales (CV = 0.318) derived from survey data collected in 2011 and 2012 and a total survey area of 2,833,855 km^2. The summer/fall density estimate of 0.00014 animals/km^2 was based on a total abundance estimate of 391 humpback whales (CV = 0.877) derived from survey data collected in 2008 and a total survey area of 2,841,092 km^2.

Table 2.9-1: Summary of Density Values for Humpback Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00068	0.00014	0.00014	0.00068
Modeling Site 2	0.00068	0.00014	0.00014	0.00068
Modeling Site 3	0.00089	0.00089	0.00089	0.00089
Modeling Site 4	S	0	S	S
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00089	0.00089	0.00089	0.00089
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00068	0.00014	0.00014	0.00068
Modeling Site 9	0.00089	0	0.00089	0.00089
Modeling Site 10	S	0	S	S
Modeling Site 11	S	0	S	S
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00068	0.00014	0.00014	0.00068

Notes: The units for numerical values are animals/km^2. S = spatial model or stratified estimates with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

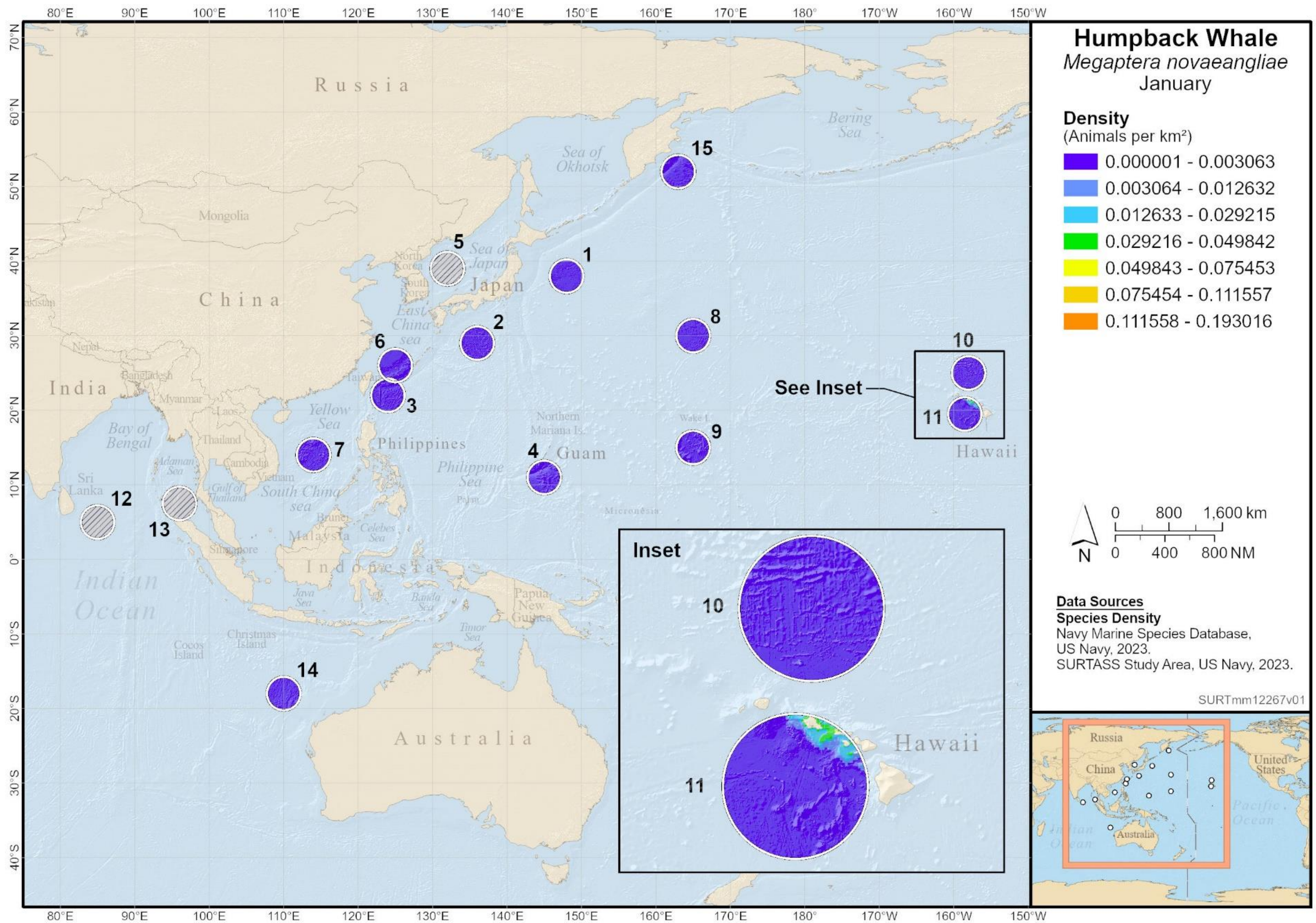


Figure 2.9-2: January Distribution of Humpback Whale in the SURTASS LFA Study Area

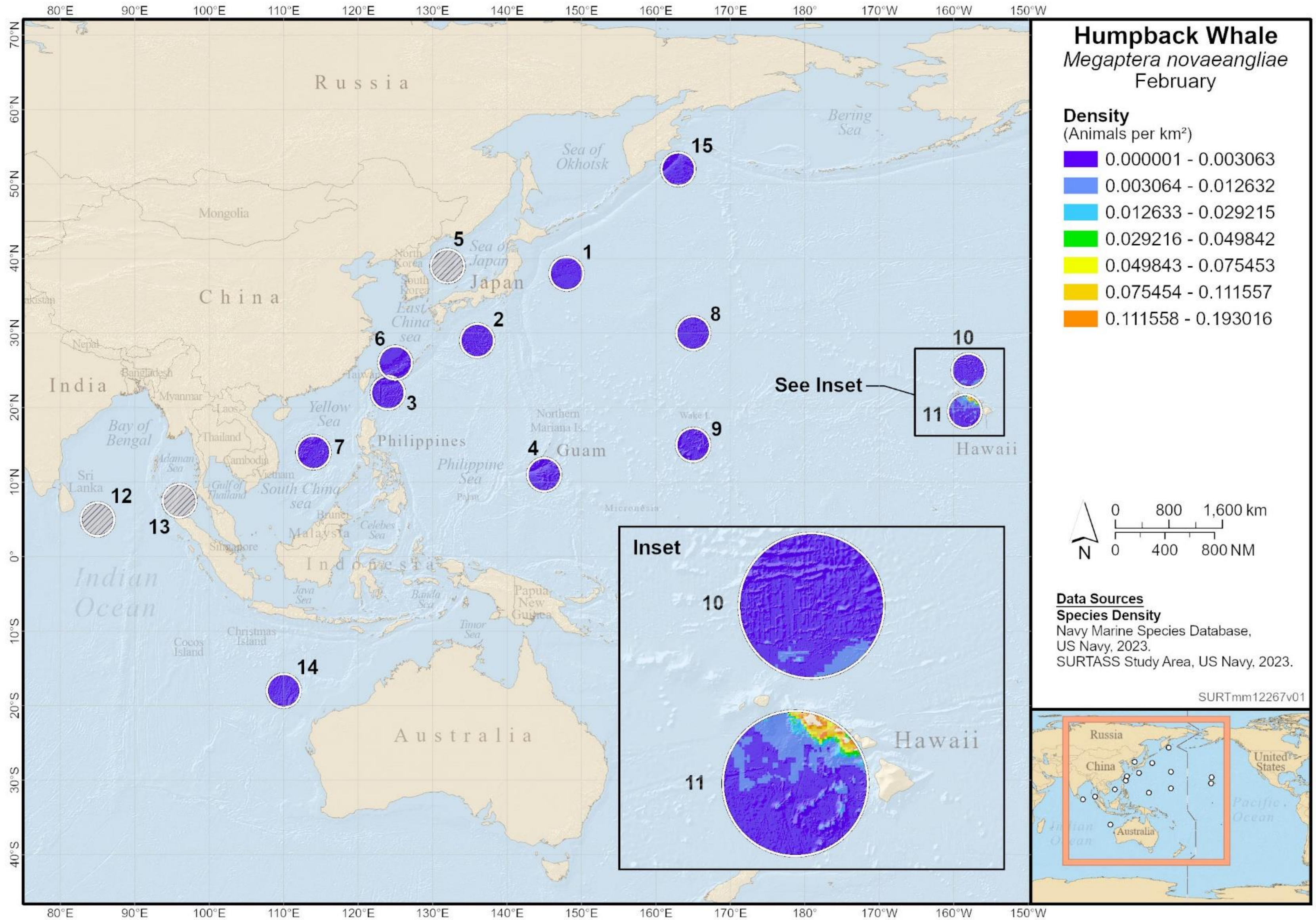


Figure 2.9-3: February Distribution of Humpback Whale in the SURTASS LFA Study Area

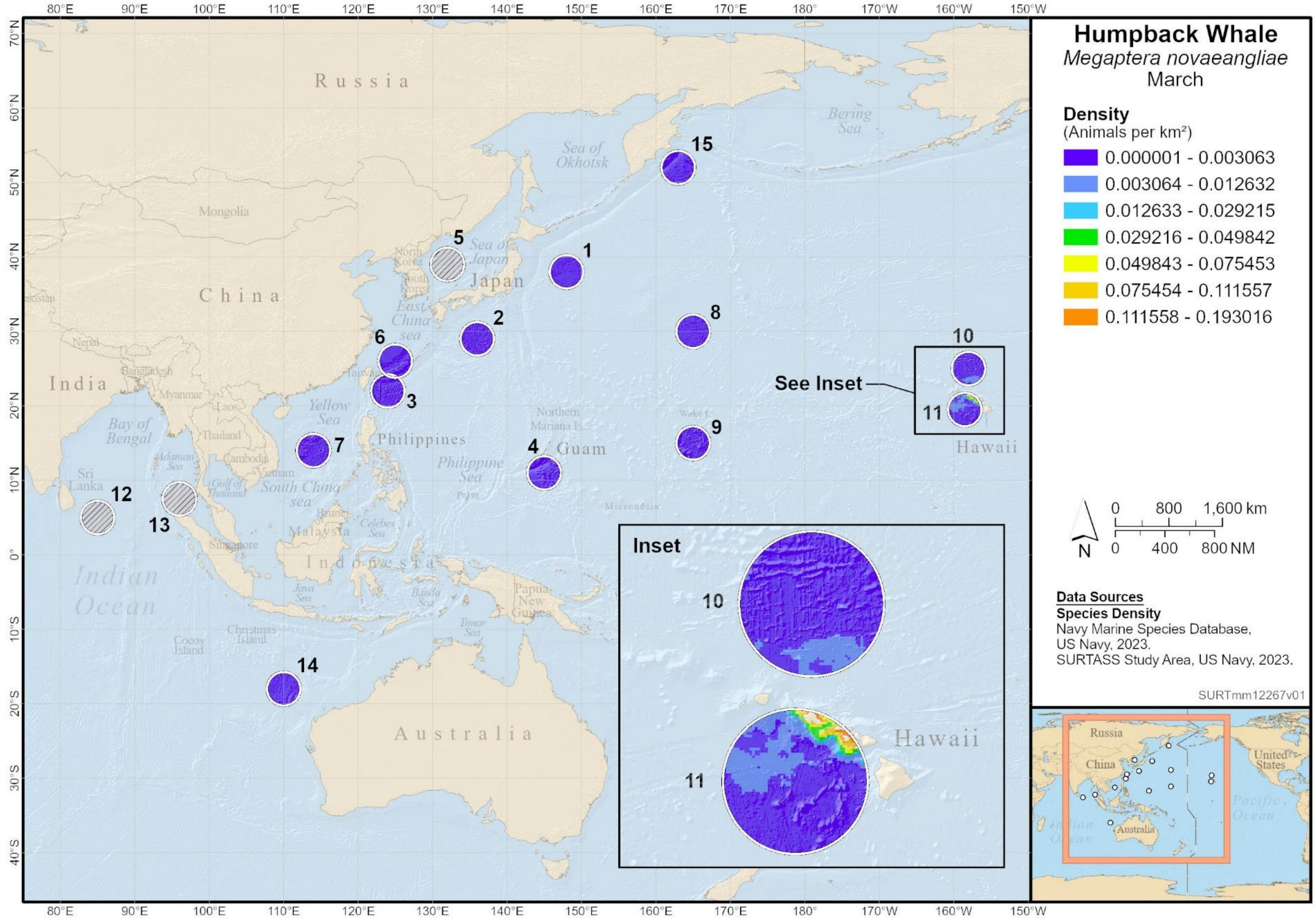


Figure 2.9-4: March Distribution of Humpback Whale in the SURTASS LFA Study Area

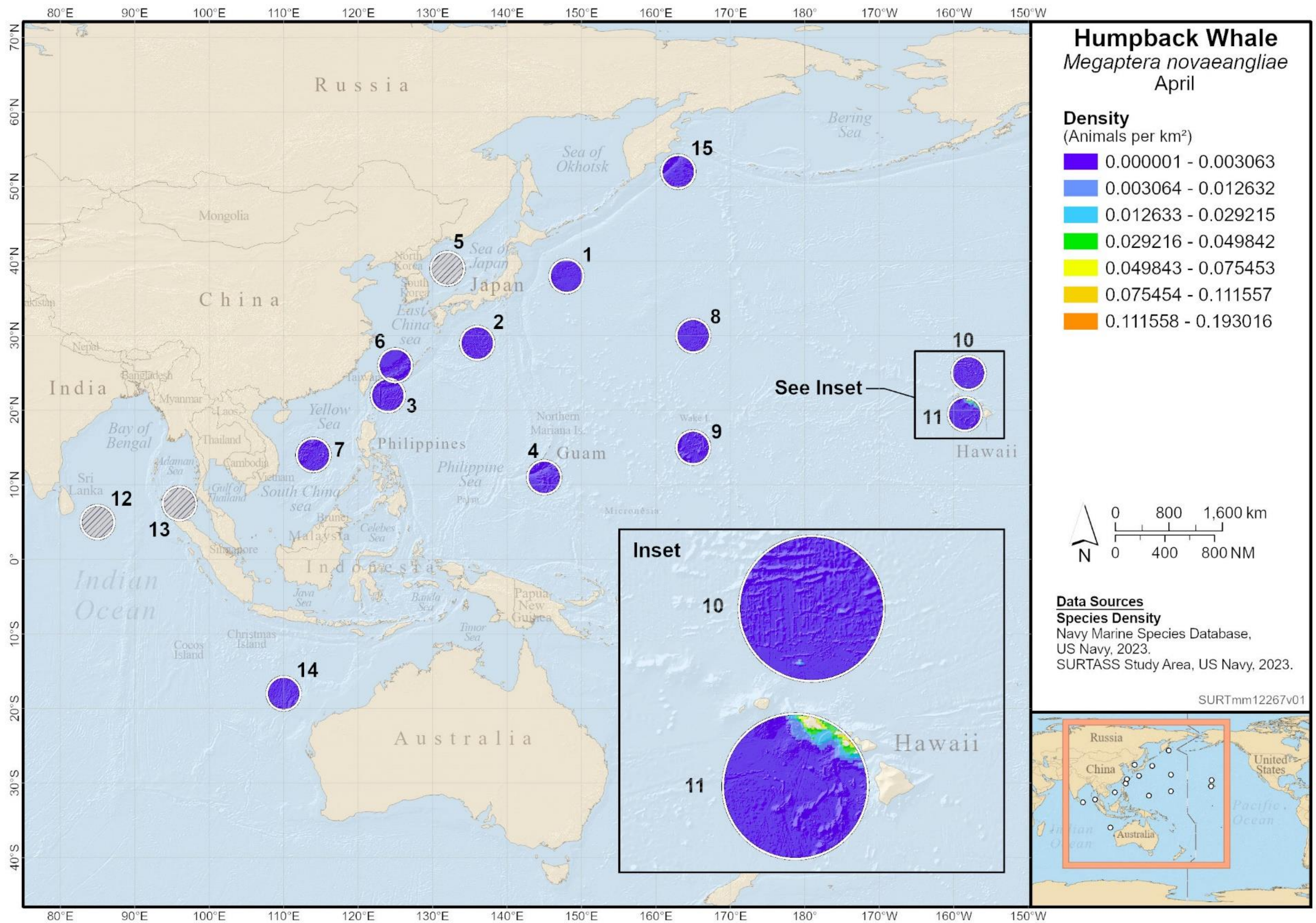


Figure 2.9-5: April Distribution of Humpback Whale in the SURTASS LFA Study Area

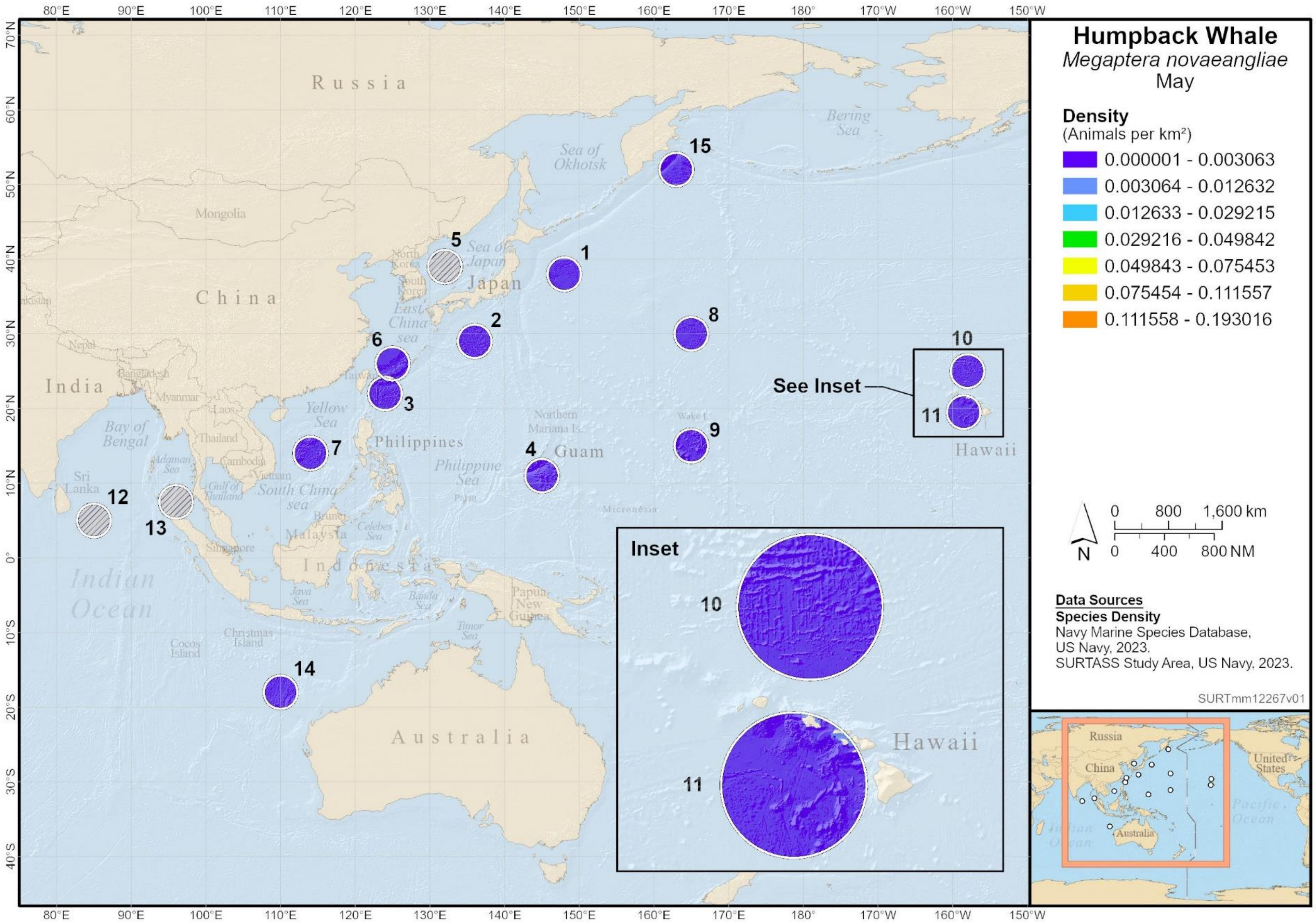


Figure 2.9-6: May Distribution of Humpback Whale in the SURTASS LFA Study Area

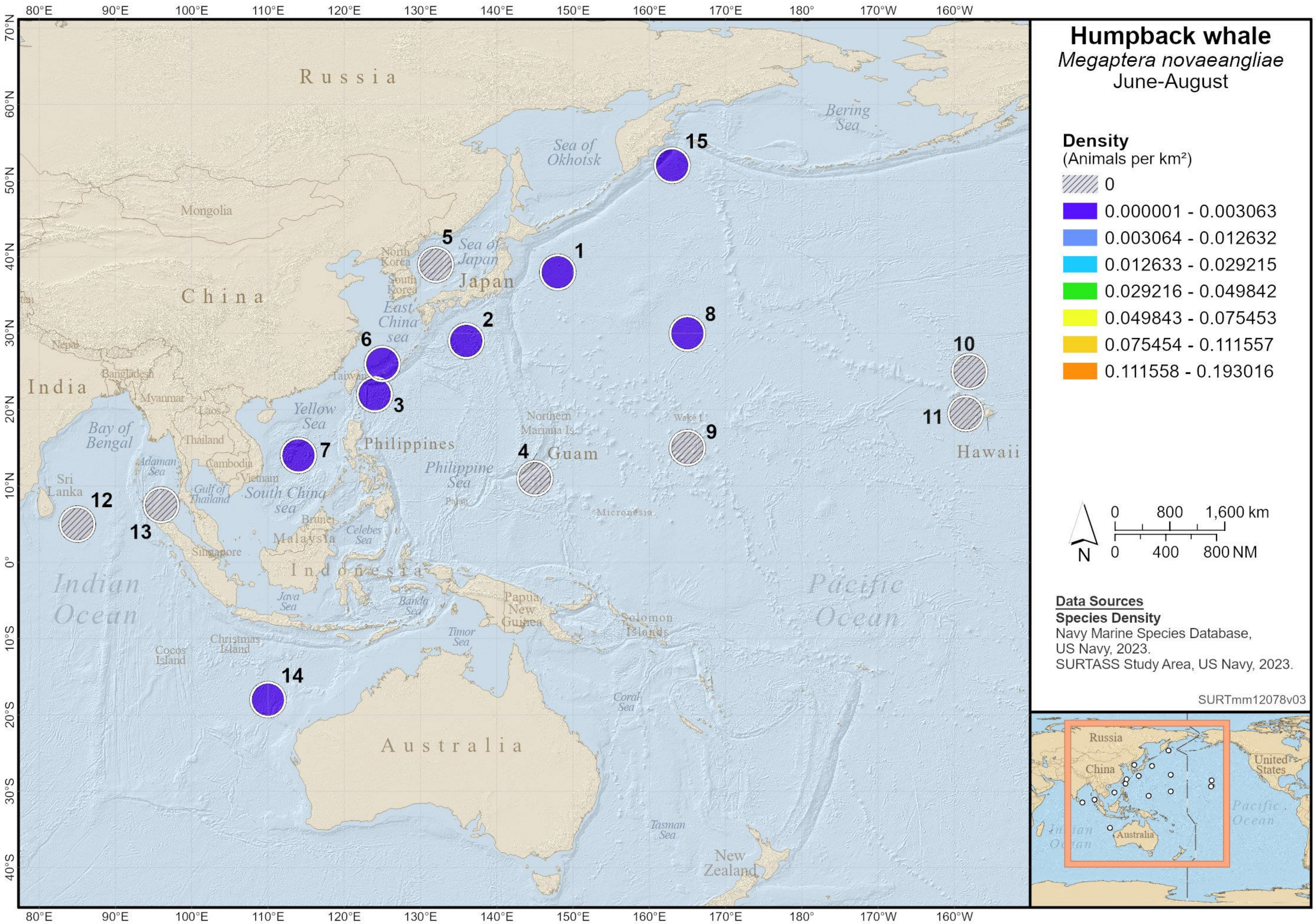


Figure 2.9-7: June–August Distribution of Humpback Whale in the SURTASS LFA Study Area

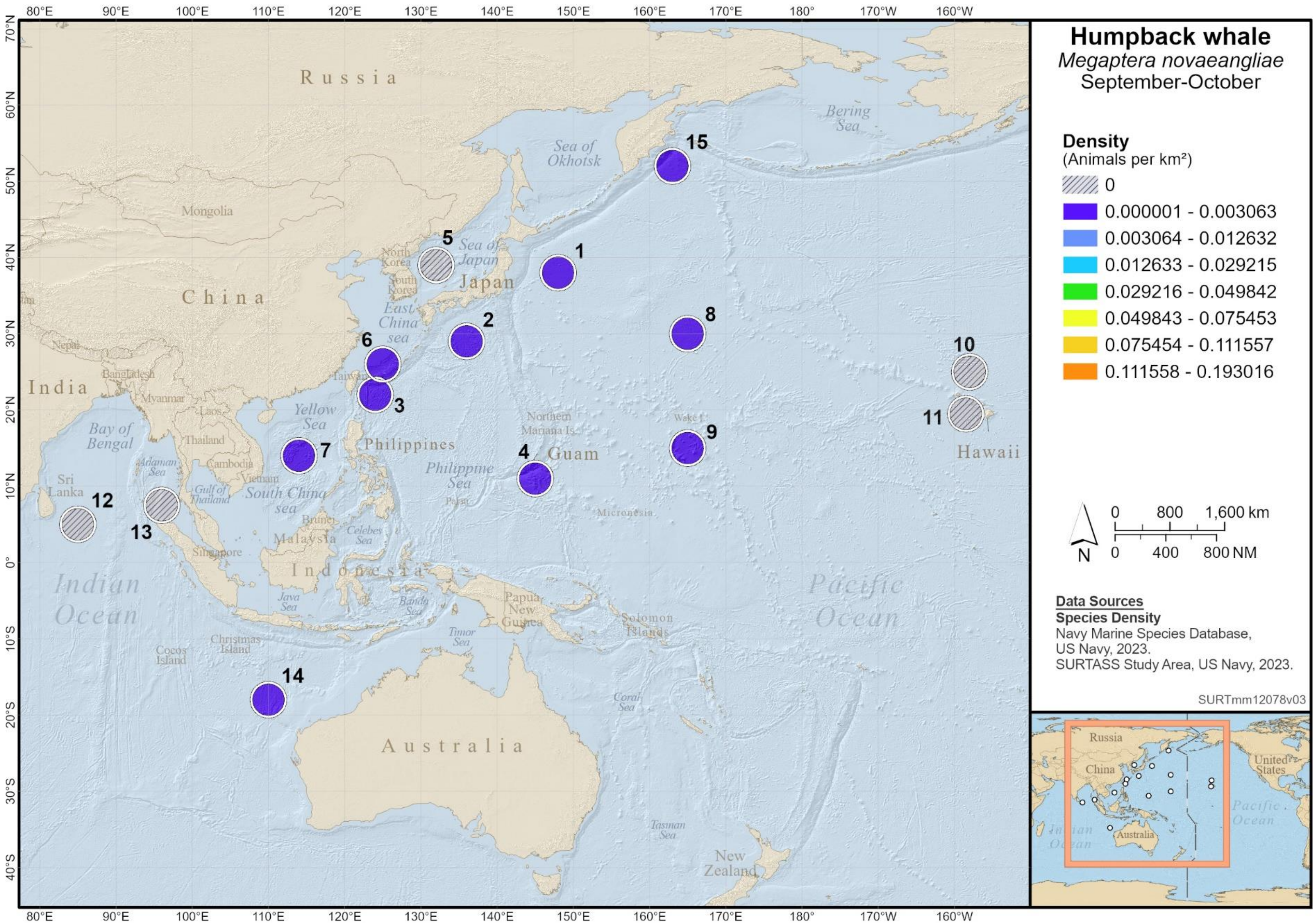


Figure 2.9-8: September–October Distribution of Humpback Whale in the SURTASS LFA Study Area

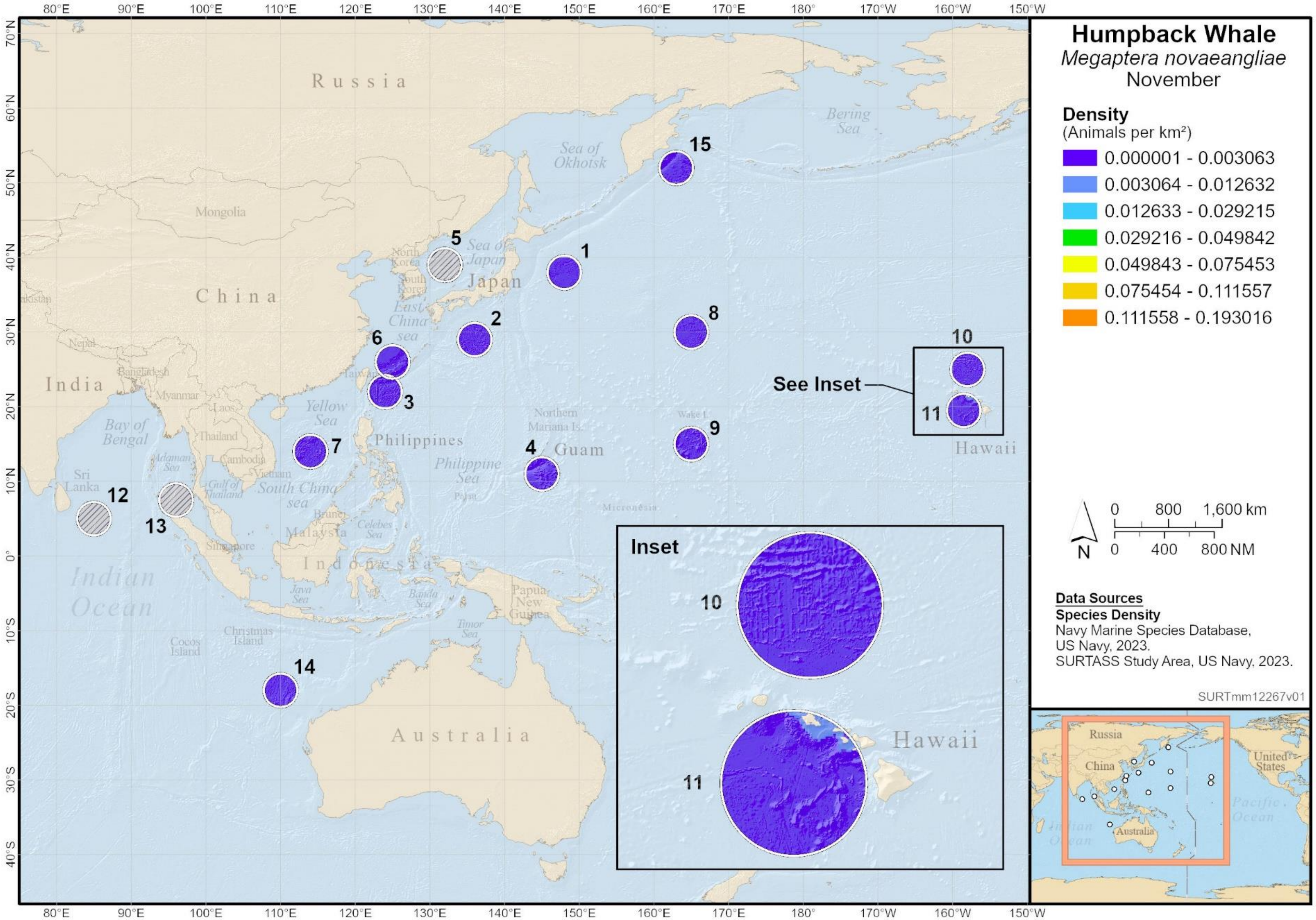


Figure 2.9-9: November Distribution of Humpback Whale in the SURTASS LFA Study Area

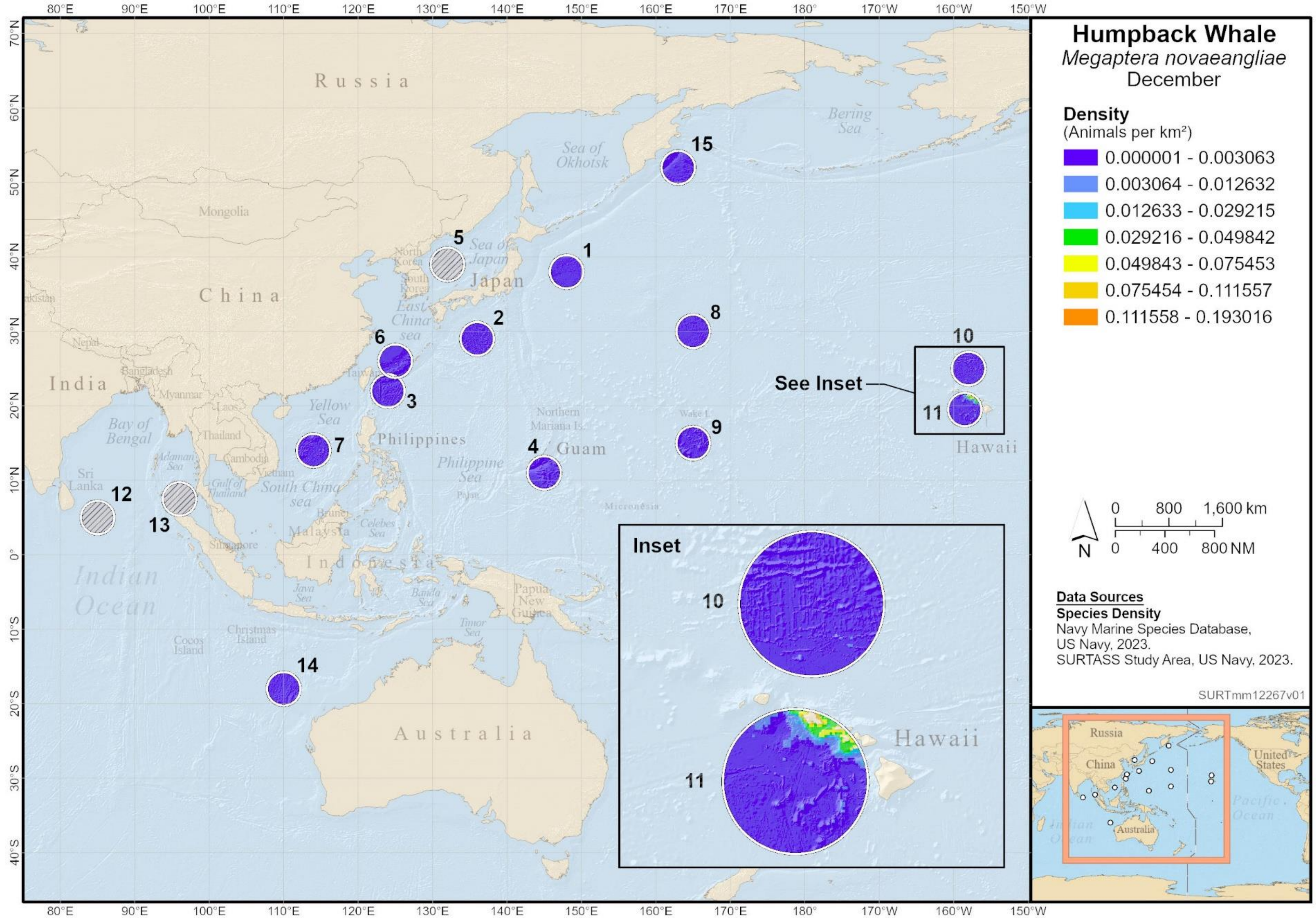


Figure 2.9-10: December Distribution of Humpback Whale in the SURTASS LFA Study Area

2.10 *PHYSETER MACROCEPHALUS*, SPERM WHALE

The sperm whale is listed as endangered under the ESA and as depleted under the MMPA throughout its range. It is also listed as Vulnerable by the IUCN Red List of Threatened Species (Taylor et al., 2019).

Sperm whales are found throughout the world's oceans in deep waters to the edge of the ice at both poles (Leatherwood et al., 1982; Rice, 1989; Whitehead, 2002). Sperm whales show a strong preference for deep waters (Rice, 1989; Whitehead, 2002). Their distribution is typically associated with waters over the continental shelf break, over the continental slope, and into deeper waters and midocean regions. Typically, sperm whale concentrations correlate with areas of high productivity. These areas are generally near drop-offs and areas with strong currents and steep topography (Gannier & Praca, 2007; Jefferson et al., 2015).

The IWC historically has recognized two stocks of sperm whale in the North Pacific, divided into eastern and western regions defined by a zig-zag line which starts at 150°W at the equator, is 160°W between 40 and 50°N, and ends up at 180°W north of 50° (Carretta et al., 2023). NMFS recognizes three stocks of sperm whale in the U.S. North Pacific: the California, Oregon, Washington stock; the Hawaii stock; and the Alaska stock (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of sperm whales is 5,387 animals, with a 95 percent confidence interval of 2,668–10,878 whales (Becker et al., 2021). The stock structure for sperm whales remains uncertain in the Indian Ocean (Mesnick et al., 2011; Mizroch & Rice, 2013).

Given their widespread distribution, sperm whales are expected to occur in all of the SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.10-1, following the modeling site descriptions. Figure 2.10-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.10.1 MODELING SITE 1 – EAST OF JAPAN

Density estimates for sperm whale were derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022). The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific includes the entirety of SURTASS modeling site 1.

2.10.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density estimates for sperm whale were derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022). The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific includes the entirety of SURTASS modeling site 2.

2.10.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density estimates for sperm whale were derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022). The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific was used to represent density at this site.

2.10.4 Modeling Site 4 – Guam

Sperm whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0162 animals/km^2 (CV = 0.79) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.10.5 Modeling Site 5 – Sea of Japan

Density data for sperm whale specific to this area were not available. In order to provide a representative estimate, density estimates for sperm whale derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022) were used. The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific was used to represent density at this site.

2.10.6 Modeling Site 6 – East China Sea

Density data for sperm whale specific to this area were not available. In order to provide a representative estimate, density estimates for sperm whale derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022) were used. The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific was used to represent density at this site.

2.10.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and sperm whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.10.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for sperm whale were derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022). The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific includes the entirety of SURTASS modeling site 8.

2.10.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Sperm whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. The estimate was based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0162 animals/km^2 (CV = 0.79) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.10.10 Modeling Site 10 – Hawaii North

Sperm whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2017 (Becker et al., 2021). The sperm whale habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on environmental conditions for every third day (tri-daily) specific to the survey years that provided coverage of waters within the Hawaiian Archipelago (i.e., 2002, 2010, 2017). The separate predictions were then averaged across the full 2002–2017 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.10.11 Modeling Site 11 – Hawaii South

Sperm whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2017 (Becker et al., 2021). The sperm whale habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on environmental conditions for every third day (tri-daily) specific to the survey years that provided coverage of waters within the Hawaiian Archipelago (i.e., 2002, 2010, 2017). The separate predictions were then averaged across the full 2002–2017 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.10.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and sperm whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.10.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and sperm whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.10.14 Modeling Site 14 – Northwest of Australia

Density estimates for sperm whale were derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead & Shin, 2022). The annual density estimate of 0.00236 animals/km^2 (CV = 0.23) for the Southern Hemisphere was used to represent density at this site.

2.10.1 Modeling Site 15 – Northeast of Japan

Density estimates for sperm whale were derived from recent analyses designed to update and improve global population estimates for this species on a regional basis (Kato & Miyashita, 2000; Whitehead &

Shin, 2022). The annual density estimate of 0.00174 animals/km^2 (CV = 0.31) for the Western North Pacific was used to represent density at this site.

Table 2.10-1: Summary of Density Values for Sperm Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00174	0.00174	0.00174	0.00174
Modeling Site 2	0.00174	0.00174	0.00174	0.00174
Modeling Site 3	0.00174	0.00174	0.00174	0.00174
Modeling Site 4	0.0162	0.0162	0.0162	0.0162
Modeling Site 5	0.00174	0.00174	0.00174	0.00174
Modeling Site 6	0.00174	0.00174	0.00174	0.00174
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00174	0.00174	0.00174	0.00174
Modeling Site 9	0.0162	0.0162	0.0162	0.0162
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0.00236	0.00236	0.00236	0.00236
Modeling Site 15	0.00174	0.00174	0.00174	0.00174

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

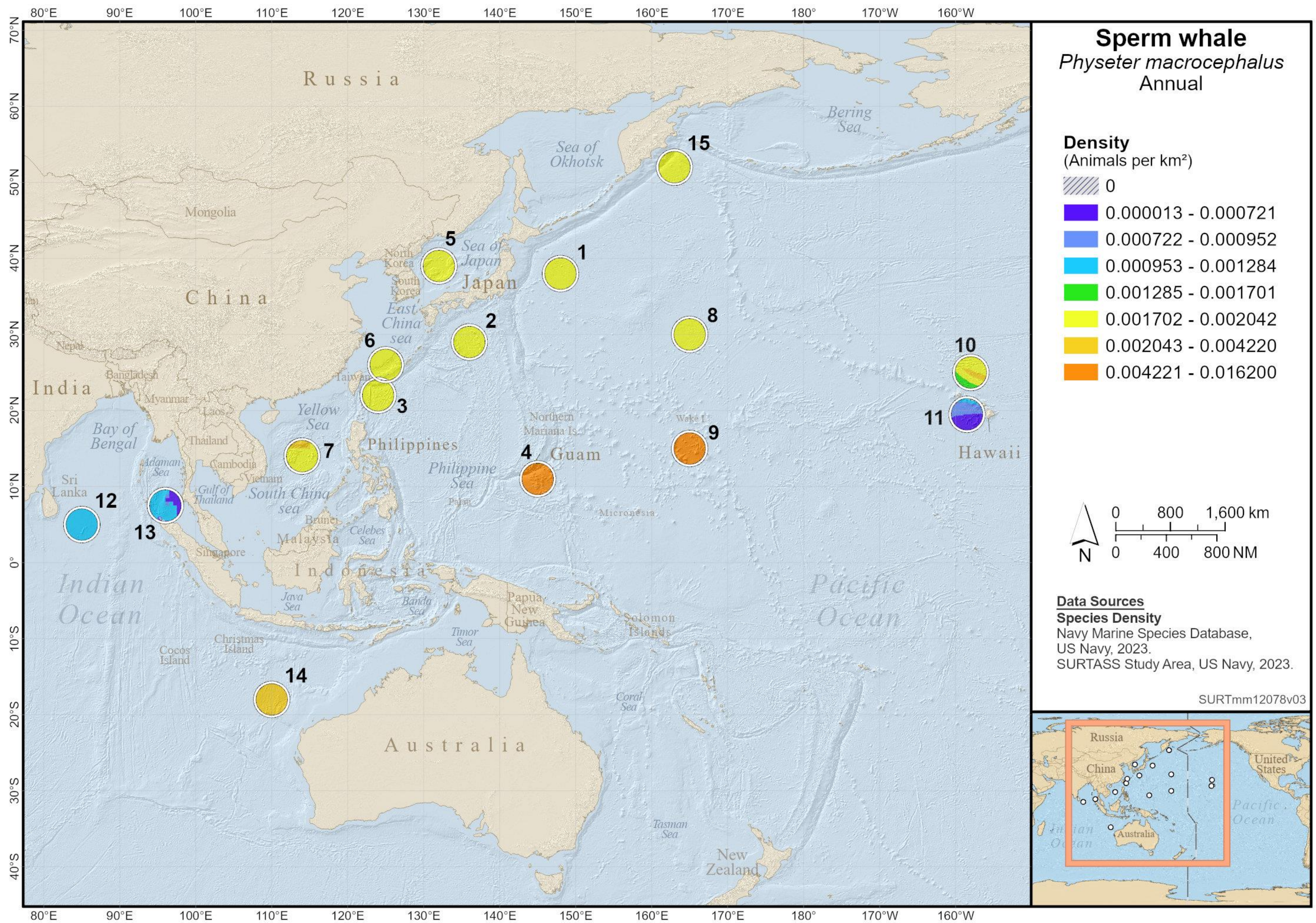


Figure 2.10-1: Annual Distribution of Sperm Whale in the SURTASS LFA Study Area

2.11 *Kogia breviceps*, Pygmy Sperm Whale

The pygmy sperm whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka & Braulik, 2020a).

Before 1966, dwarf and pygmy sperm whales were thought to be a single species, until form and structure distinction were shown (Handley, 1966). Misidentifications of these two species are still common (Jefferson et al., 2015). Rare sightings indicate they may avoid human activity, and they are rarely active at the sea surface. Because of the scarcity of biological information available for pygmy sperm whales, almost nothing is known of population status for this species. Stranding frequency suggests they may not be as uncommon as sighting records would suggest (Jefferson et al., 2015; Maldini et al., 2005).

Pygmy sperm whales appear to be distributed worldwide in temperate to tropical waters (Caldwell & Caldwell, 1989; McAlpine, 2002). Pygmy sperm whales can occur close to shore and sometimes over the outer continental shelf. However, they generally occur over and near the continental slope and beyond (Bloodworth & Odell, 2008; Jefferson et al., 2015). The pygmy sperm whale may frequent more temperate habitats than the dwarf sperm whale, which is more of a tropical species. Although deep oceanic waters may be the primary habitat for this species, there are very few oceanic sighting records offshore (Jefferson et al., 2015). The lack of sightings may have more to do with the difficulty of detecting and identifying these animals at sea and lack of effort than with any real distributional preferences.

NMFS recognizes two stocks of pygmy sperm whale in the U.S. North Pacific: the California, Oregon, Washington stock; and the Hawaii stock (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of pygmy sperm whales is 42,083 animals, with a 95 percent confidence interval of 3,406–132,103 whales (Bradford et al., 2021).

Pygmy sperm whales are expected to occur in all of the SURTASS modeling sites except the most northern, site 15 (Northeast of Japan). A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.11-1, following the modeling site descriptions. Figure 2.11-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.11.1 Modeling Site 1 – East of Japan

Density data for pygmy sperm whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.2 Modeling Site 2 – North Philippine Sea

Density data for pygmy sperm whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.3 Modeling Site 3 – West Philippine Sea

Density data for pygmy sperm whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.4 Modeling Site 4 – Guam

Pygmy sperm whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ was used to characterize pygmy sperm whale density (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.5 Modeling Site 5 – Sea of Japan

Density data for pygmy sperm whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.6 Modeling Site 6 – East China Sea

Density data for pygmy sperm whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and pygmy sperm whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.11.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for pygmy sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for pygmy sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.01719 animals/km^2 (CV = 0.64) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.11.10 Modeling Site 10 – Hawaii North

Pygmy sperm whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for pygmy sperm whale of 0.01719 animals/km^2 (CV = 0.64) was used year round.

2.11.11 Modeling Site 11 – Hawaii South

Pygmy sperm whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for pygmy sperm whale of 0.01719 animals/km^2 (CV = 0.64) was used year round.

2.11.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pygmy sperm whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.11.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pygmy sperm whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.11.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pygmy sperm whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.11-1: Summary of Density Values for Pygmy Sperm Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.01719	0.01719	0.01719	0.01719
Modeling Site 2	0.01719	0.01719	0.01719	0.01719
Modeling Site 3	0.01719	0.01719	0.01719	0.01719
Modeling Site 4	0.01719	0.01719	0.01719	0.01719
Modeling Site 5	0.01719	0.01719	0.01719	0.01719
Modeling Site 6	0.01719	0.01719	0.01719	0.01719
Modeling Site 7	S	S	S	S
Modeling Site 8	0.01719	0.01719	0.01719	0.01719
Modeling Site 9	0.01719	0.01719	0.01719	0.01719
Modeling Site 10	0.01719	0.01719	0.01719	0.01719
Modeling Site 11	0.01719	0.01719	0.01719	0.01719
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

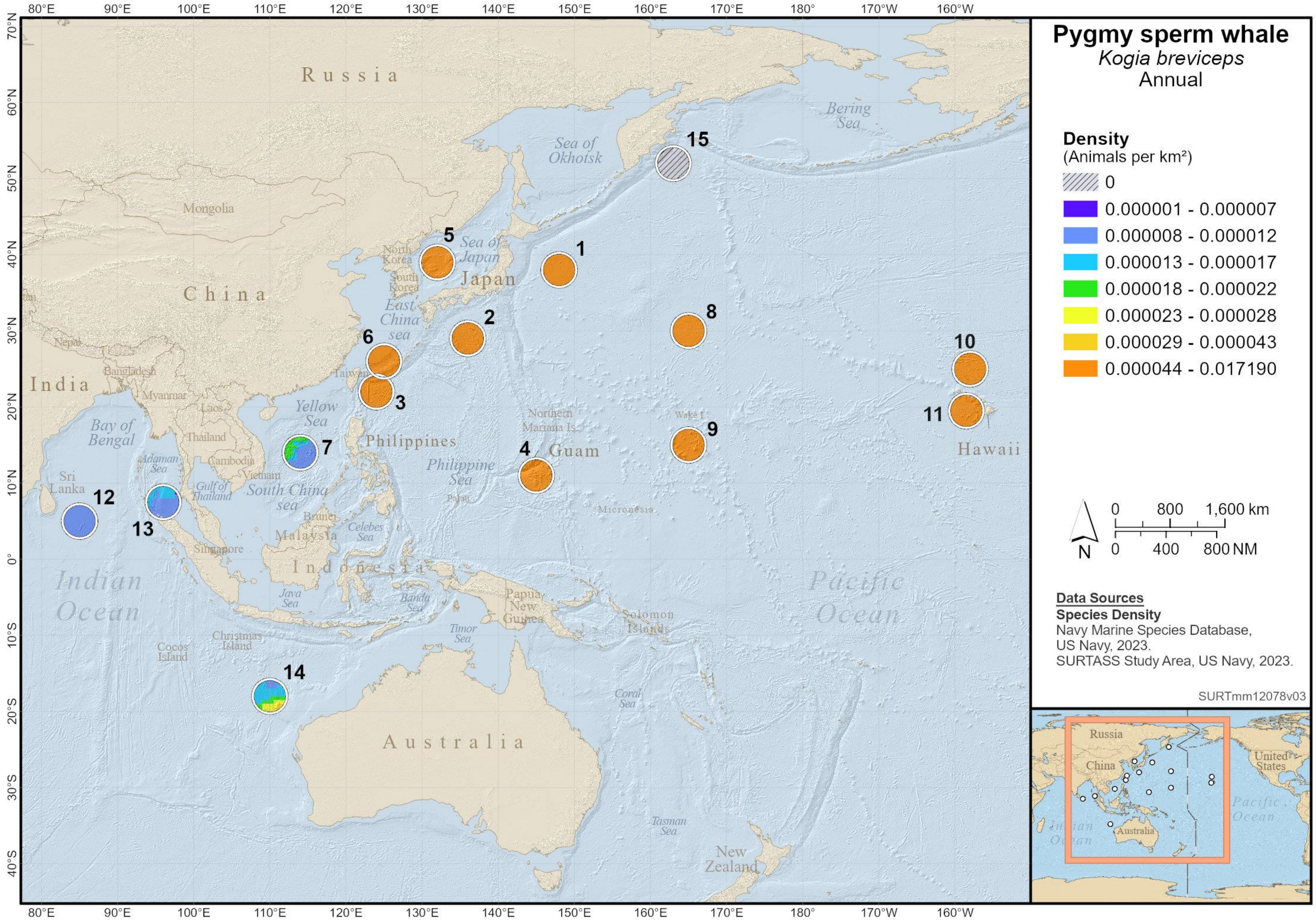


Figure 2.11-1: Annual Distribution of Pygmy Sperm Whale in the SURTASS LFA Study Area

2.12 *Kogia sima*, Dwarf Sperm Whale

The dwarf sperm whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka & Braulik, 2020b).

Before 1966, dwarf and pygmy sperm whales were thought to be a single species, until form and structure distinction were shown (Handley, 1966). Misidentifications of these two species are still common (Jefferson et al., 2015). Rare sightings indicate they may avoid human activity, and they are rarely active at the sea surface. Because of the scarcity of biological information available for dwarf sperm whales, almost nothing is known of population status for this species. Stranding frequency suggests they may not be as uncommon as sighting records would suggest (Jefferson et al., 2015; Maldini et al., 2005).

Dwarf sperm whales appear to be distributed worldwide in temperate to tropical waters (Caldwell & Caldwell, 1989; McAlpine, 2002). Dwarf sperm whales generally occur in offshore waters and appear to prefer warmer waters than the pygmy sperm whale (Jefferson et al., 2015). Although deep oceanic waters may be the primary habitat for this species, there are very few oceanic sighting records offshore (Jefferson et al., 2015). The lack of sightings may have more to do with the difficulty of detecting and identifying these animals at sea and lack of effort than with any real distributional preferences.

NMFS recognizes two stocks of dwarf sperm whale in the U.S. North Pacific: the California, Oregon, Washington stock; and the Hawaii stock (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of dwarf sperm whales is 37,440 animals, with a 95 percent confidence interval of 9,758–143,648 whales (Bradford et al., 2021).

Dwarf sperm whales are expected to occur in all of the SURTASS modeling sites except the most northern, site 15 (Northeast of Japan). A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.12-1, following the modeling site descriptions. Figure 2.12-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.12.1 Modeling Site 1 – East of Japan

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.2 Modeling Site 2 – North Philippine Sea

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.3 Modeling Site 3 – West Philippine Sea

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.4 Modeling Site 4 – Guam

Dwarf sperm whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area. Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.5 Modeling Site 5 – Sea of Japan

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.6 Modeling Site 6 – East China Sea

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and dwarf sperm whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.12.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for dwarf sperm whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021).

The most recent estimate of 0.0153 animals/km^2 (CV = 0.78) was based on 2002 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.12.10 Modeling Site 10 – Hawaii North

Dwarf sperm whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent uniform density estimate for dwarf sperm whale of 0.0153 animals/km^2 (CV = 0.78) was used year round.

2.12.11 Modeling Site 11 – Hawaii South

Dwarf sperm whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent uniform density estimate for dwarf sperm whale of 0.0153 animals/km^2 (CV = 0.78) was used year round.

2.12.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and dwarf sperm whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.12.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and dwarf sperm whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.12.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and dwarf sperm whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.12-1: Summary of Density Values for Dwarf Sperm Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.01530	0.01530	0.01530	0.01530
Modeling Site 2	0.01530	0.01530	0.01530	0.01530
Modeling Site 3	0.01530	0.01530	0.01530	0.01530
Modeling Site 4	0.01530	0.01530	0.01530	0.01530
Modeling Site 5	0.01530	0.01530	0.01530	0.01530
Modeling Site 6	0.01530	0.01530	0.01530	0.01530
Modeling Site 7	S	S	S	S
Modeling Site 8	0.01530	0.01530	0.01530	0.01530
Modeling Site 9	0.01530	0.01530	0.01530	0.01530
Modeling Site 10	0.01530	0.01530	0.01530	0.01530
Modeling Site 11	0.01530	0.01530	0.01530	0.01530
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

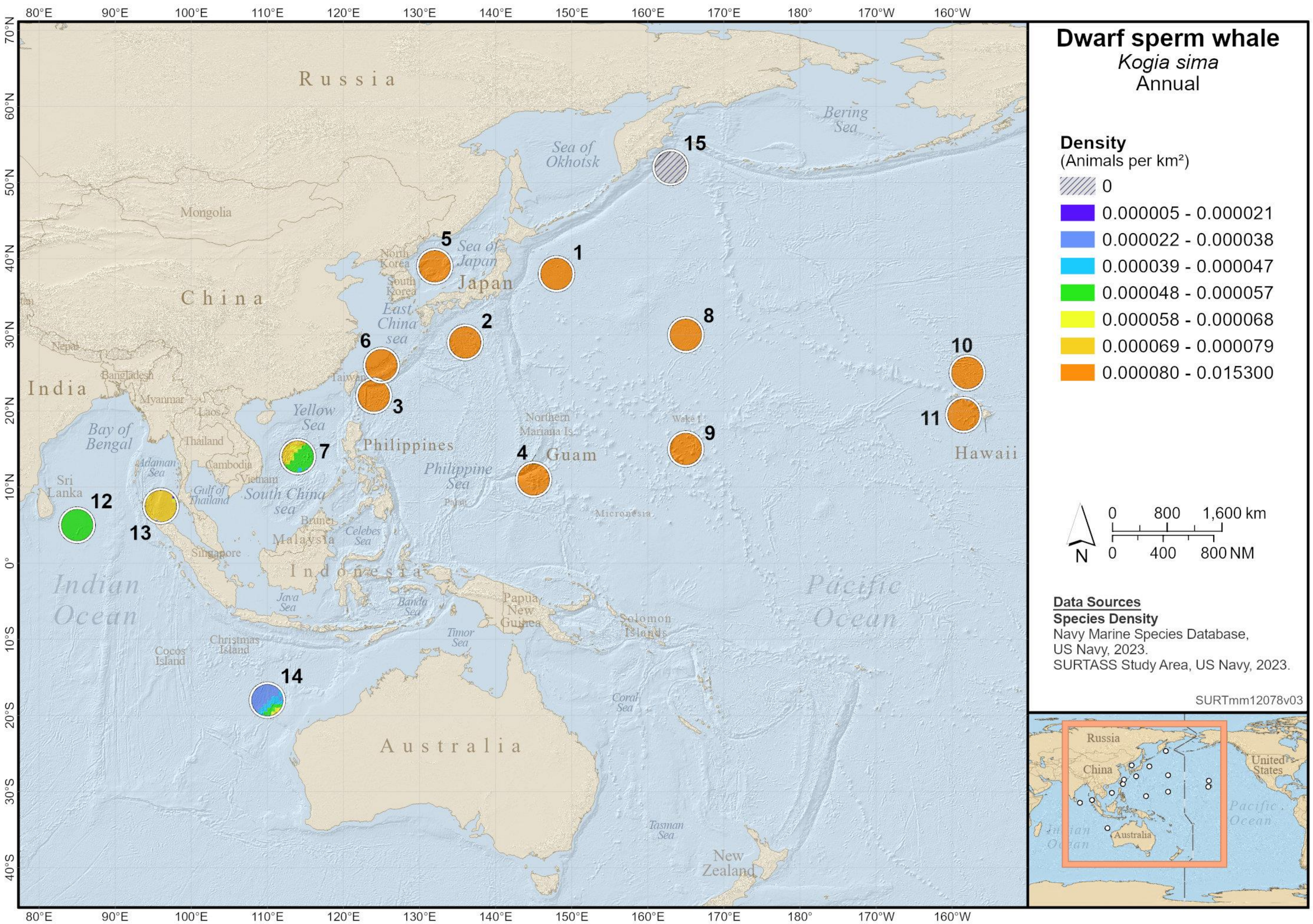


Figure 2.12-1: Annual Distribution of Dwarf Sperm Whale in the SURTASS LFA Study Area

2.13 *Delphinus delphis*, Common Dolphin

The common dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Braulik et al., 2021).

The taxonomic status of common dolphins has been controversial and has changed over time. Currently, the Society for Marine Mammalogy's Committee on Taxonomy and NMFS recognize all common dolphins as a single species, *D. delphis*, with long-and short-beaked common dolphins recognized as separate subspecies *D. delphis bairdii* and *D. delphis delphis*, respectively. Recently, based on additional analysis and newly obtained genetic data, long-beaked common dolphins and short-beaked common dolphins in the eastern Pacific have been proposed to be split as distinct species, *Delphis bairdii* and *Delphis delphis*, respectively (Jefferson et al., 2024). However, in June 2024 the proposal failed to get the two-third majority votes needed to pass from the Society for Marine Mammalogy's Committee on Taxonomy. Additional taxonomic work is warranted, but long-beaked common dolphins that occur in the western Pacific and Indian Oceans are recognized as *Delphinus capensis*, with the standard subspecies recognized as *D. capensis capensis* and the Indo-Pacific common dolphin recognized as *D. capensis tropicalis* (Jefferson et al., 2015). All forms of long-beaked common dolphin occur in more shallow, nearshore waters than short-beaked common dolphins, although their ranges often overlap. Given the offshore locations of the SURTASS modeling sites where common dolphins could occur, short-beaked common dolphins are more likely to be encountered than long-beaked common dolphins.

The short-beaked common dolphin is widely distributed in tropical, subtropical, and temperate waters in the Pacific and Atlantic Oceans, although they do not occur in the Gulf of Mexico or in most waters in the Caribbean Sea (Jefferson et al., 2015). They are distributed from nearshore waters to offshore waters more than thousands of kilometers from shore. This species seems to prefer areas with upwellings and steep sea-bottom (Jefferson et al., 2015).

NMFS recognizes a single stock of short-beaked common dolphin in the U.S. North Pacific, the California/Oregon/Washington stock (Carretta et al., 2023), with a recent abundance estimate of 1,056,308 (CV = 0.207) animals (Becker et al., 2020).

Common dolphins are expected to occur in only six of the SURTASS modeling sites (1, 2, 3, 5, 6, and 8). A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.13-1, following the modeling site descriptions. Figure 2.13-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.13.1 Modeling Site 1 – East of Japan

Density data for common dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.13.2 Modeling Site 2 – North Philippine Sea

Density data for common dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.13.3 Modeling Site 3 – West Philippine Sea

Density data for common dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.13.4 Modeling Site 5 – Sea of Japan

Density data for common dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.13.5 Modeling Site 6 – East China Sea

Density data for common dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.13.6 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for common dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.13-1: Summary of Density Values for Common Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0	0	0	0
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

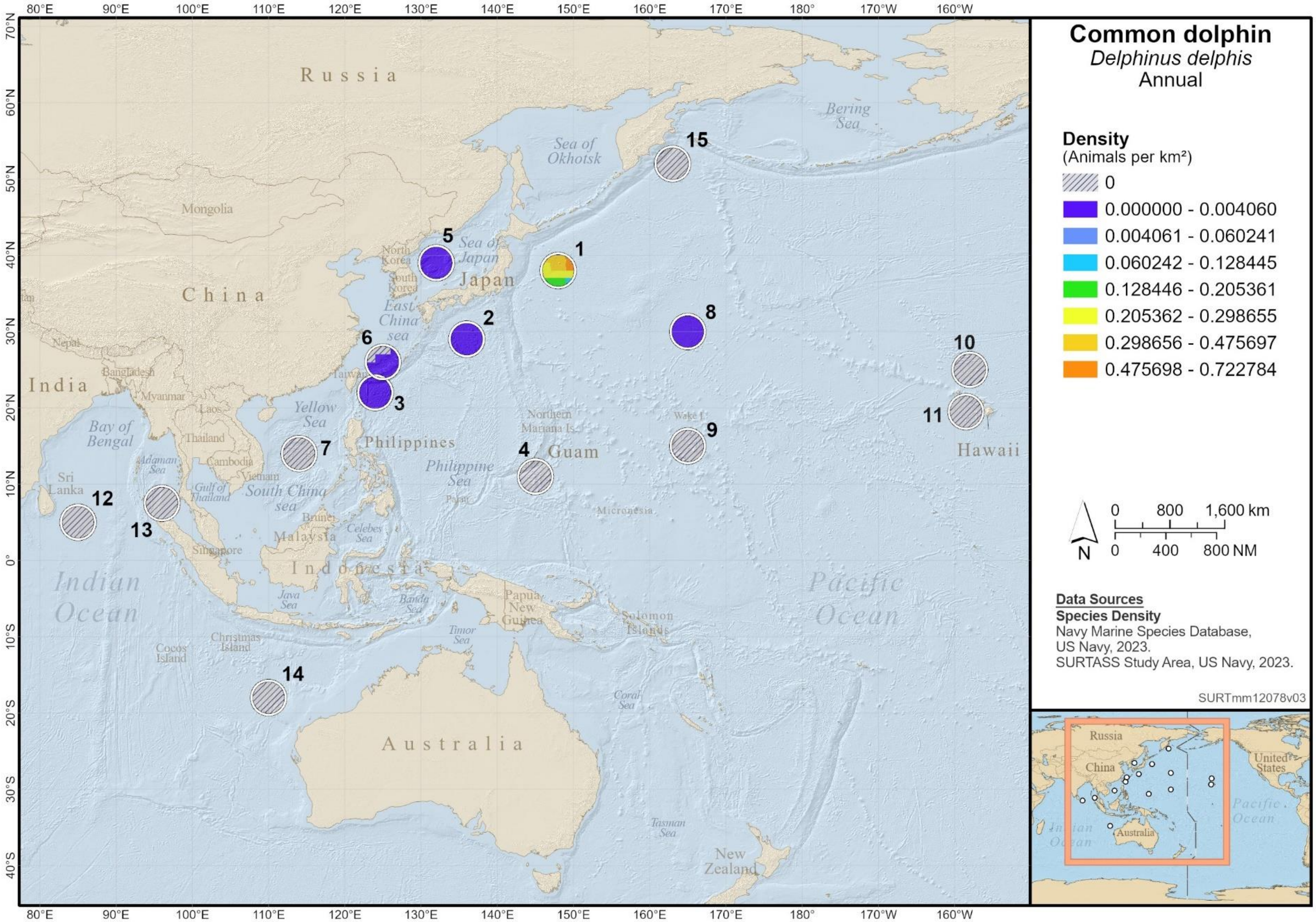


Figure 2.13-1: Annual Distribution of Common Dolphin in the SURTASS LFA Study Area

2.14 *Feresa attenuata*, Pygmy Killer Whale

The pygmy killer whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Braulik, 2018).

Pygmy killer whale has a worldwide distribution in tropical and subtropical oceans and generally does not range poleward of 40° N or of 35° S (Jefferson et al., 2015). Although the pygmy killer whale has an extensive global distribution, it is not known to occur in high densities in any region and is, therefore, probably one of the least abundant pantropical delphinids (Waring et al., 2013). The pygmy killer whale is considered an open ocean deepwater species, but may occur close to shore around oceanic islands where the water is deep (Davis et al., 2000; Jefferson et al., 2015).

NMFS recognizes a single Pacific management stock of pygmy killer whale that includes animals found within waters of the Hawaiian Islands EEZ and in adjacent high seas (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of pygmy killer whales is 10,328 animals, with a 95 percent confidence interval of 2,771–38,491 whales (Bradford et al., 2021).

Pygmy killer whales are expected to occur in all of the SURTASS modeling sites except site 5 (Sea of Japan) and the most northern, site 15 (Northeast of Japan). A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.14-1, following the modeling site descriptions. Figure 2.14-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.14.1 Modeling Site 1 – East of Japan

Density data for pygmy killer whale were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.00255 animals/km^2 (CV = 1.03, approximated using a log-normal distribution) was applied to this modeling site, which lies just to the east of the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.14.2 Modeling Site 2 – North Philippine Sea

Density data for pygmy killer whale were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.00255 animals/km^2 (CV = 1.03, approximated using a log-normal distribution) was applied to this modeling site, which is encompassed within the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.14.3 Modeling Site 3 – West Philippine Sea

Density data for pygmy killer whale were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.00255 animals/km^2 (CV = 1.03, approximated using a log-normal distribution) was applied to this modeling site, which lies just to the south of the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.14.4 Modeling Site 4 – Guam

Pygmy killer whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0448 animals/km^2 (CV = 1.11) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.14.5 Modeling Site 6 – East China Sea

Density data for pygmy killer whale were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.00255 animals/km^2 (CV = 1.03, approximated using a log-normal distribution) was applied to this modeling site, which overlaps the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.14.6 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and pygmy killer whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.14.7 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for pygmy killer whale were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.00255 animals/km^2 (CV = 1.03, approximated using a log-normal distribution) was applied to this modeling site, which lies to the east of the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.14.8 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Pygmy killer whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. The estimate was based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0448 animals/km^2 (CV = 1.11) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.14.9 Modeling Site 10 – Hawaii North

Pygmy killer whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for pygmy killer whale of 0.00422 animals/km^2 (CV = 0.75) was used year round.

2.14.10 MODELING SITE 11 – HAWAII SOUTH

Pygmy killer whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for pygmy killer whale of 0.00422 animals/km^2 (CV = 0.75) was used year round.

2.14.11 MODELING SITE 12 – OFFSHORE SRI LANKA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pygmy killer whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.14.12 MODELING SITE 13 – ANDAMAN SEA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pygmy killer whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.14.13 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pygmy killer whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.14-1: Summary of Density Values for Pygmy Killer Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00255	0.00255	0.00255	0.00255
Modeling Site 2	0.00255	0.00255	0.00255	0.00255
Modeling Site 3	0.00255	0.00255	0.00255	0.00255
Modeling Site 4	0.04480	0.04480	0.04480	0.04480
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00255	0.00255	0.00255	0.00255
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00255	0.00255	0.00255	0.00255
Modeling Site 9	0.04480	0.04480	0.04480	0.04480
Modeling Site 10	0.00422	0.00422	0.00422	0.00422
Modeling Site 11	0.00422	0.00422	0.00422	0.00422
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

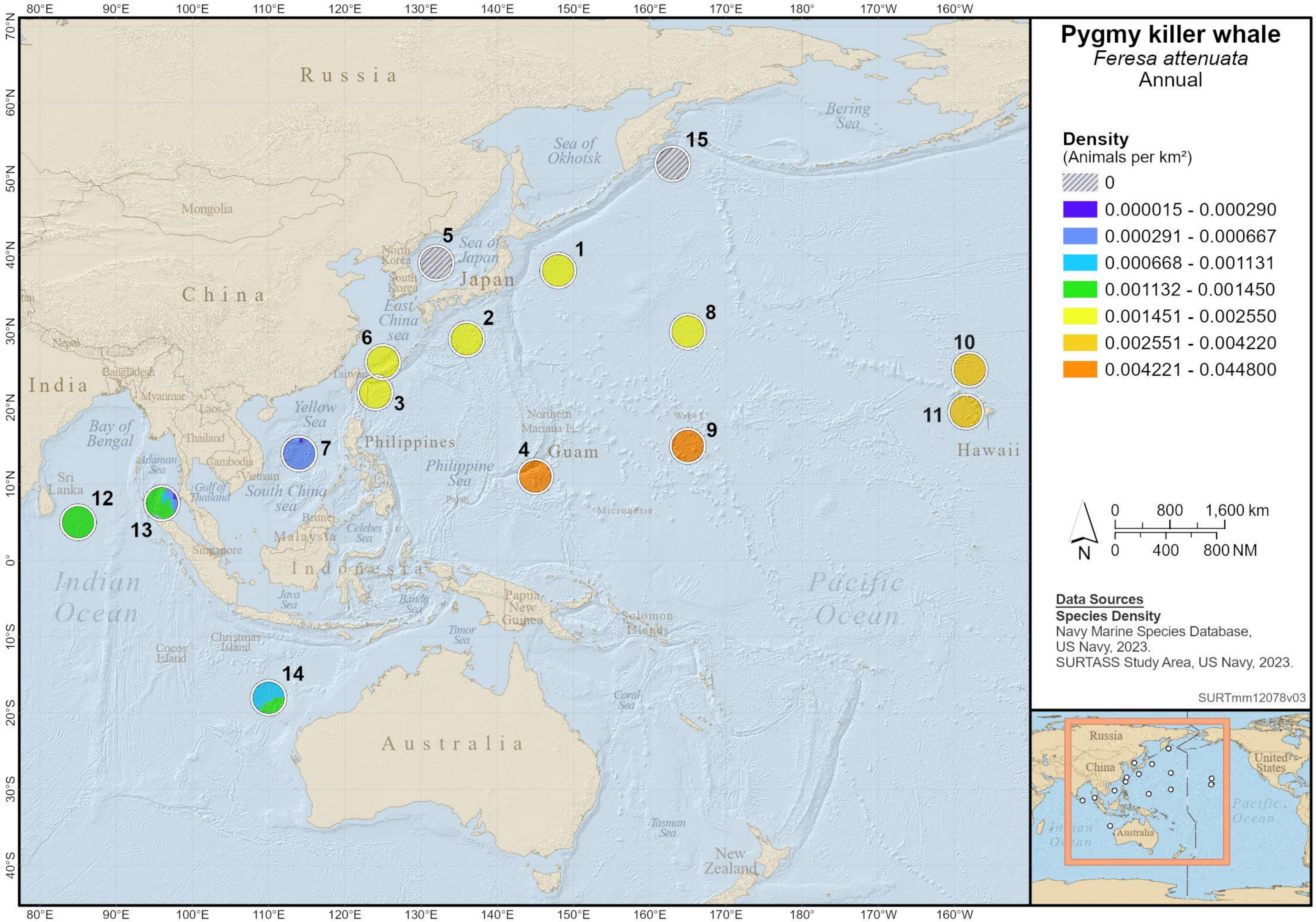


Figure 2.14-1: Annual Distribution of Pygmy Killer Whale in the SURTASS LFA Study Area

2.15 *GLOBICEPHALA MACRORHYNCHUS*, SHORT-FINNED PILOT WHALE

The short-finned pilot whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Minton et al., 2018).

The short-finned pilot whale is widely distributed throughout most tropical and warm temperate waters of the world and occurs in waters over the continental shelf break, in slope waters, and in areas of high topographic relief (Baird, 2013; Olson, 2009). Short-finned pilot whales are not considered a migratory species, although seasonal shifts in abundance have been noted in some portions of the species' range. A number of studies in different regions suggest that the distribution and seasonal inshore/offshore movements of pilot whales coincide closely with the abundance of squid, their preferred prey (Bernard & Reilly, 1999; Hui, 1985; Payne & Heinemann, 1993).

NMFS recognizes two stocks of short-finned pilot whale in the U.S. North Pacific: the California, Oregon, Washington stock; and the Hawaii stock (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of short-finned pilot whales is 19,242 animals, with a 95 percent confidence interval of 12,289–30,129 whales (Becker et al., 2022b).

Short-finned pilot whales are expected to occur in all of the SURTASS modeling sites except the most northern, site 15 (Northeast of Japan). A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.15-1, following the modeling site descriptions. Figure 2.15-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.15.1 MODELING SITE 1 – EAST OF JAPAN

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.4 Modeling Site 4 – Guam

Short-finned pilot whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0123 animals/km^2 (CV = 0.98) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.15.5 Modeling Site 5 – Sea of Japan

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.6 Modeling Site 6 – East China Sea

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and short-finned pilot whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.15.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° TO 40° N

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° TO 25° N

Density data for short-finned pilot whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.15.10 Modeling Site 10 – Hawaii North

Short-finned pilot whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2020 (Becker et al., 2022b). The short-finned pilot whale habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on weekly environmental conditions specific to the most recent four years of the study period (i.e., 2017–2020). The separate weekly predictions were then averaged across the full 2017–2020 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.15.11 Modeling Site 11 – Hawaii South

Short-finned pilot whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2020 (Becker et al., 2022b). The short-finned pilot whale habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on weekly environmental conditions specific to the most recent four years of the study period (i.e., 2017–2020). The separate weekly predictions were then averaged across the full 2017–2020 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.15.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and short-finned pilot whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.15.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and short-finned pilot whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.15.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and short-finned pilot whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.15-1: Summary of Density Values for Short-Finned Pilot Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0123	0.0123	0.0123	0.0123
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

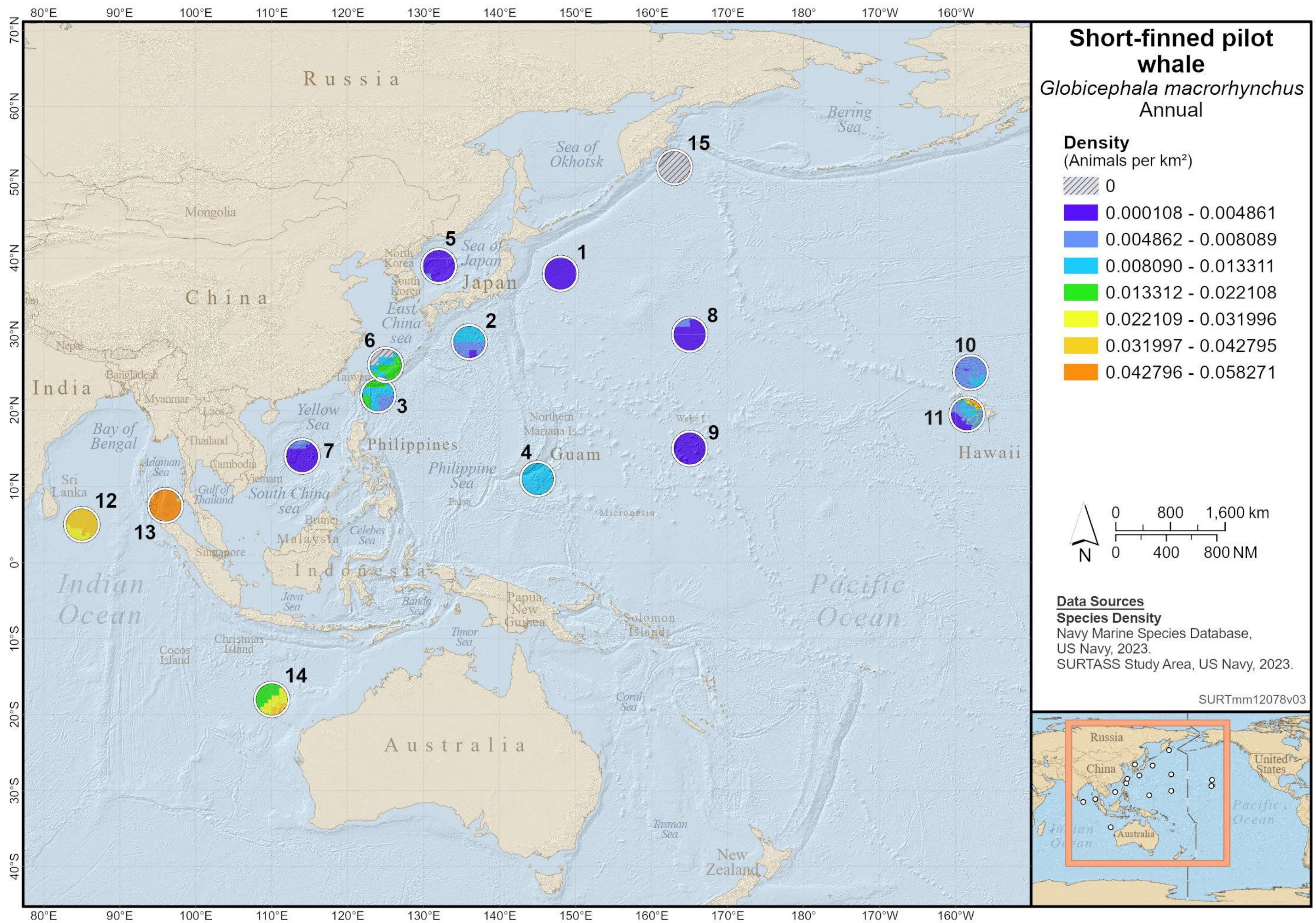


Figure 2.15-1: Annual Distribution of Short-Finned Pilot Whale in the SURTASS LFA Study Area

2.16 *Grampus griseus*, Risso's Dolphin

Risso's dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka & Braulik, 2018a).

Risso's dolphins are distributed worldwide in tropical and temperate waters along the continental shelf break and over the continental slope and outer continental shelf (Baumgartner, 1997; Cañadas et al., 2002; Davis et al., 1998; Green et al., 1992). Risso's dolphins are also found in association with submarine canyons (Mussi et al., 2004). This species appears to be distributed primarily in waters between 30° S and 45° N latitude (Jefferson et al., 2015).

NMFS recognizes two stocks of Risso's dolphin in the U.S. North Pacific: the California, Oregon, Washington stock; and the Hawaii stock (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of Risso's dolphin is 6,979 animals, with a 95 percent confidence interval of 3,649–13,348 whales (Becker et al., 2022b).

Risso's dolphins are expected to occur in all of the SURTASS modeling sites except the most northern, site 15 (Northeast of Japan). A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.16-1, following the modeling site descriptions. Figure 2.16-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.16.1 Modeling Site 1 – East of Japan

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.2 Modeling Site 2 – North Philippine Sea

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.3 Modeling Site 3 – West Philippine Sea

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.4 Modeling Site 4 – Guam

Risso's dolphin density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ was used to characterize Risso's dolphin density (Bradford et al., 2021). The most recent estimate of 0.00255 animals/km^2 (CV = 0.50) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.16.5 Modeling Site 5 – Sea of Japan

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.6 Modeling Site 6 – East China Sea

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Risso's dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.16.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for Risso's dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.16.10 Modeling Site 10 – Hawaii North

Risso's dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2020 (Becker et al., 2022b). The Risso's dolphin habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on weekly environmental conditions specific to the most recent four years of the study period (i.e., 2017–2020). The separate weekly predictions were then averaged across the full 2017–2020 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.16.11 Modeling Site 11 – Hawaii South

Risso's dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on habitat-based density models developed from sighting data collected within the Hawaiian Islands EEZ from 2002 to 2020 (Becker et al., 2022b). The Risso's dolphin habitat model was used to derive spatially explicit density values for the Hawaiian Islands EEZ by predicting on weekly environmental conditions specific to the most recent four years of the study period (i.e., 2017–2020). The separate weekly predictions were then averaged across the full 2017–2020 period to provide a multi-year average surface of spatially explicit density and associated CV estimates at an approximate 9 km^2 grid resolution.

2.16.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Risso's dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.16.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Risso's dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.16.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Risso's dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.16-1: Summary of Density Values for Risso's Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0025	0.0025	0.0025	0.0025
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

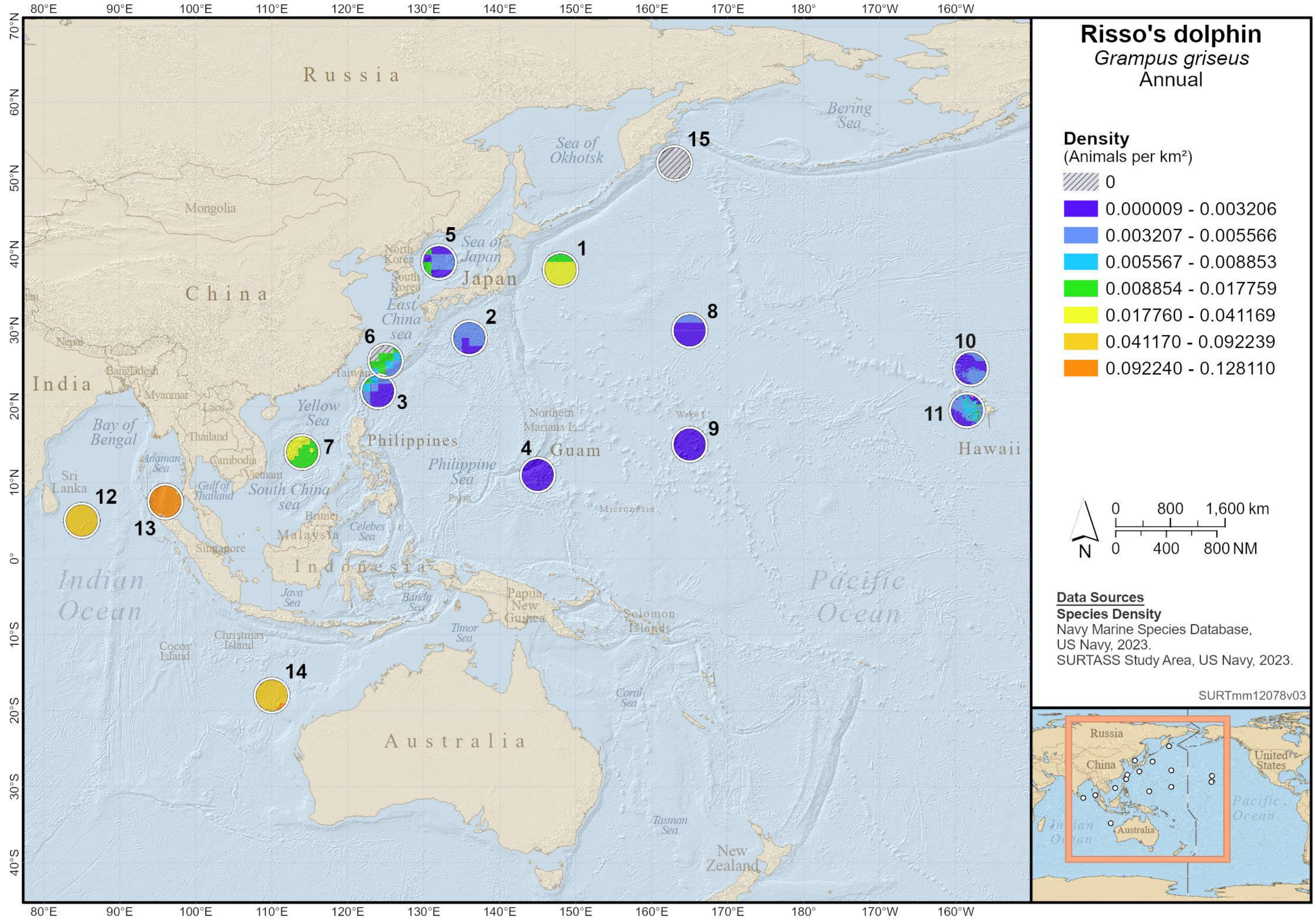


Figure 2.16-1: Annual Distribution of Risso's Dolphin in the SURTASS LFA Study Area

2.17 *Lagenodelphis hosei*, Fraser's Dolphin

Fraser's dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka & Braulik, 2018b).

Fraser's dolphin has a pantropical distribution, mainly occurring between 30°N and 30°S throughout the Pacific, Atlantic, and Indian Oceans (Jefferson et al., 2015). Fraser's dolphin is considered an open ocean deepwater species, except where deep water approaches the coast (Dolar, 2009).

NMFS recognizes a single Pacific management stock of Fraser's dolphins that includes animals found within the Hawaiian Islands EEZ and in adjacent high-sea waters (Carretta et al., 2023). The most recent abundance estimate for the Hawaii stock of Fraser's dolphins is 40,960 animals, with a 95 percent confidence interval of 11,887–14,143 dolphins (Bradford et al., 2021).

Given their distribution, Fraser's dolphins are expected to occur in the SURTASS modeling sites located in the tropical and subtropical waters of the western Pacific and eastern Indian oceans. For all the other sites (1, 5, 8, and 15), a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.17-1, following the modeling site descriptions. Figure 2.17-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.17.1 Modeling Site 2 – North Philippine Sea

Density data for Fraser's dolphin were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.01233 animals/km^2 (CV = 0.63, approximated using a log-normal distribution) was applied to this modeling site, which is encompassed within the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.17.2 Modeling Site 3 – West Philippine Sea

Density data for Fraser's dolphin were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.01233 animals/km^2 (CV = 0.63, approximated using a log-normal distribution) was applied to this modeling site, which lies just to the south of the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.17.3 Modeling Site 4 – Guam

Fraser's dolphin density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ was used to characterize Fraser's dolphin density (Bradford et al., 2021). The most recent estimate of 0.01673 animals/km^2 (CV = 0.70) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.17.4 Modeling Site 6 – East China Sea

Density data for Fraser's dolphin were based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and (Kanaji et al., 2023c). The resulting uniform density estimate of 0.01233 animals/km^2 (CV = 0.63, approximated using a log-normal distribution) was applied to this modeling site, which overlaps the survey area. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.17.5 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Fraser's dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.17.6 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Fraser's dolphin density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the representative transit corridor site east of the MITT Study Area, given the similar location of these sites in the western North Pacific. The estimate was based on Bayesian line-transect analyses of sighting data collected off the Pacific coast of Japan from surveys conducted between 2006 and 2021 (Kanaji et al., 2023c). The resulting uniform density estimate of 0.01233 animals/km^2 (CV = 0.63, approximated using a log-normal distribution) was applied to this modeling site. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.17.7 Modeling Site 10 – Hawaii North

Fraser's dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for Fraser's dolphin of 0.01673 animals/km^2 (CV = 0.70) was used year round.

2.17.8 Modeling Site 11 – Hawaii South

Fraser's dolphin density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017 (Bradford et al., 2021). The most recent 2017 uniform density estimate for Fraser's dolphin of 0.01673 animals/km^2 (CV = 0.70) was used year round.

2.17.9 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Fraser's dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.17.10 MODELING SITE 13 – ANDAMAN SEA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Fraser's dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.17.11 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Fraser's dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.17-1: Summary of Density Values for Fraser's Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.01233	0.01233	0.01233	0.01233
Modeling Site 3	0.01233	0.01233	0.01233	0.01233
Modeling Site 4	0.01673	0.01673	0.01673	0.01673
Modeling Site 5	0	0	0	0
Modeling Site 6	0.01233	0.01233	0.01233	0.01233
Modeling Site 7	S	S	S	S
Modeling Site 8	0	0	0	0
Modeling Site 9	0.01233	0.01233	0.01233	0.01233
Modeling Site 10	0.01673	0.01673	0.01673	0.01673
Modeling Site 11	0.01673	0.01673	0.01673	0.01673
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

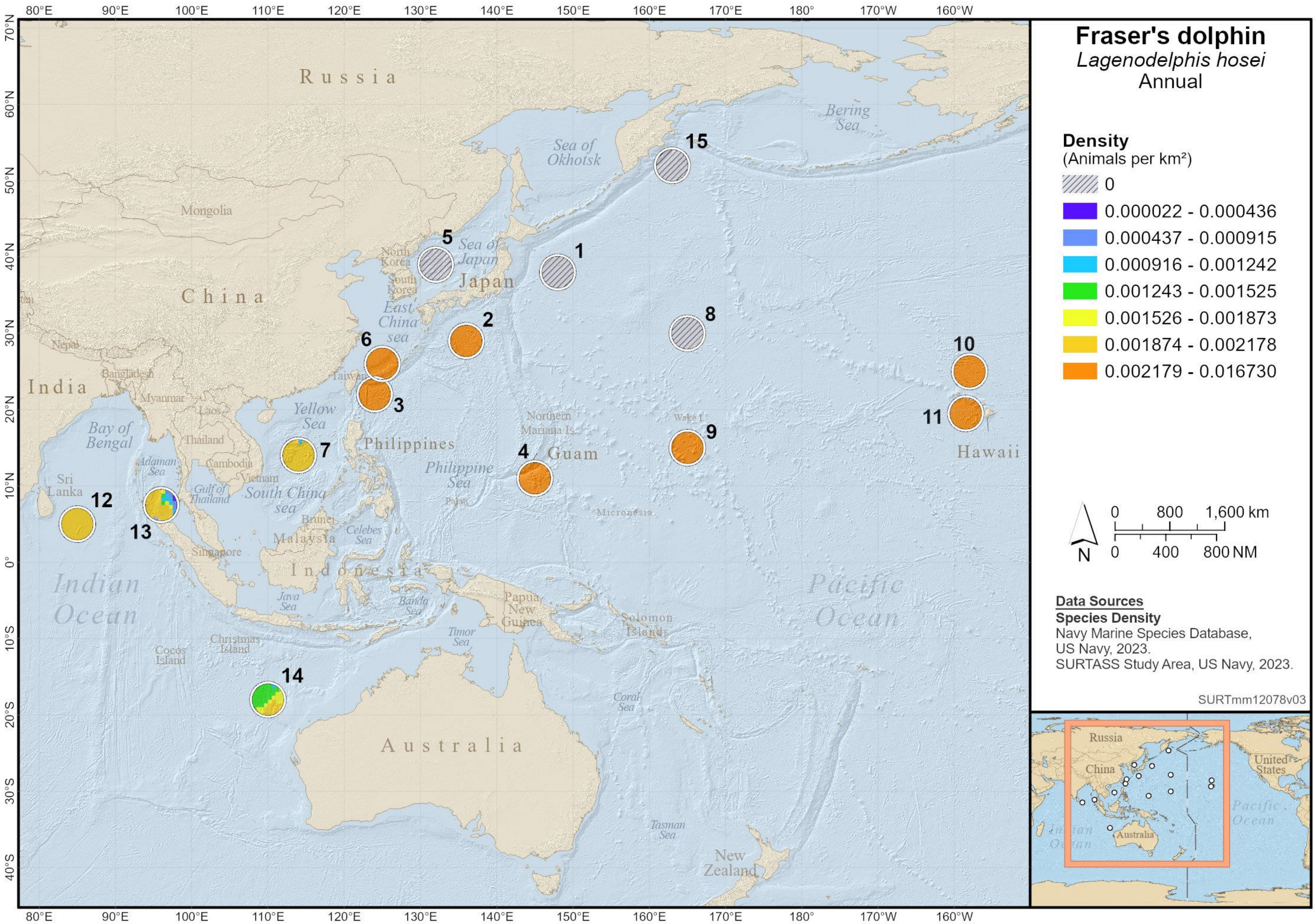


Figure 2.17-1: Annual Distribution of Fraser's Dolphin in the SURTASS LFA Study Area

2.18 *Lagenorhynchus obliquidens*, Pacific White-Sided Dolphin

Pacific white-sided dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Ashe & Braulik, 2018).

Pacific white-sided dolphins are found in cold temperate waters of the North Pacific and some adjacent seas, including the Sea of Japan (Ferguson, 2005; Jefferson et al., 2015; Leatherwood et al., 1984; Reeves et al., 2002). Pacific white-sided dolphin abundance was found to increase in shelf and slope waters off the U.S. West Coast (Becker et al., 2020), although sighting records and captures in open sea driftnets indicate that this species also occurs in oceanic waters well beyond the shelf and slope (Ferrero & Walker, 1996; Leatherwood et al., 1984).

Although there is evidence that two forms of Pacific white-sided dolphin occur off the U.S. west coast (a northern and southern stock), due to the difficulty of distinguishing the two stocks in the field, and given an area of apparent overlap off Southern California (Lux et al., 1997), NMFS currently recognizes a single stock, the California, Oregon, and Washington stock for the U.S. west coast (Carretta et al., 2023). In the North Pacific Ocean, an abundance of 931,000 Pacific white-sided dolphins was estimated (Buckland et al., 1993); however, this estimate is now more than 30 years old.

Given their known distribution patterns in the North Pacific, Pacific white-sided dolphins are only expected to occur in SURTASS modeling site 1 (East of Japan), site 2 (North Philippine Sea), site 5 (Sea of Japan), site 6 (East China Sea), site 8 (Offshore Japan/Western North Pacific 25° to 40° N), and site 15 (Northeast of Japan). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.18-1, following the modeling site descriptions. Figure 2.18-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.18.1 Modeling Site 1 – East of Japan

Density data for Pacific white-sided dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.18.2 Modeling Site 2 – North Philippine Sea

Density data for Pacific white-sided dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.18.3 Modeling Site 5 – Sea of Japan

Density data for Pacific white-sided dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.18.4 Modeling Site 6 – East China Sea

Density data for Pacific white-sided dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.18.5 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Pacific white-sided dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.18.6 Modeling Site 15 – Northeast of Japan

Density data for Pacific white-sided dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.18-1: Summary of Density Values for Pacific White-Sided Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

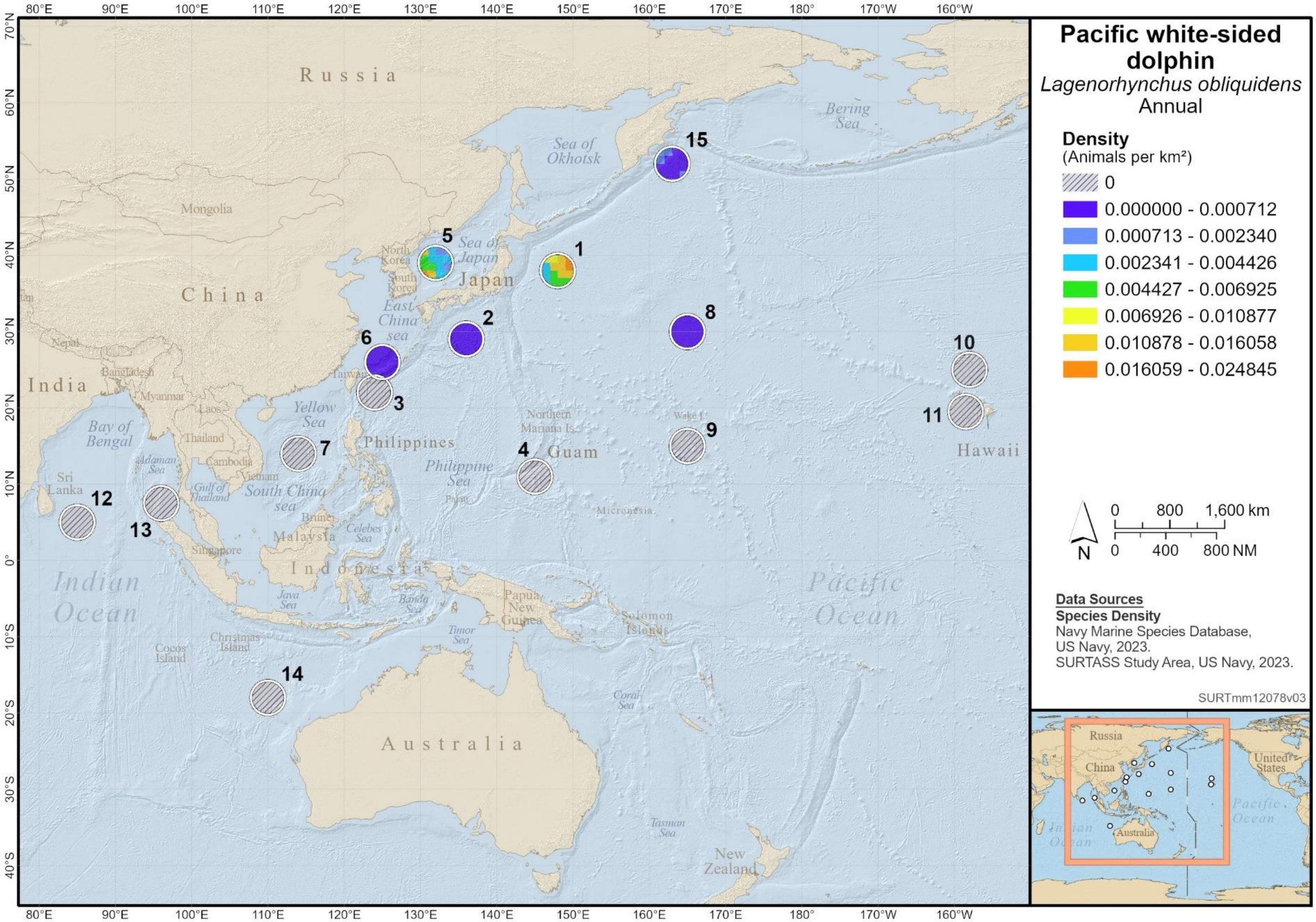


Figure 2.18-1: Annual Distribution of Pacific White-Sided Dolphin in the SURTASS LFA Study Area

2.19 *LISSODELPHIS BOREALIS*, NORTHERN RIGHT WHALE DOLPHIN

Northern right whale dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Braulik & Jefferson, 2018).

The northern right whale dolphin occurs in cool-temperate to subarctic waters of the North Pacific Ocean, from the west coast of North America to Japan and Russia. Northern right whale dolphins do not appear to enter the Sea of Japan (Jefferson et al., 2015). This species is distributed from approximately 30°N to 50°N, 145°W to 118°E and generally not as far north as the Bering Sea (Jefferson et al., 2015). The species occurs primarily in offshore waters although they do occur in shelf and slope waters along the U.S. West Coast (Becker et al., 2020).

NMFS currently recognizes a single stock of northern right whale dolphin, the California, Oregon, and Washington stock for the U.S. west coast (Carretta et al., 2023). The global population of northern right whale dolphins in the North Pacific Ocean is estimated at 68,000 animals (Jefferson et al., 2015). The most current estimate for the California, Oregon, and Washington stock is 29,285 (CV = 0.717) animals (Becker et al., 2020).

Given their known distribution patterns in the North Pacific, northern right whale dolphins are only expected to occur in SURTASS modeling Site 1 (East of Japan), Site 8 (Offshore Japan/Western North Pacific 25° to 40° N), and Site 15 (Northeast of Japan). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.19-1, following the modeling site descriptions. Figure 2.19-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.19.1 MODELING SITE 1 – EAST OF JAPAN

Density data for northern right whale dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.19.2 MODELING SITE 8 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 25° TO 40° N

Density data for northern right whale dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.19.3 MODELING SITE 15 – NORTHEAST OF JAPAN

Density data for northern right whale dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.19-1: Summary of Density Values for Northern Right Whale Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

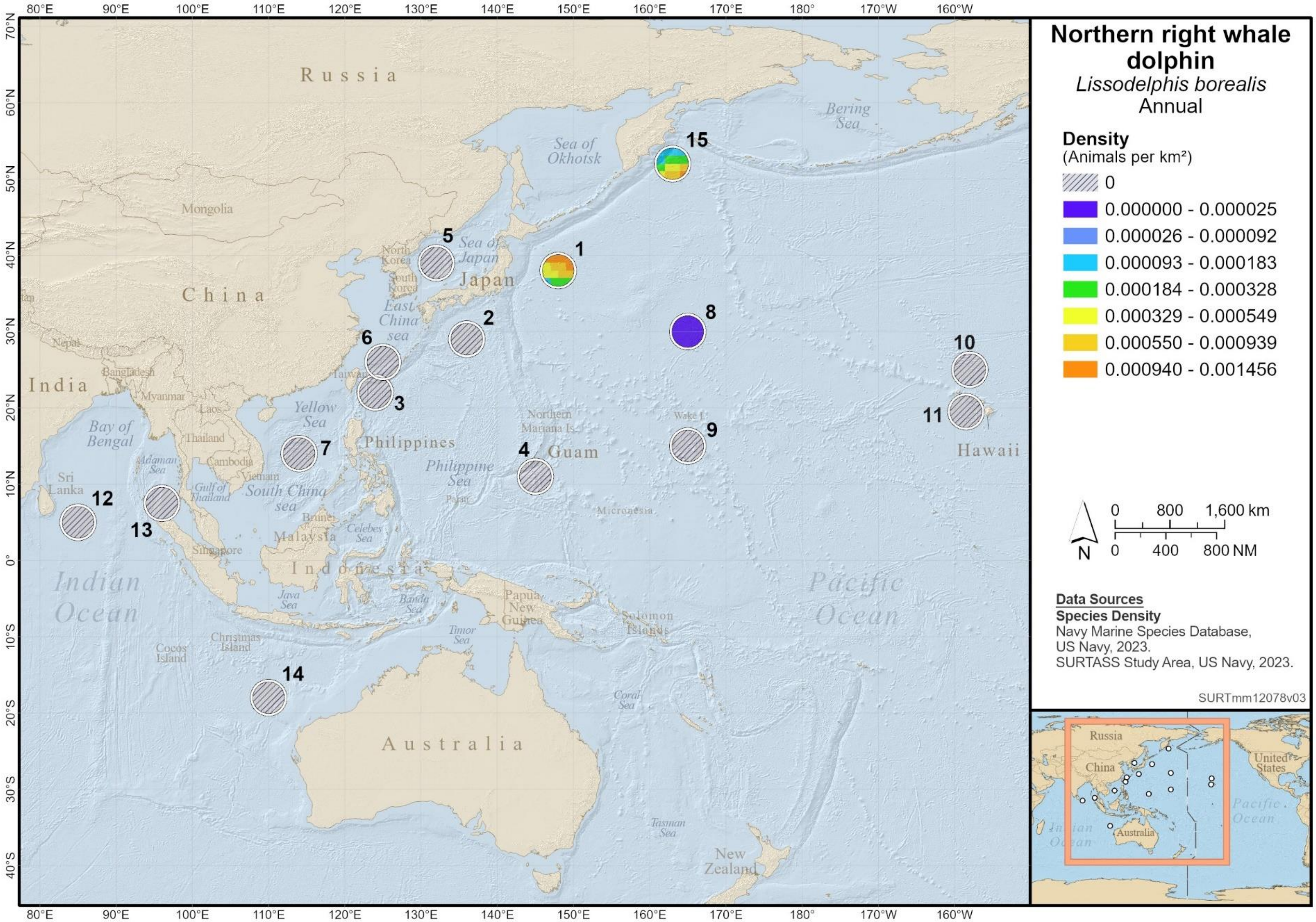


Figure 2.19-1: Annual Distribution of Northern Right Whale Dolphin in the SURTASS LFA Study Area

2.20 *Neophocaena phocaenoides*, Indo-Pacific Finless Porpoise

The Indo-Pacific finless porpoise is listed as Vulnerable by the IUCN Red List of Threatened Species (Wang & Reeves, 2017).

Indo-Pacific finless porpoises occur in shallow (usually <50 meters [m] deep) tropical to warm temperate coastal marine waters (including bays, mangrove swamps, and estuaries) around the northern rim of the Indian and western Pacific Oceans (Collins et al., 2005; Jefferson et al., 2015; Preen, 2004). There are few estimates of abundance available for this species, and only for select regions. The abundance of Indo-Pacific Finless Porpoises in Hong Kong and adjacent waters was estimated to be at least 217 (Jefferson et al., 2002). Data collected during boat-based surveys conducted between 2013 and 2016 in the coastal waters of Matang, Peninsular Malaysia, supported the derivation of design-based estimates for Indo-Pacific finless porpoise of 600 animals (CV = 0.27), with an associated 95 percent confidence interval of 354–1,016 porpoises (Kuit et al., 2021).

Indo-Pacific finless porpoises are only expected to occur in SURTASS modeling Site 13 (Andaman Sea), and only in very shallow (<50 m deep) coastal waters. A zero density is assumed for deeper waters within modeling Site 13 and for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.20-1, following the modeling site descriptions. Figure 2.20-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.20.1 Modeling Site 13 – Andaman Sea

Density data for Indo-Pacific finless porpoise were based on design-based estimates for coastal Malaysia (Kuit et al., 2021) and were selected to provide conservative estimates for the shallow (<50 m deep) coastal waters within Site 13, located just to the northwest of the survey area. The density estimate of 0.71 animals/km (CV = 0.271) was applied from the shore to the 50 m isobath within the modeling site. Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.20-1: Summary of Density Values for Indo-Pacific Finless Porpoise in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13: from shore to 50 m isobath	0.71	0.71	0.71	0.71
Modeling Site 13: >50 m depth	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

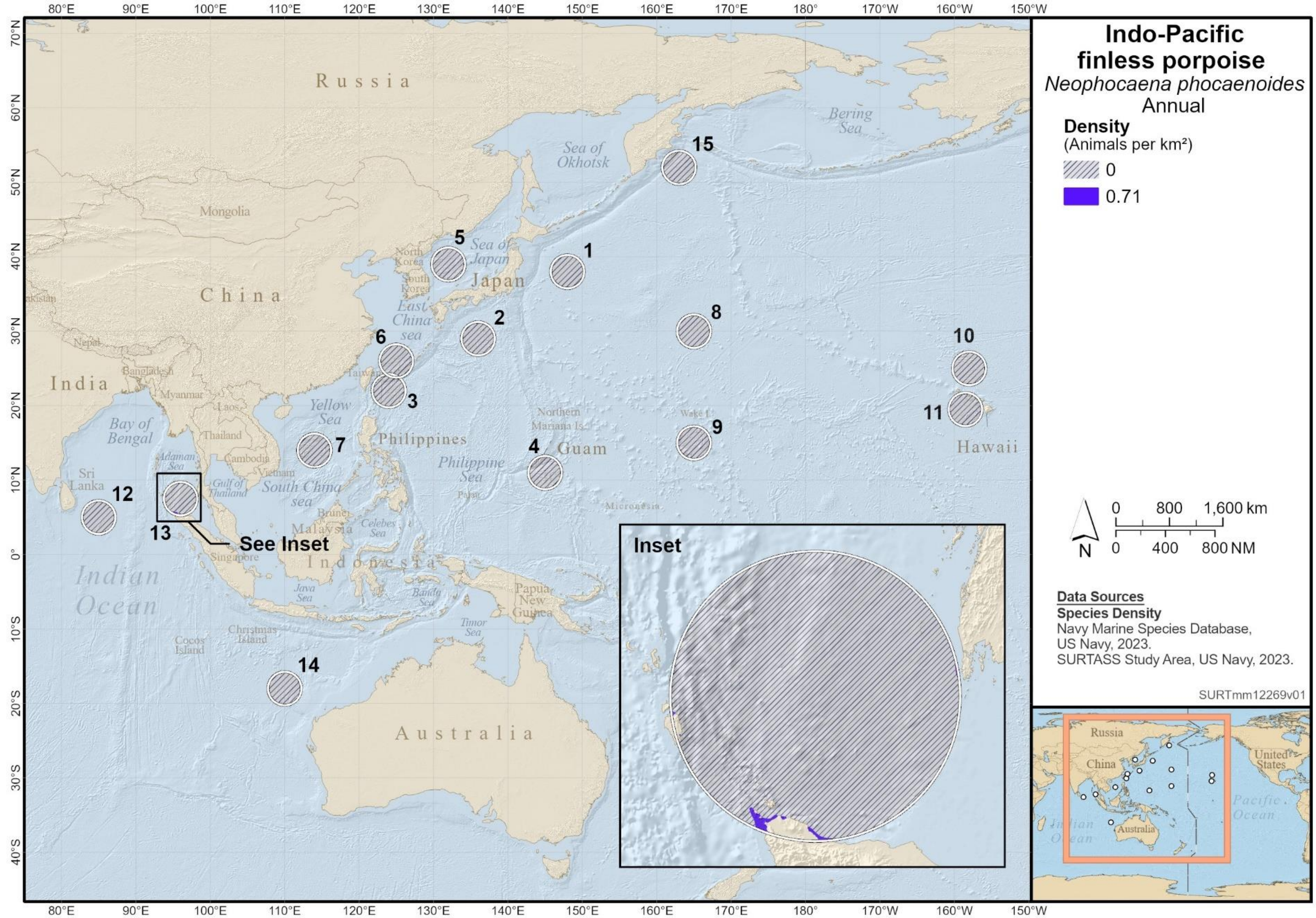


Figure 2.20-1: Annual Distribution of Indo-Pacific Finless Porpoise in the SURTASS LFA Study Area

2.21 *ORCAELLA BREVIROSTRIS*, IRRAWADDY DOLPHIN

The Mekong River subpopulation of the Irrawaddy dolphin is listed as Critically Endangered by the IUCN Red List of Threatened Species (Smith et al., 2023).

Irrawaddy dolphins are patchily distributed in coastal, brackish, and fresh waters associated with river mouths of the tropical and subtropical Indo-Pacific (Jefferson et al., 2015). Their range is poorly documented in much of Southeast Asia, but there are known freshwater populations in the Irrawaddy, Mahakam, and Mekong rivers, as well as Songkhla Lake (Thailand) and Chilika Lagoon (India).

Irrawaddy dolphins are only expected to occur in SURTASS modeling Site 13 (Andaman Sea), and only in very shallow (<20 m deep) coastal waters. A zero density is assumed for deeper waters within modeling Site 13 and for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.21-1, following the modeling site descriptions. Figure 2.21-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.21.1 MODELING SITE 13 – ANDAMAN SEA

Density data for Irrawaddy dolphin were based on design-based estimates for coastal Malaysia (Kuit et al., 2021) and were selected to provide conservative estimates for the shallow (<20 m deep) coastal waters within Site 13, located just to the northwest of the survey area. The density estimate of 0.66 animals/km (CV = 0.133) was applied from the shore to the 20 m isobath within the modeling site. Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.21-1: Summary of Density Values for Irrawaddy Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13: from shore to 20 m isobath	0.66	0.66	0.66	0.66
Modeling Site 13: >20 m depth	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

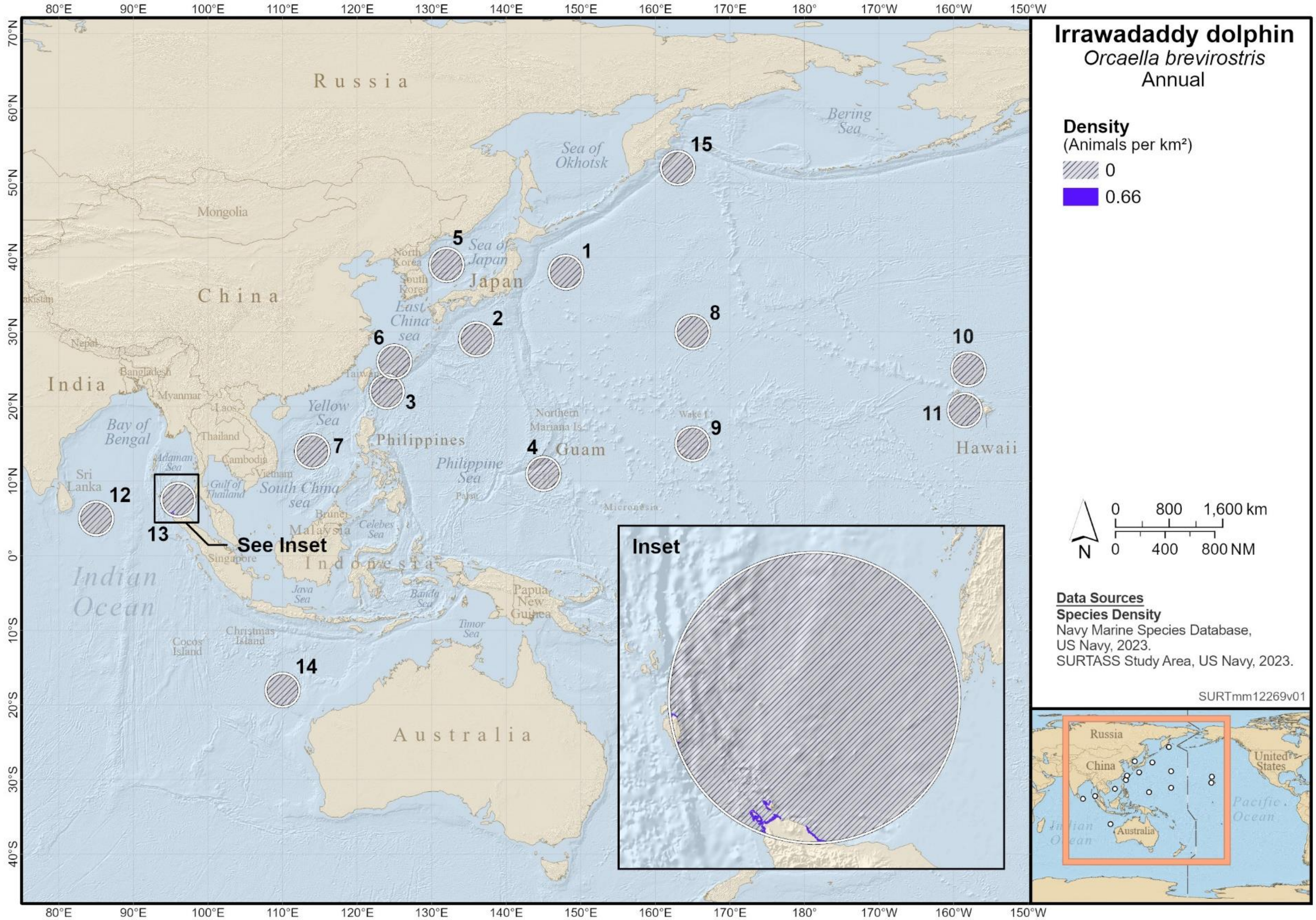


Figure 2.21-1: Annual Distribution of Irrawaddy Dolphin in the SURTASS LFA Study Area

2.22 *ORCINUS ORCA*, KILLER WHALE

A single species of killer whale is currently recognized, but strong and increasing evidence indicates the possibility of several different species of killer whales worldwide, many of which are called “ecotypes” (Ford, 2008; Morin et al., 2010; Morin et al., 2024). The different geographic forms of killer whale are distinguished by distinct social and foraging behaviors and other ecological traits. In the North Pacific, these recognizable geographic forms are variously known as “residents,” “transients” (also known as Bigg’s killer whales), and “offshores” (Baird, 2000; Barrett Lennard et al., 1996; Morin et al., 2024).

Eight killer whale stocks are recognized within the Pacific U.S. EEZ, including (1) the Eastern North Pacific Alaska Resident stock—occurring from Southeast Alaska to the Bering Sea; (2) the Eastern North Pacific Northern Resident stock—occurring from British Columbia through Alaska; (3) the Eastern North Pacific Southern Resident stock—occurring mainly within the inland waters of Washington State and southern British Columbia but extending from central California into southern Southeast Alaska; (4) the West Coast Transient stock—occurring from Alaska through California; (5) the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock—occurring from southeast Alaska to the Bering Sea; (6) the AT1 Stock—found only in Prince William Sound, (7) the Eastern North Pacific Offshore stock—occurring from Alaska through California, and (8) the Hawaiian stock (Carretta et al., 2023). The Southern Resident killer whale stock is listed as endangered under the ESA. Of these stocks, only the Hawaiian stock would occur within the SURTASS LFA Study Area within modeling sites 10 and 11. The most recent abundance estimate for the Hawaiian stock of killer whales is 161 animals, with a 95 percent confidence interval of 29–881 whales (Bradford et al., 2021). Killer whale is listed as Data Deficient by the IUCN Red List of Threatened Species (Reeves et al., 2017).

Killer whales are found worldwide in all ocean areas, but they are most numerous in coastal waters and at higher latitudes (Dahlheim & Heyning, 1999; Jefferson et al., 2015). Given their cosmopolitan distribution, killer whales are expected to occur in all of the SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.22-1, following the modeling site descriptions. Figure 2.22-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.22.1 MODELING SITE 1 – EAST OF JAPAN

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.3 Modeling Site 3 – West Philippine Sea

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.4 Modeling Site 4 – Guam

Killer whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT study area. Given the lack of regionally specific density data for this species, the recent design-based estimate for the Hawaiian Islands EEZ was used to characterize killer whale density (Bradford et al., 2021). The most recent estimate of 0.00007 animals/km^2 (CV = 1.06) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.22.5 Modeling Site 5 – Sea of Japan

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.6 Modeling Site 6 – East China Sea

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and killer whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.22.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.22.10 Modeling Site 10 – Hawaii North

Killer whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00007 animals/km^2 (CV = 1.06) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.22.11 Modeling Site 11 – Hawaii South

Killer whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00007 animals/km^2 (CV = 1.06) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.22.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and killer whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.22.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and killer whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.22.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012). Based on a synthesis of available information on worldwide killer whale abundance and distribution (Forney & Wade, 2006), a killer whale density estimate of 0.0010 animals/km^2 was estimated for modeling site 14. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.22.15 Modeling Site 15 – Northeast of Japan

Density data for killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure

1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.22-1: Summary of Density Values for Killer Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.00007	0.00007	0.00007	0.00007
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	0.00007	0.00007	0.00007	0.00007
Modeling Site 11	0.00007	0.00007	0.00007	0.00007
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0.0010	0.0010	0.0010	0.0010
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

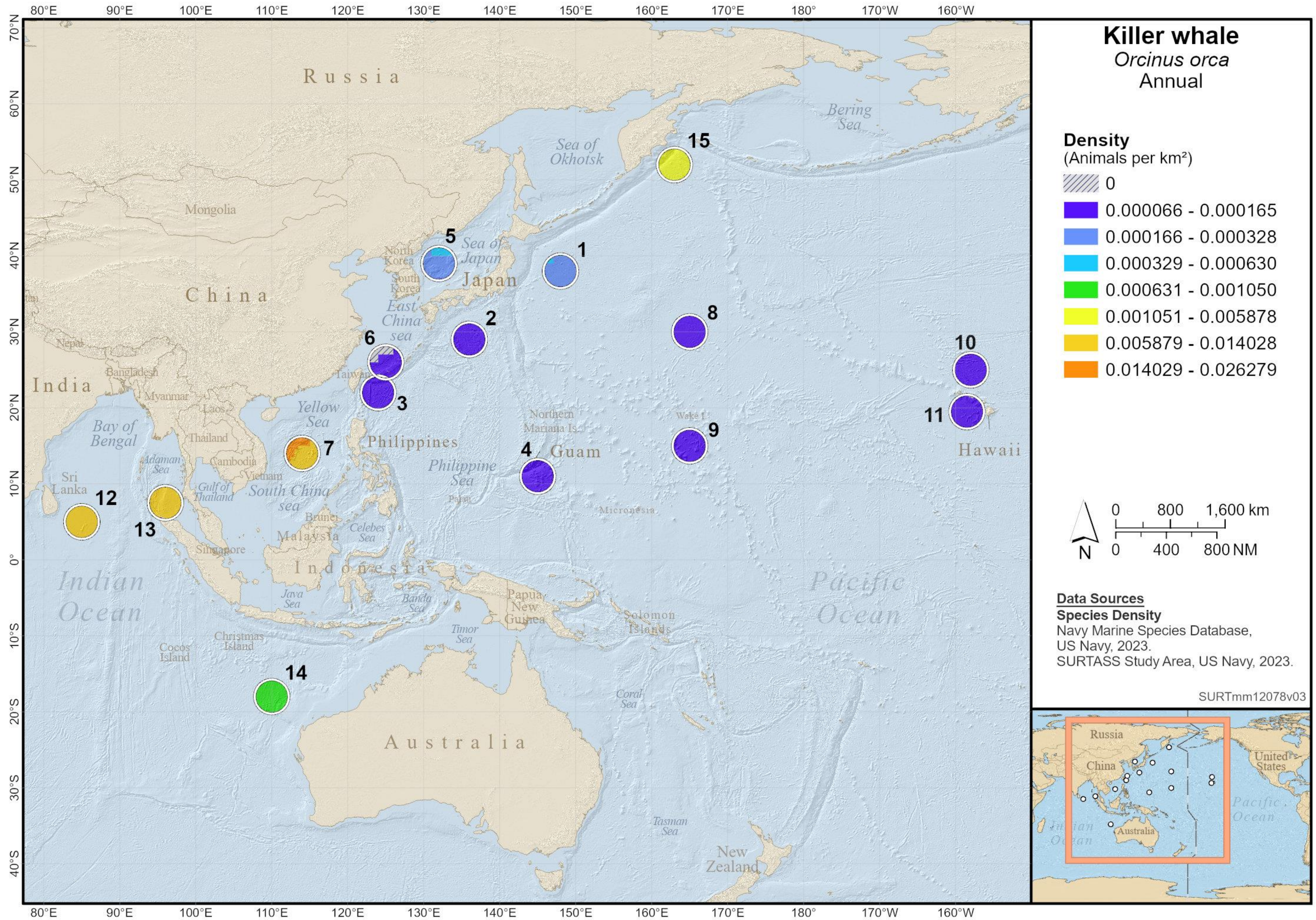


Figure 2.22-1: Annual Distribution of Killer Whale in the SURTASS LFA Study Area

2.23 *Peponocephala electra*, Melon-Headed Whale

Melon-headed whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka & Brownell Jr., 2019).

Melon-headed whales are found worldwide in tropical and subtropical waters. They are occasionally reported at higher latitudes, but these movements are considered beyond their typical range because the records indicate these movements occurred during incursions of warm water currents (Perryman et al., 1994). Melon-headed whales are most often found in offshore deep waters (Jefferson et al., 2015).

NMFS recognizes two Pacific management stocks of melon-headed whales within the Hawaiian Islands EEZ based on photo-identification, social network analysis, movement data, and genetics (Oleson et al., 2013a). These stocks are (1) the Kohala Resident stock, which includes melon-headed whales off the Kohala and west coast of Hawaii Island in waters less than 2,500 m deep; and (2) the Hawaiian Islands stock, which includes melon-headed whales inhabiting waters throughout the U.S. Exclusive Economic Zone of the Hawaiian Islands (Carretta et al., 2023). The most recent abundance estimate for the Hawaiian Islands stock of melon-headed whales is 40,647 animals, with a 95 percent confidence interval of 11,097–148,890 whales (Bradford et al., 2021).

Melon-headed whales are expected to occur in all the SURTASS modeling sites except Site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.23-1, following the modeling site descriptions. Figure 2.23-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.23.1 Modeling Site 1 – East of Japan

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.2 Modeling Site 2 – North Philippine Sea

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.3 Modeling Site 3 – West Philippine Sea

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.4 Modeling Site 4 – Guam

Melon-headed whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sightings collected during the Navy's 2007 systematic survey of the waters off Guam and the CNMI (Fulling et al., 2011). During this survey, there were a total of two on-effort melon-headed whale sightings, which supported the derivation of a design-based density estimate of 0.00428 animals/km^2 (CV = 0.70).

2.23.5 Modeling Site 5 – Sea of Japan

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.6 Modeling Site 6 – East China Sea

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and melon-headed whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.23.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for melon-headed whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.23.10 MODELING SITE 10 – HAWAII NORTH

Melon-headed whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands stock (Bradford et al., 2021). The most recent estimate of 0.01661 animals/km^2 (CV = 0.74) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.23.11 MODELING SITE 11 – HAWAII SOUTH

Melon-headed whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands stock (Bradford et al., 2021). The most recent estimate of 0.01661 animals/km^2 (CV = 0.74) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.23.12 MODELING SITE 12 – OFFSHORE SRI LANKA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and melon-headed whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.23.13 MODELING SITE 13 – ANDAMAN SEA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and melon-headed whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.23.14 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and melon-headed whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.23-1: Summary of Density Values for Melon-Headed Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.00428	0.00428	0.00428	0.00428
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	0.01661	0.01661	0.01661	0.01661
Modeling Site 11	0.01661	0.01661	0.01661	0.01661
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

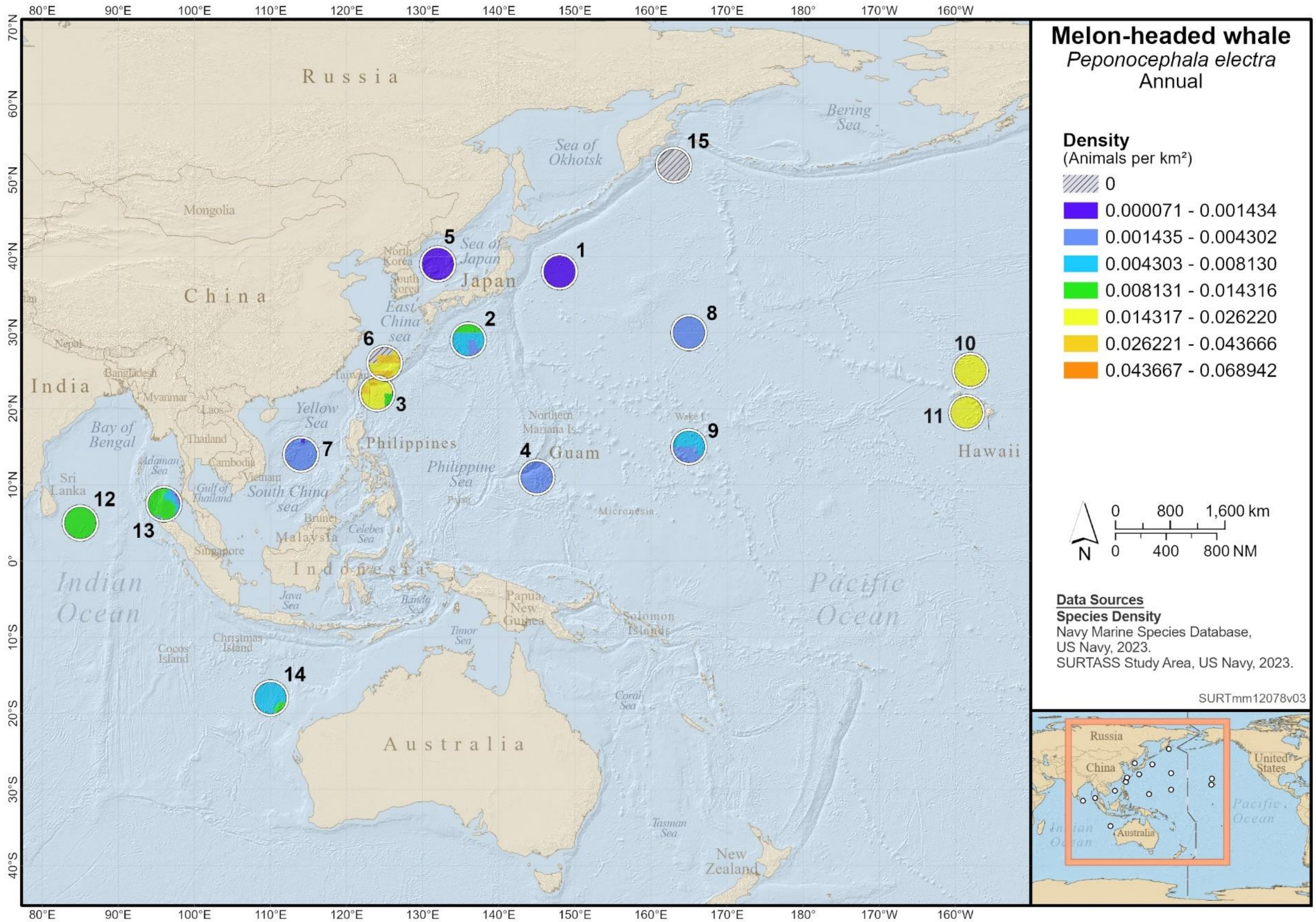


Figure 2.23-1: Annual Distribution of Melon-Headed Whale in the SURTASS LFA Study Area

2.24 *Pseudorca crassidens*, False Killer Whale

NMFS currently recognizes three stocks of false killer whale in Hawaiian waters: the Main Hawaiian Islands insular stock, the Northwestern Hawaiian Islands stock, and the Hawaii pelagic stock (Carretta et al., 2023). There are two additional stocks recognized outside of Hawaiian waters, including the Palmyra Atoll stock, which includes animals found within the U.S. EEZ of Palmyra Atoll; and the American Samoa stock, which includes animals found within the U.S. EEZ of American Samoa. The Main Hawaiian Islands insular stock is listed as endangered under the ESA (National Oceanic and Atmospheric Administration, 2012). False killer whale is listed as a Near Threatened species by the IUCN Red List of Threatened Species (Baird, 2018).

False killer whales occur worldwide throughout warm temperate and tropical oceans in deep open-ocean waters and around oceanic islands, although they sometimes occur over the continental shelf and occasionally come into shallow coastal waters (Baird et al., 2008; Leatherwood & Reeves, 1983; Odell & McClune, 1999). Occasional inshore movements are usually associated with movements of prey and shoreward flooding of warm ocean currents.

False killer whales are expected to occur in all the SURTASS modeling sites except site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.24-1, following the modeling site descriptions. Figure 2.24-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table. For the two sites that include waters within the Hawaiian Islands EEZ (site 10 and site 11), insets are provided to show the different density estimates for the three stocks of false killer whale known to occur in this region.

2.24.1 Modeling Site 1 – East of Japan

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.2 Modeling Site 2 – North Philippine Sea

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.3 Modeling Site 3 – West Philippine Sea

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.4 MODELING SITE 4 – GUAM

False killer whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.00109 animals/km^2 (CV = 0.84) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.24.1 MODELING SITE 5 – SEA OF JAPAN

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.2 MODELING SITE 6 – EAST CHINA SEA

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.3 MODELING SITE 7 – SOUTH CHINA SEA

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and false killer whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.24.4 MODELING SITE 8 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 25° TO 40° N

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.5 MODELING SITE 9 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 10° TO 25° N

Density data for false killer whale were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.24.6 Modeling Site 10 – Hawaii North

False killer whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Of the three false killer whale stocks that occur within the Hawaiian Islands EEZ, only individuals belonging to the Hawaii pelagic stock are expected to occur within modeling site 10. Sighting data collected from systematic ship surveys within the central Pacific between 1986 and 2017, including the three Hawaiian Islands EEZ surveys in 2002, 2010, and 2017, supported the development of a habitat-based density model specific to the Hawaii Pelagic Stock of false killer whale (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.24.7 Modeling Site 11 – Hawaii South

False killer whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, with separate estimates defined for the three stocks that have partially overlapping ranges with the Hawaiian Islands EEZ as summarized below.

Main Hawaiian Islands Insular Stock. Bradford et al. (2018) used photo-identification and mark-recapture methods to estimate annual abundance of the Main Hawaiian Islands insular stock of false killer whales from 2000 to 2015. The resulting density estimate for this stock was 0.00057 animals/km^2 (CV = 0.14), which was applicable to the published range of this species, which extends within a modified 72 km radius around the Main Hawaiian Islands (Carretta et al., 2022).

Northwestern Hawaiian Islands Stock. Bradford et al. (2020) provided abundance estimates for the Northwestern Hawaiian Islands Stock of false killer whale based on multiple-covariate line-transect analyses of sighting data collected on three surveys of waters within the Hawaiian Islands EEZ in 2002, 2010, and 2017. The Bradford et al. (2020) estimate of 0.00106 animals/km^2 (CV = 1.71) for the most recent year (2017) is considered a year round estimate for this stock within its approximate 449,801 km^2 area range boundaries.

Hawaii Pelagic Stock. Sighting data collected from systematic ship surveys within the central Pacific between 1986 and 2017, including the three Hawaiian Islands EEZ surveys in 2002, 2010, and 2017, supported the development of a habitat-based density model specific to the Hawaii Pelagic Stock of false killer whale (Becker et al., 2021; Bradford et al., 2020).

Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.24.8 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and false killer whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.24.9 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and false killer whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.24.10 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and false killer whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.24-1: Summary of Density Values for False Killer Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.00109	0.00109	0.00109	0.00109
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Hawaii Pelagic Stock	S	S	S	S
Modeling Site 11 Main Hawaiian Islands Insular Stock (range specific)	0.00057	0.00057	0.00057	0.00057
Modeling Site 11 Northwestern Hawaiian Islands Stock (range specific)	0.00106	0.00106	0.00106	0.00106
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

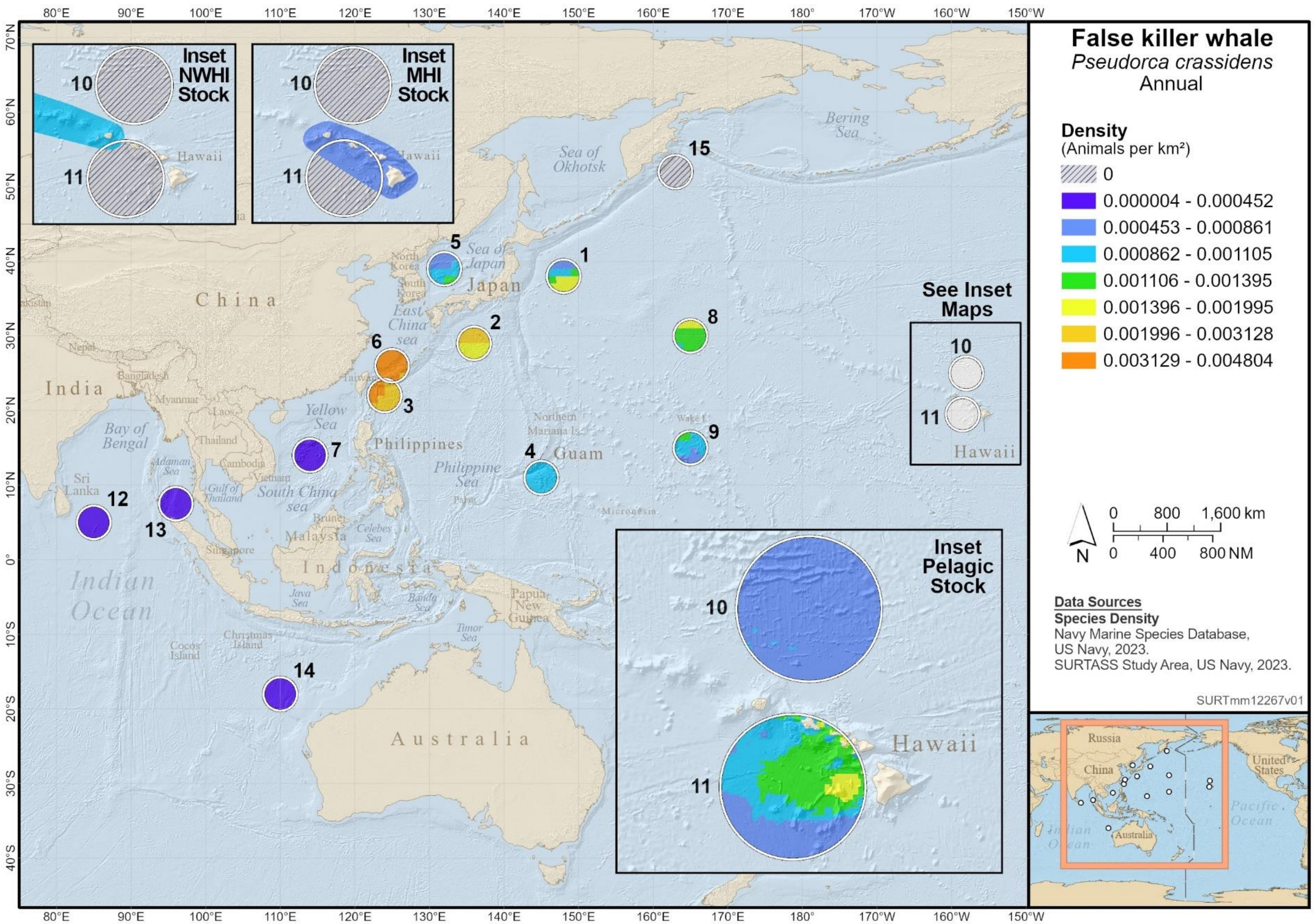


Figure 2.24-1: Annual Distribution of False Killer Whale in the SURTASS LFA Study Area

2.25 *Sousa chinensis*, Indo-Pacific Humpback Dolphin

The Indo-Pacific humpback dolphin is listed as Vulnerable by the IUCN Red List of Threatened Species (Jefferson et al., 2017).

Indo-Pacific humpback dolphins occur in shallow tropical to warm temperate coastal waters, often entering river mouths, estuaries, and mangroves (Jefferson et al., 2015). Their distribution extends from central China in the east, south through the Indo-Malay Archipelago, and west around the coastal rim of the Indian Ocean. Based on a recent habitat modeling study for waters off Hong Kong, rainfall, salinity, and river discharge were significant environmental factors influencing the density of Indo-Pacific humpback dolphins, consistent with their observed preference for estuarine habitat (Jefferson et al., 2023).

Indo-Pacific humpback dolphins are only expected to occur in SURTASS modeling Site 13 (Andaman Sea), and only in very shallow (<30 m deep) coastal waters. A zero density is assumed for deeper waters within modeling Site 13 and for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.25-1, following the modeling site descriptions. Figure 2.25-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.25.1 Modeling Site 13 – Andaman Sea

Density data for Indo-Pacific humpback dolphin were based on mark-recapture estimates derived from photo-identification data for coastal Malaysia (Kuit et al., 2021) and were selected to provide conservative estimates for the shallow (<30 m deep) coastal waters within Site 13, located just to the northwest of the survey area. The density estimate of 0.15 animals/km (CV = 0.101) was applied from the shore to the 30 m isobath within the modeling site. Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.25-1: Summary of Density Values for Indo-Pacific Humpback Dolphin in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13: from shore to 30m isobath	0.15	0.15	0.15	0.15
Modeling Site 13: >30m depth	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

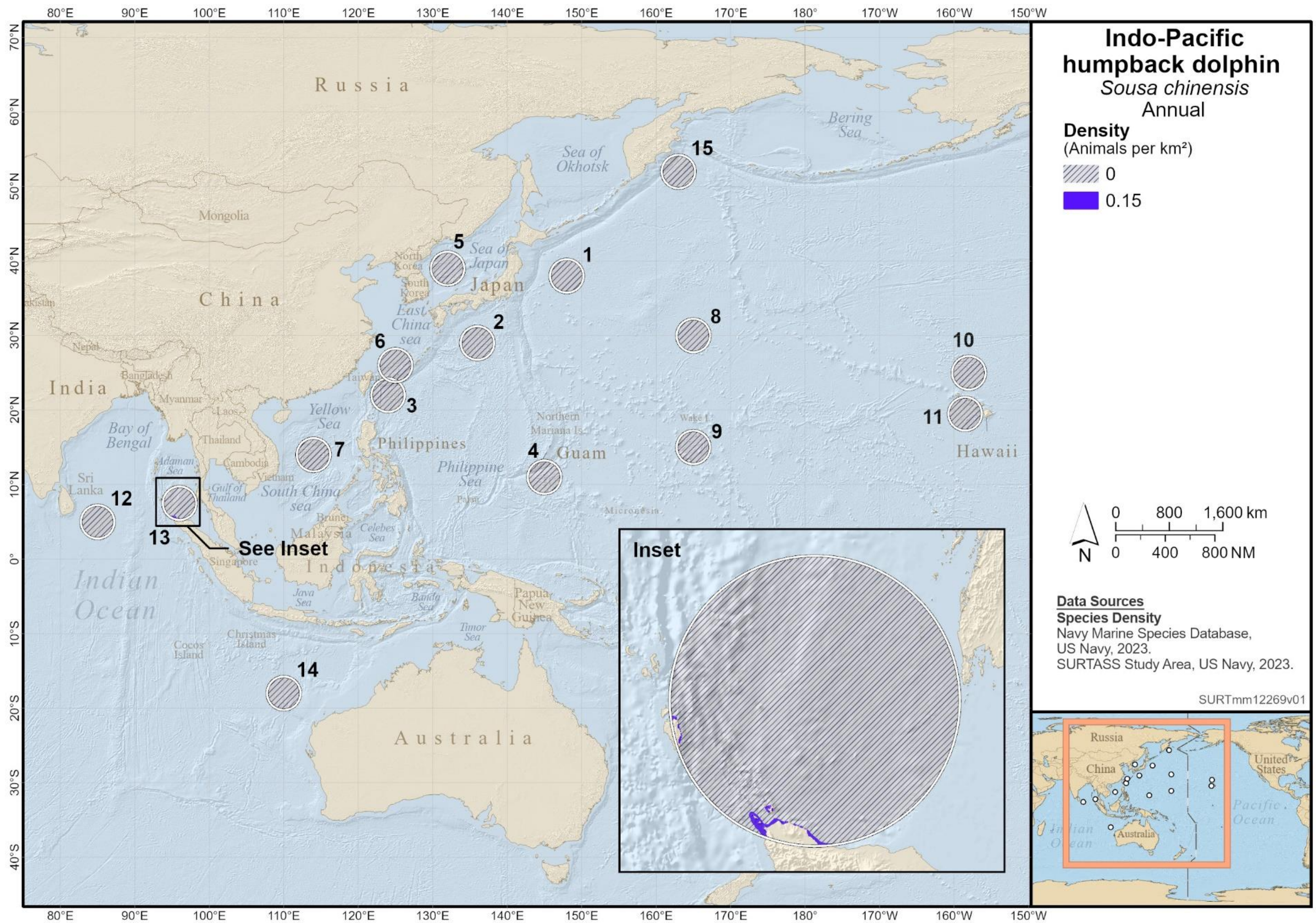


Figure 2.25-1: Annual Distribution of Indo-Pacific Humpback Dolphin in the SURTASS LFA Study Area

2.26 *STENELLA ATTENUATA*, PANTROPICAL SPOTTED DOLPHIN

Pantropical spotted dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka & Braulik, 2018c).

The pantropical spotted dolphin is distributed in offshore tropical and subtropical waters of the Pacific, Atlantic, and Indian Oceans between about 40° N and 40° S (Baldwin et al., 1999; Perrin, 2009). Pantropical dolphins are much more abundant in the lower latitudes of its range. They are found mostly in deeper offshore waters but do approach the coast in some areas, such as around the Hawaiian Islands (Jefferson et al., 2015; Perrin, 2001).

NMFS recognizes four management stocks of pantropical spotted dolphin within the U.S. EEZ of the Hawaiian Islands: (1) the Oahu stock, (2) the 4-Islands stock, (3) the Hawaii Island stock, and (4) the Hawaii Pelagic stock (Carretta et al., 2023). Spotted dolphins in the eastern tropical Pacific are managed separately (Carretta et al., 2023).

Pantropical spotted dolphins are expected to occur in all the SURTASS modeling sites except Site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.26-1, following the modeling site descriptions. Figure 2.26-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table. For the two sites that include waters within the Hawaiian Islands EEZ (site 10 and site 11), insets are provided to show the different density estimates for the four stocks of pantropical spotted dolphin known to occur in this region.

2.26.1 MODELING SITE 1 – EAST OF JAPAN

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.4 MODELING SITE 4 – GUAM

Pantropical spotted dolphin density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on new habitat-based density models developed from line-transect survey data collected in the region between 2007 and 2021 (Becker et al., In Prep.). These models provided the first spatially explicit density estimates for this species developed specifically for the MITT Study Area (Becker et al., In Prep.). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.5 MODELING SITE 5 – SEA OF JAPAN

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.6 MODELING SITE 6 – EAST CHINA SEA

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.7 MODELING SITE 7 – SOUTH CHINA SEA

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and pantropical spotted dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.26.8 MODELING SITE 8 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 25° TO 40° N

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.9 MODELING SITE 9 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 10° TO 25° N

Density data for pantropical spotted dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.26.10 Modeling Site 10 – Hawaii North

Pantropical spotted dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Of the four pantropical spotted dolphin stocks that occur within the Hawaiian Islands EEZ, only individuals belonging to the Hawaii pelagic stock are expected to occur within modeling site 10. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model specific to the Hawaii Pelagic Stock of pantropical spotted dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.26.11 Modeling Site 11 – Hawaii South

Pantropical spotted dolphin density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, with separate estimates defined for the four stocks that have partially overlapping ranges with the Hawaiian Islands EEZ as summarized below.

Oahu/Maui Nui/Hawaii Island Stocks. New survey data collected by NMFS within the Exclusive Economic Zone of the Hawaiian Islands, including the Main Hawaiian Islands, supported the derivation of the first habitat-based density model for the insular stocks of spotted dolphin in this study area (Becker et al., 2022b). The new habitat-based density model for the insular stocks of spotted dolphin represents an improvement to the uniform density values used in Phase III because it provides spatially explicit density estimates. The model was applied to all seasons within the range of the respective stock boundaries.

Hawaii Pelagic Stock. New survey data collected by NMFS within waters of the Hawaiian Islands EEZ supported the derivation of an updated pantropical spotted dolphin density estimates from model-based analyses (Becker et al., 2022b). The new habitat-based density model for spotted dolphin is specific to the pelagic stock (i.e., it was developed using only those sightings of animals identified as belonging to the pelagic stock) and provides spatially explicit density estimates throughout the Hawaiian Islands EEZ, including the entirely of SURTASS site 11.

Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.26.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pantropical spotted dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.26.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pantropical spotted dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.26.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and pantropical spotted dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.26-1: Summary of Density Values for Pantropical Spotted Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	S	S	S	S
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Insular Stocks (range specific)	S	S	S	S
Modeling Site 11 Hawaii Pelagic Stock	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

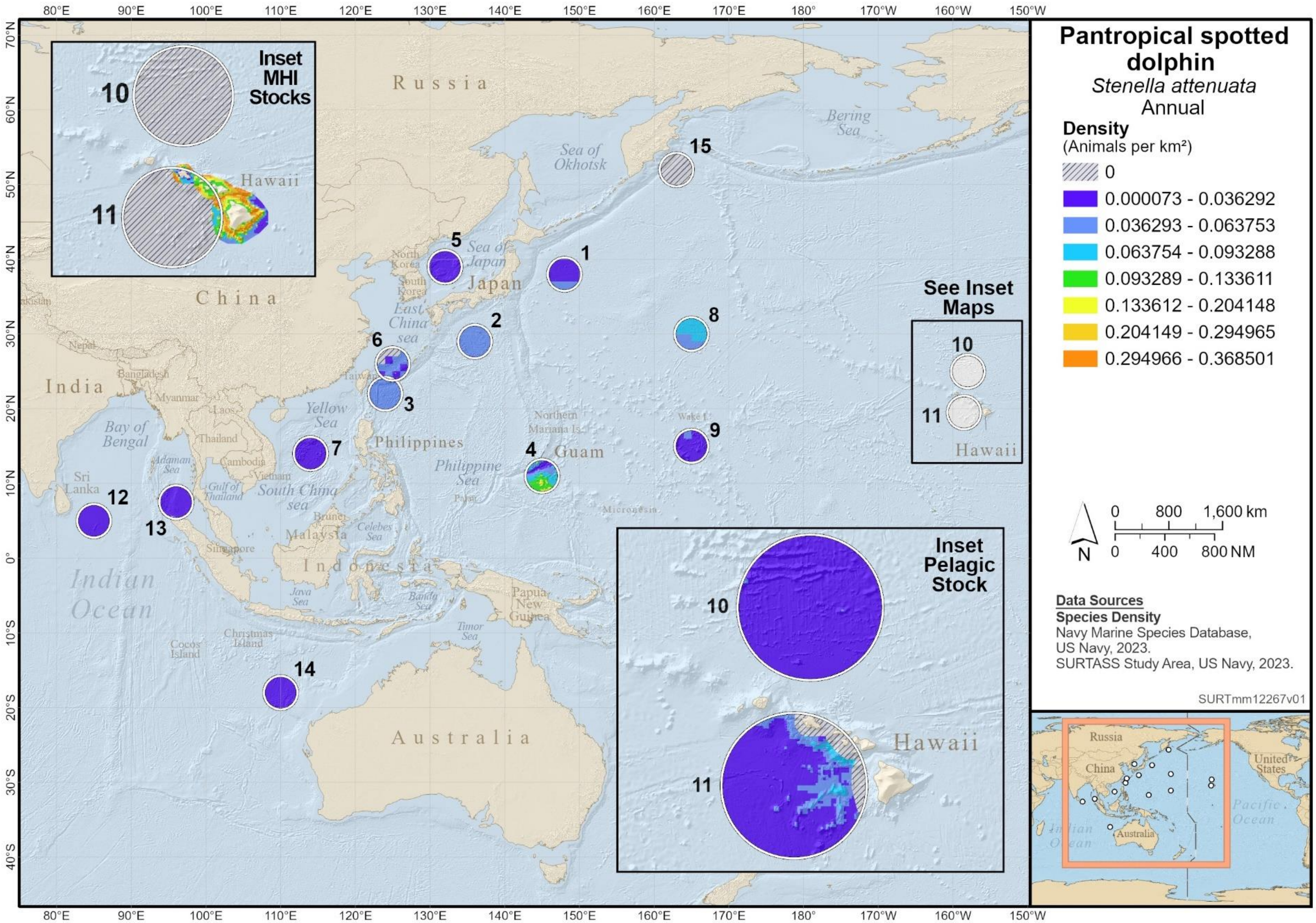


Figure 2.26-1: Annual Distribution of Pantropical Spotted Dolphin in the SURTASS LFA Study Area

2.27 *STENELLA COERULEOALBA*, STRIPED DOLPHIN

Striped dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Braulik, 2019).

The striped dolphin is one of the most common and abundant dolphin species, with a worldwide range that includes both tropical and temperate waters (Jefferson et al., 2015). Although primarily a warm-water species, the range of the striped dolphin extends higher into temperate regions than those of any other species in the genus *Stenella.* Striped dolphins are generally restricted to oceanic regions and are seen close to shore only where deep water approaches the coast. In some areas (e.g., the eastern tropical Pacific), they are mostly associated with convergence zones and regions of upwelling (Au & Perryman, 1985; Reilly, 1990).

NMFS recognizes two stocks of striped dolphin within the Pacific EEZ, a Hawaiian stock and a California/Oregon/Washington stock (Carretta et al., 2023).

Striped dolphins are expected to occur in all the SURTASS modeling sites except site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.27-1, following the modeling site descriptions. Figure 2.27-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.27.1 MODELING SITE 1 – EAST OF JAPAN

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.2 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.4 Modeling Site 4 – Guam

Striped dolphin density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on new habitat-based density models developed from line-transect survey data collected in the region between 2007 and 2021 (Becker et al., In Prep.). These models provided the first spatially explicit density estimates for this species developed specifically for the MITT study area (Becker et al., In Prep.). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.5 Modeling Site 5 – Sea of Japan

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.6 Modeling Site 6 – East China Sea

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and striped dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.27.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for striped dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.27.10 Modeling Site 10 – Hawaii North

Striped dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model for striped dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.27.11 Modeling Site 11 – Hawaii South

Striped dolphin density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model for striped dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.27.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and striped dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.27.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and striped dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.27.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and striped dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.27-1: Summary of Density Values for Striped Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	S	S	S	S
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

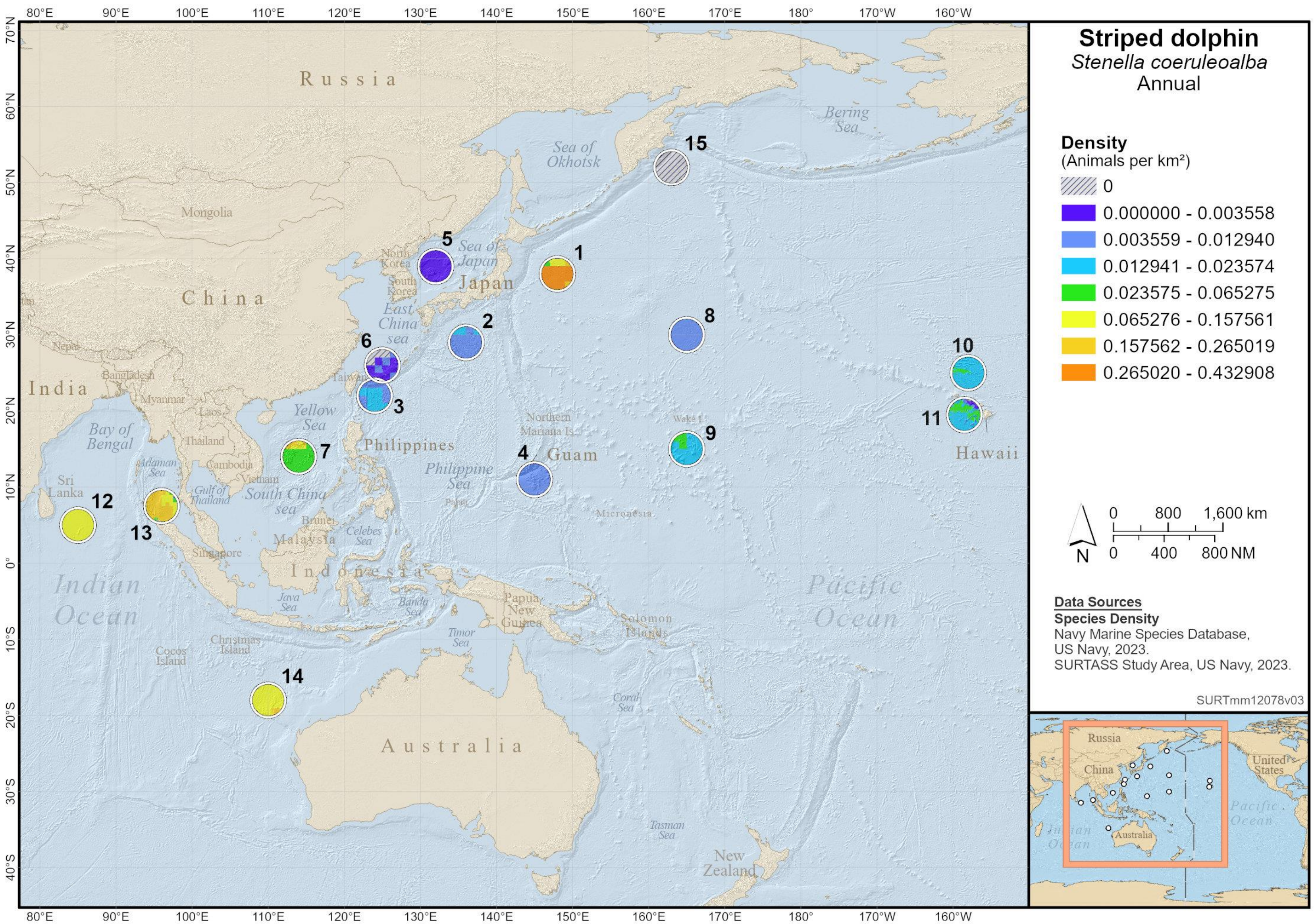


Figure 2.27-1: Annual Distribution of Striped Dolphin in the SURTASS LFA Study Area

2.28 *Stenella longirostris*, Spinner Dolphin

Spinner dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Braulik & Reeves, 2018).

Four well-differentiated geographical forms of spinner dolphins have been described as separate subspecies: *Stenella longirostris longirostris, S. l. orientalis, S. l. centroamericana,* and *S. l. rosiventris* (Jefferson et al., 2015). The *S.l. longirostris* subspecies is known as the Gray's spinner dolphin and occurs in the Atlantic, Indian, and western and central Pacific oceans. *S.I. orientalis* subspecies is found in the eastern tropical Pacific Ocean, and *S. l. centroamericana* is found in coastal waters off Central America. *S. l. rosiventris*, is recognized as the dwarf spinner dolphin and is present in shallow waters ranging from Southeast Asia to northern Australia (Jefferson et al., 2015).

The spinner dolphin is a pantropical species whose distribution is nearly identical to that of pantropical spotted dolphins, with range limits between about 40° N and 40° S (Jefferson et al., 2015). In the Hawaiian Islands, spinner dolphins occur along the leeward coasts of all the major islands and around several of the atolls northwest of the main Hawaiian Islands. These island-associated stocks of spinner dolphins are expected to occur in shallow water resting areas (about 50 m deep or less) throughout the middle of the day, moving into deep waters offshore during the night to feed (Heenehan et al., 2016; Heenehan et al., 2017; Norris & Dohl, 1980).

NMFS recognizes six stocks of spinner dolphins within the Hawaiian Islands EEZ, including a Hawaii Island stock, Oahu/Maui Nui stock, a Kauai/Niihau stock, a Pearl and Hermes Reef stock, a Midway Atoll/Kure stock, and a Hawaii Pelagic stock. Spinner dolphins in the eastern tropical Pacific are managed separately (Carretta et al., 2023).

Spinner dolphins are expected to occur in all the SURTASS modeling sites except site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.28-1, following the modeling site descriptions. Figure 2.28-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table. For the two sites that include waters within the Hawaiian Islands EEZ (site 10 and site 11), insets are provided to show the density estimates for the different stocks of spinner dolphin known to occur in this region.

2.28.1 Modeling Site 1 – East of Japan

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.2 Modeling Site 2 – North Philippine Sea

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see

Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.3 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.4 MODELING SITE 4 – GUAM

Spinner density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on new habitat-based density models developed from line-transect survey data collected in the region between 2007 and 2021 (Becker et al., In Prep.). These models provided the first spatially explicit density estimates for this species developed specifically for the MITT study area (Becker et al., In Prep.). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.5 MODELING SITE 5 – SEA OF JAPAN

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.6 MODELING SITE 6 – EAST CHINA SEA

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.7 MODELING SITE 7 – SOUTH CHINA SEA

Survey data are extremely limited in the South China Sea (Kaschner et al. 2012), and spinner dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.28.8 MODELING SITE 8 – OFFSHORE JAPAN/WESTERN NORTH PACIFIC 25° TO 40° N

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see

Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for spinner dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.28.10 Modeling Site 10 – Hawaii North

Spinner dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Of the four spinner dolphin stocks that occur within the Hawaiian Islands EEZ, only individuals belonging to the Hawaii pelagic stock are expected to occur within modeling site 10. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model specific to the Hawaii Pelagic Stock of striped dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.28.11 Modeling Site 11 – Hawaii South

Spinner dolphin density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, with separate estimates defined for the four stocks that have partially overlapping ranges with the Hawaiian Islands EEZ as summarized below.

Hawaii Island Stock. Based on year-round photo-identification surveys conducted from 2010 to 2012 (Tyne et al., 2016), the most recent (2012) abundance estimate for the Hawaii Island stock of spinner dolphins is 665 (CV = 0.09). Given this stock's boundaries (i.e., extending from the coast out to 10 nautical miles [NM] from shore), the approximate range area was calculated as 9,498.85 km^2, resulting in a density estimate of 0.070 animals/km^2. This estimate was applied to the area encompassing the range of the Hawaii Island stock.

Oahu/Maui Nui Stock. The most recent abundance available for this stock of spinner dolphins is based on analyses by Hill et al. (2010). The (Hill et al., 2010) abundance estimate for the Oahu/Maui Nui stock of spinner dolphins is 355 (CV = 0.09). Given this stock's boundaries (i.e., extending from the coasts of the islands out to 10 NM from shore), the approximate range area was calculated as 15,387.57 km^2, resulting in a density estimate of 0.023 animals/km^2. This estimate was applied to the area encompassing the range of the Oahu/Maui Nui stock.

Kauai/Niihau Stock. The most recent abundance available for this stock of spinner dolphins is based on analyses by Hill et al. (2010), who derived an abundance estimate of 611 (CV = 0.20) for the Kauai/Niihau stock of spinner dolphins. Given this stock's boundaries (i.e., extending from the coasts of the islands out to 10 NM from shore), the approximate range area was calculated as 6,214.22 km^2, resulting in a density estimate of 0.097 animals/ km^2. This estimate was applied to the area encompassing the range of the Kauai/Niihau stock.

Hawaii Pelagic Stock. The limited number of on-effort sightings of spinner dolphins during ship surveys conducted by NMFS within the Hawaiian Islands EEZ (12 total for the 2002–2017 surveys) did not support the development of an updated habitat-based density model for this species (Becker et al., 2021). Forney et al. (2015) developed a habitat-based model for spinner dolphins using survey data collected within the central North Pacific from 1997 to 2012, and density predictions from this model are currently the best available. The model was developed using all spinner dolphin sightings (i.e., not identified to stock), but given the transect coverage on the surveys that contributed data to the habitat model, most of the spinner dolphin sightings were from the Hawaii Pelagic stock.

2.28.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and spinner dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.28.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and spinner dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.28.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and spinner dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.28-1: Summary of Density Values for Spinner Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	S	S	S	S
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Hawaii Island Stock (range specific)	0.070	0.070	0.070	0.070
Modeling Site 11 Oahu/Maui Nui Stock (range specific)	0.023	0.023	0.023	0.023
Modeling Site 11 Kauai/Niihau Stock (range specific)	0.097	0.097	0.097	0.097
Modeling Site 11 Hawaii Pelagic Stock	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

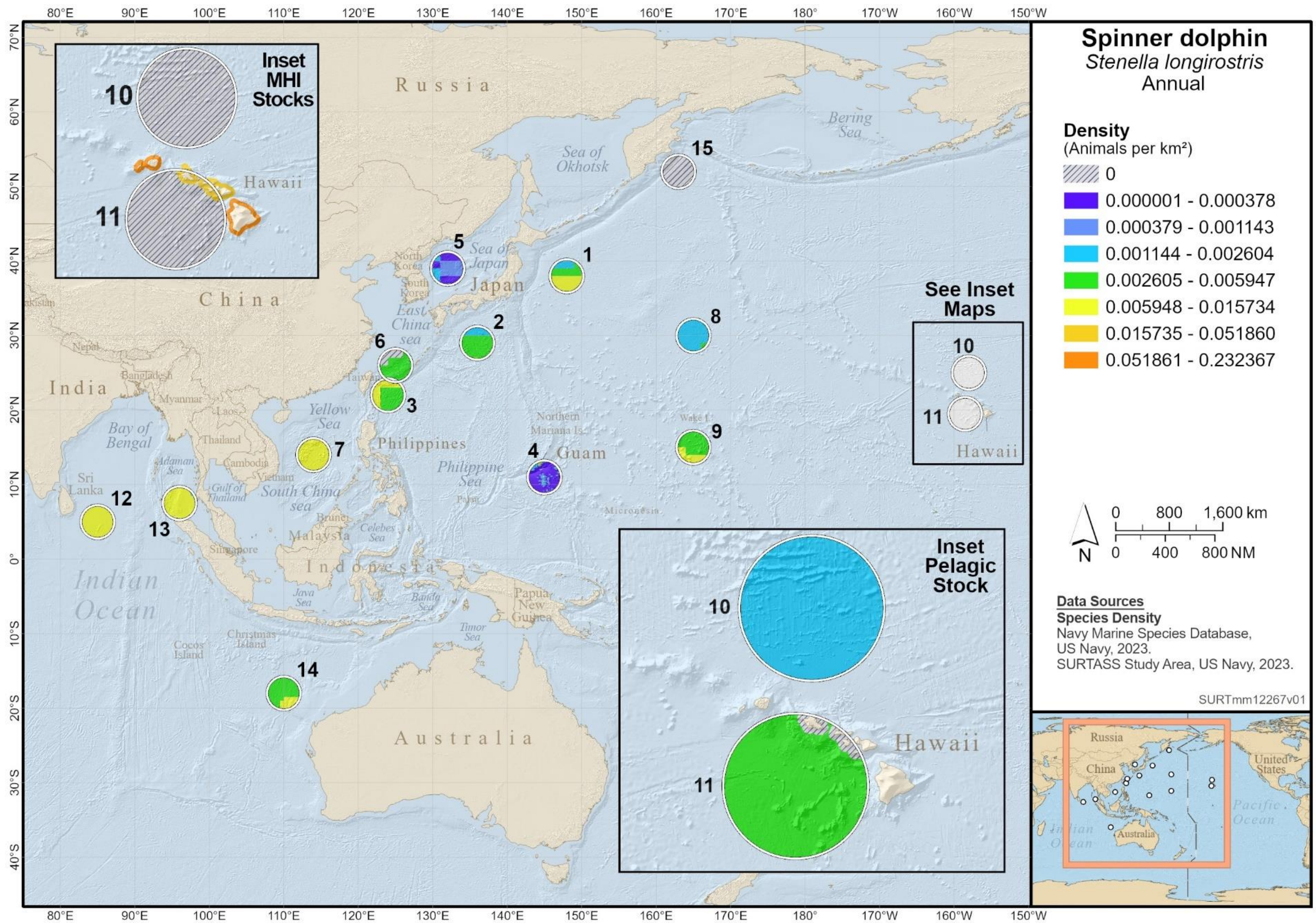


Figure 2.28-1: Annual Distribution of Spinner Dolphin in the SURTASS LFA Study Area

2.29 *Steno bredanensis*, Rough-Toothed Dolphin

Rough-toothed dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Kiszka et al., 2019).

Rough-toothed dolphins are considered a pelagic species and are distributed worldwide in tropical and subtropical waters. They are generally observed from 35° S to 40° N in deep oceanic waters, although in some areas they occur in shallow coastal waters (Jefferson et al., 2015; National Oceanic and Atmospheric Administration, 2022). Within waters of the Hawaiian EEZ, they can be found close to the islands and atolls (Bradford et al., 2017).

NMFS recognizes two Pacific management stocks of rough-toothed dolphin EEZ, a Hawaiian stock and an American Samoa stock (Carretta et al., 2023).

Rough-toothed dolphins are expected to occur in all the SURTASS modeling sites except site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.29-1, following the modeling site descriptions. Figure 2.29-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.29.1 Modeling Site 1 – East of Japan

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.2 Modeling Site 2 – North Philippine Sea

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.3 Modeling Site 3 – West Philippine Sea

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.4 Modeling Site 4 – Guam

Rough-toothed dolphin density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.).

The estimate of 0.0954 animals/km^2 (CV = 1.22) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.29.5 Modeling Site 5 – Sea of Japan

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.6 Modeling Site 6 – East China Sea

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and rough-toothed dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.29.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for rough-toothed dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.29.10 Modeling Site 10 – Hawaii North

Rough-toothed dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model for rough-toothed dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.29.11 Modeling Site 11 – Hawaii South

Rough-toothed dolphin density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model for rough-toothed dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.29.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and rough-toothed dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.29.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and rough-toothed dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.29.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and rough-toothed dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.29-1: Summary of Density Values for Rough-Toothed Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0954	0.0954	0.0954	0.0954
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

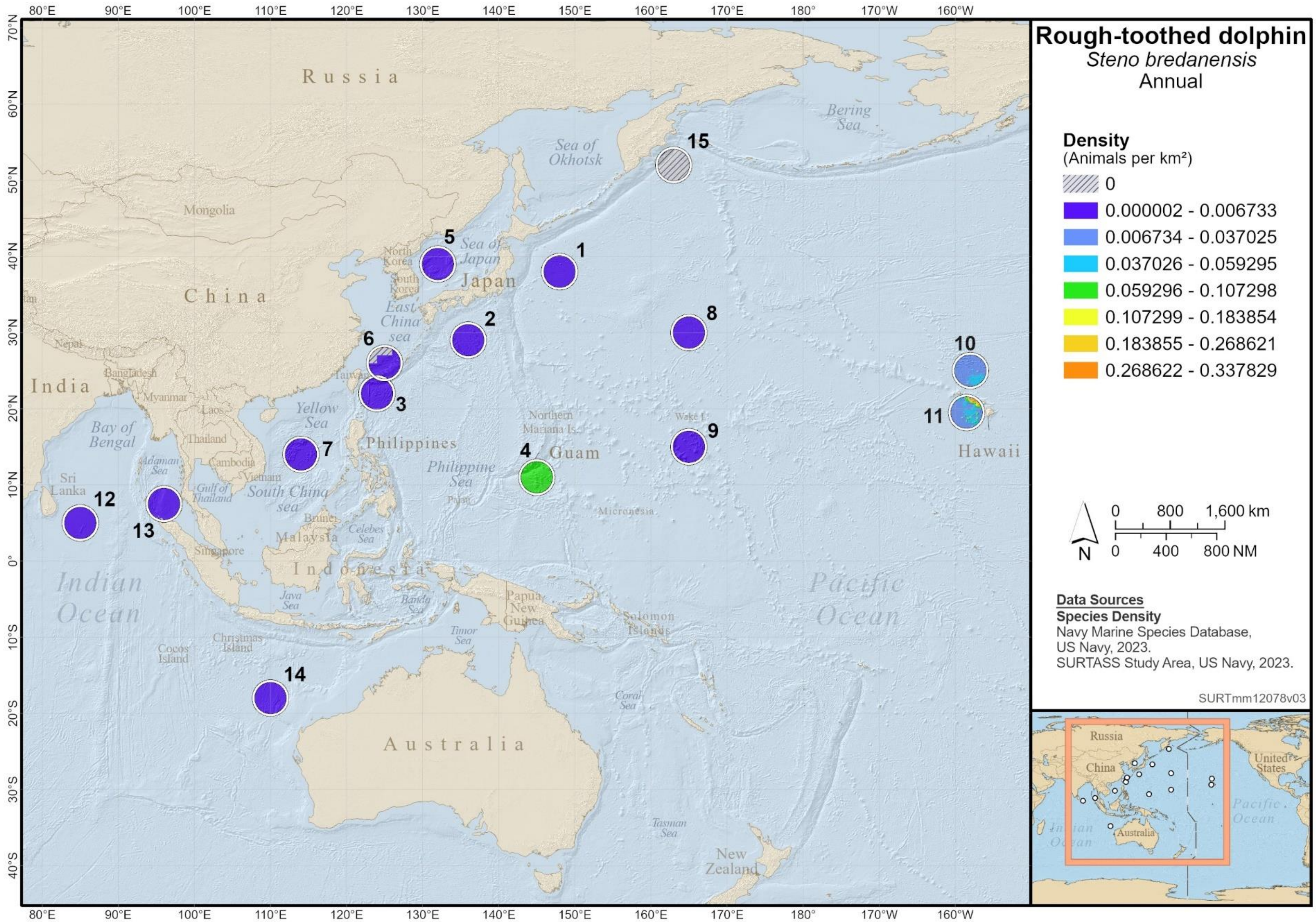


Figure 2.29-1: Annual Distribution of Rough-Toothed Dolphin in the SURTASS LFA Study Area

2.30 *Tursiops aduncus*, Indo-Pacific Bottlenose Dolphin

The Indo-Pacific bottlenose dolphin is listed as Near Threatened by the IUCN Red List of Threatened Species (Braulik et al., 2019).

Indo-Pacific bottlenose dolphins occur in shallow tropical to warm temperate coastal waters of the Indo-Pacific, with their distribution extending into some enclosed bodies of water such as the Gulf of Thailand (Jefferson et al., 2015). They are found throughout the islands and peninsulas of the Indo-Malay Archipelago, occurring almost exclusively in shallow waters over the continental shelf (Jefferson et al., 2015).

Indo-Pacific bottlenose dolphins are only expected to occur in SURTASS modeling site 13 (Andaman Sea), and only in coastal waters over the continental shelf. A zero density is assumed for deeper waters within modeling Site 13 and for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.30-1, following the modeling site descriptions. Figure 2.30-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.30.1 Modeling Site 13 – Andaman Sea

Density data for Indo-Pacific bottlenose dolphin were derived from the Kaschner et al. (2006) RES models as they were the only quantitative estimates available. These spatially explicit estimates were incorporated into the NMSDD for this site. Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.30-1: Summary of Density Values for Indo-Pacific Bottlenose Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

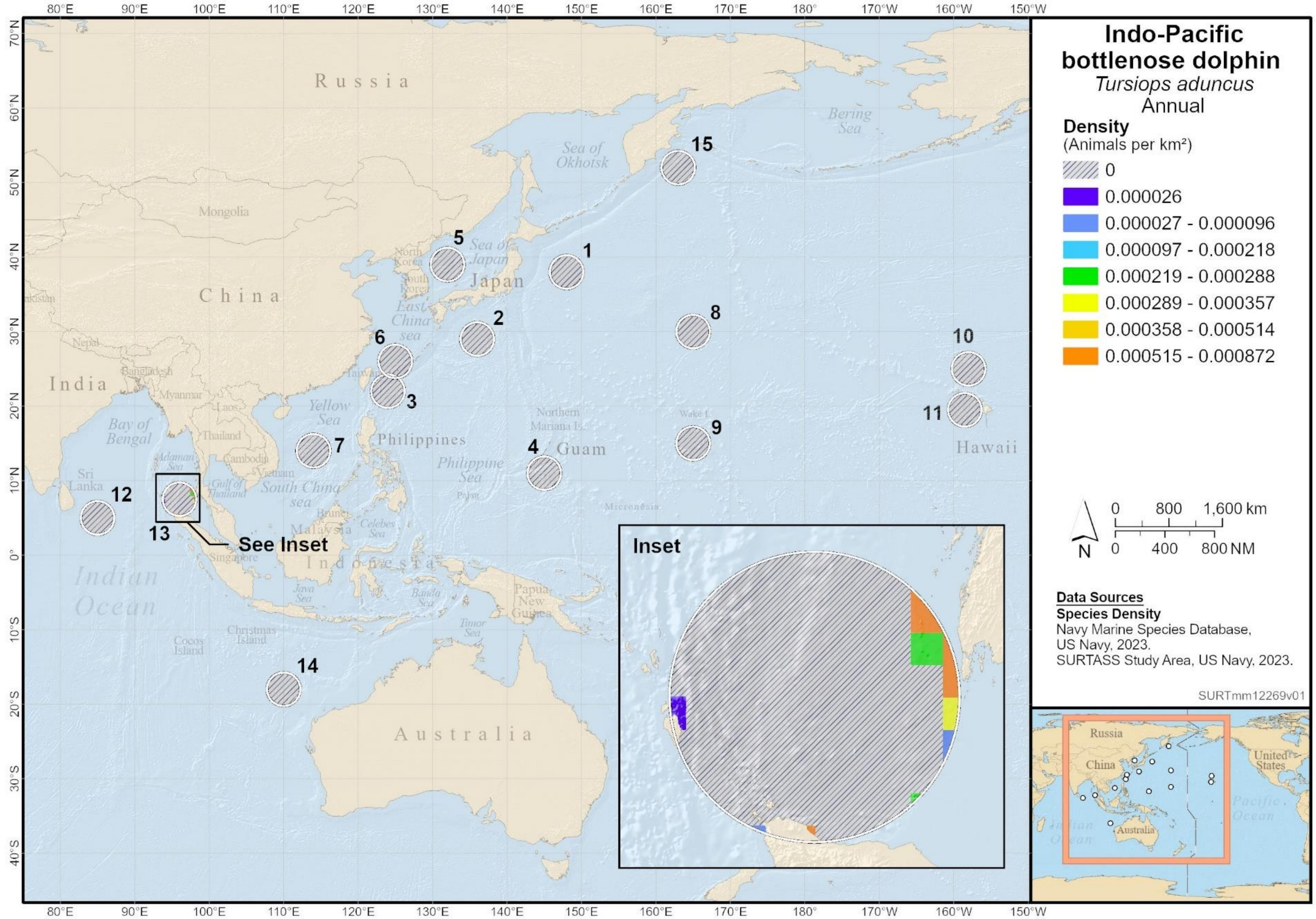


Figure 2.30-1: Annual Distribution of Indo-Pacific Bottlenose Dolphin in the SURTASS LFA Study Area

2.31 *Tursiops truncatus*, Common Bottlenose Dolphin

The common bottlenose dolphin is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Wells et al., 2019).

There are two morphologically and genetically distinct bottlenose dolphin morphotypes (distinguished by physical differences) described as coastal and offshore forms (Duffield, 1987; Duffield et al., 1983).

Common bottlenose dolphins are found in coastal and continental shelf waters of tropical and temperate regions of the world and generally do not range north or south of 45° latitude (Jefferson et al., 2011; Wells & Scott, 2009). They occur in most enclosed or semi-enclosed seas in habitats ranging from shallow, murky, estuarine waters to deep, clear offshore waters in oceanic region, although they typically have higher density closer to shore (Jefferson et al., 2011; Wells & Scott, 2009).

NMFS recognizes two stocks and one stock complex of common bottlenose dolphins in U.S. Pacific waters: a Hawaiian Island Stock Complex, a California/Oregon/Washington Offshore stock, and a California Coastal stock (Carretta et al., 2023). The Hawaiian Islands Stock Complex includes an Oahu stock, a Maui Nui stock (Molokai, Lanai, Maui, Kahoolawe), a Kauai/Niihau stock, a Hawaii Island stock, and a Hawaii Pelagic stock.

Common bottlenose dolphins are expected to occur in all the SURTASS modeling sites except site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.31-1, following the modeling site descriptions. Figure 2.31-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table. For the two sites that include waters within the Hawaiian Islands EEZ (site 10 and site 11), insets are provided to show the different density estimates for the five stocks of common bottlenose dolphin known to occur in this region.

2.31.1 Modeling Site 1 – East of Japan

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.2 Modeling Site 2 – North Philippine Sea

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.3 Modeling Site 3 – West Philippine Sea

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.4 Modeling Site 4 – Guam

Common bottlenose dolphin density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0185 animals/km^2 (CV = 1.11) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.31.5 Modeling Site 5 – Sea of Japan

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.6 Modeling Site 6 – East China Sea

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and common bottlenose dolphin density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.31.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for common bottlenose dolphin were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.31.10 Modeling Site 10 – Hawaii North

Common bottlenose dolphin density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area. Of the five common bottlenose dolphin stocks that occur within the Hawaiian Islands EEZ, only individuals belonging to the Hawaii pelagic stock are expected to occur within modeling site 10. Sighting data collected from systematic ship surveys within waters of the Hawaiian Islands EEZ from 2000 to 2020 supported the development of a habitat-based density model specific to the Hawaii Pelagic Stock of common bottlenose dolphin (Becker et al., 2021; Bradford et al., 2020). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.31.11 Modeling Site 11 – Hawaii South

Common bottlenose dolphin density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, with separate estimates defined for the five stocks that have partially overlapping ranges with the Hawaiian Islands EEZ as summarized below.

Oahu Stock. The most recent abundance estimate available for the Oahu stock of common bottlenose dolphins is based on analyses by Van Cise et al. (2021), who estimated annual abundance of the four insular stocks between 2000 and 2018 using photo identification techniques. The most recent (2018) abundance estimate for the Oahu stock of common bottlenose dolphins is 112 animals (CV = 0.17). Given this stock's boundaries (i.e., extending from the coast of the island out to the 1,000 m isobath), the approximate range area was calculated as 3,972.86 km^2, resulting in a density estimate of 0.0282 animals/km^2. This estimate was applied to the area encompassing the range of the Oahu stock. The Navy applied this estimate to all seasons.

Maui Nui Stock. The most recent abundance estimate available for the Maui Nui stock of common bottlenose dolphins is based on analyses by Van Cise et al. (2021), who estimated annual abundance of the four insular stocks between 2000 and 2018 using photo identification techniques. The most recent (2018) abundance estimate for the Maui Nui stock of common bottlenose dolphins is 64 animals (CV = 0.15). Given this stock's boundaries (i.e., extending from the coast of the island out to the 1,000 m isobath), the approximate range area was calculated as 11,069.20 km^2, resulting in a density estimate of 0.0058 animals/km^2. This estimate was applied to the area encompassing the range of the Maui Nui stock. The Navy applied this estimate to all seasons.

Kauai/Niihau Stock. The most recent abundance estimate available for the Kauai/Niihau stock of common bottlenose dolphins is based on analyses by Van Cise et al. (2021), who estimated annual abundance of the four insular stocks between 2000 and 2018 using photo identification techniques. The most recent (2018) abundance estimate for the Kauai/Niihau stock of common bottlenose dolphins is 112 animals (CV = 0.24). Given this stock's boundaries (i.e., extending from the coast of the island out to the 1,000 m isobath), the approximate range area was calculated as 2,820.28 km^2, resulting in a density estimate of 0.0397 animals/km^2. This estimate was applied to the area encompassing the range of the Kauai/Niihau stock. The Navy applied this estimate to all seasons.

Hawaii Island Stock. The most recent abundance estimate available for the Hawaii Island stock of common bottlenose dolphins is based on analyses by Van Cise et al. (2021), who estimated annual abundance of the four insular stocks between 2000 and 2018 using photo identification techniques. The most recent (2018) abundance estimate for the Hawaii Island stock of common bottlenose dolphins is 136 animals (CV = 0.43). Given this stock's boundaries (i.e., extending from the coast of the island out to the 1,000 m isobath), the approximate range area was calculated as 4,652.37 km^2, resulting in a density estimate of 0.0292 animals/km^2. This estimate was applied to the area encompassing the range of the Hawaii Island stock. The Navy applied this estimate to all seasons.

HRC: Hawaii Pelagic Stock. New survey data collected by NMFS within the Exclusive Economic Zone of the Hawaiian Islands supported the derivation of updated common bottlenose dolphin density estimates from model-based analyses (Becker et al., 2022b). The new common bottlenose dolphin model is specific to the pelagic stock (i.e., it was developed using only those sightings of animals identified as belonging to the pelagic stock). Given the lack of seasonal data for this species, the Navy applied these spatially explicit density estimates year round.

2.31.12 MODELING SITE 12 – OFFSHORE SRI LANKA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and common bottlenose dolphin density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.31.13 MODELING SITE 13 – ANDAMAN SEA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and common bottlenose dolphin density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.31.14 MODELING SITE 14 – NORTHWEST OF AUSTRALIA

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and common bottlenose dolphin density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.31-1: Summary of Density Values for Common Bottlenose Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0185	0.0185	0.0185	0.0185
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Oahu Stock (range specific)	0.0282	0.0282	0.0282	0.0282
Modeling Site 11 Maui Nui Stock (range specific)	0.0058	0.0058	0.0058	0.0058
Modeling Site 11 Kauai/Niihau Stock (range specific)	0.0397	0.0397	0.0397	0.0397
Modeling Site 11 Hawaii Island Stock (range specific)	0.0292	0.0292	0.0292	0.0292
Modeling Site 11 Hawaii Pelagic Stock (range specific)	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

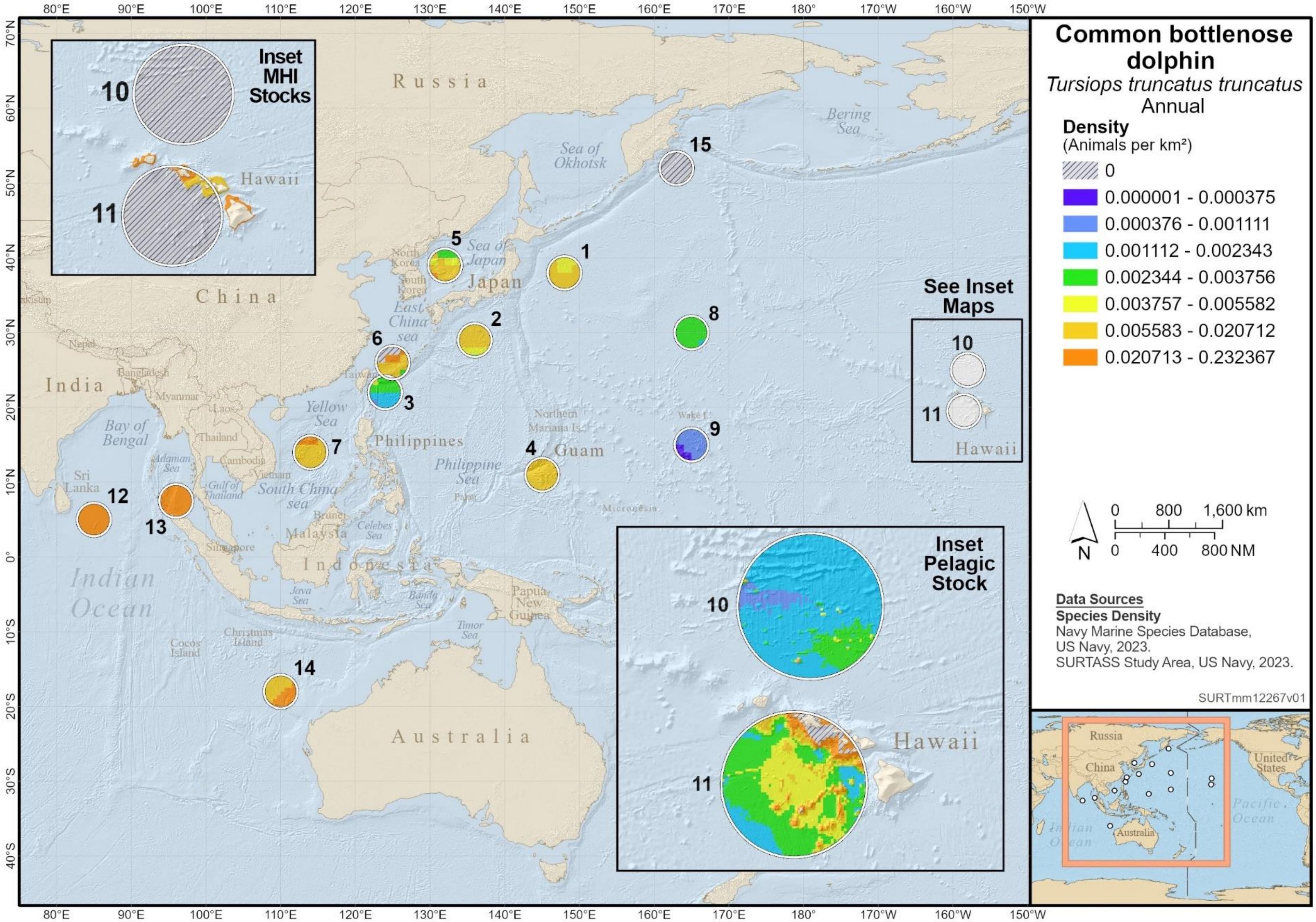


Figure 2.31-1: Annual Distribution of Common Bottlenose Dolphin in the SURTASS LFA Study Area

2.32 *Phocoenoides dalli dalli* and *P.d. truei*, Dall's Porpoise

Dall's porpoise is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Jefferson & Braulik, 2018).

Dall's porpoise is one of the most common odontocete species in north Pacific waters (Calambokidis & Barlow, 2004; Ferrero & Walker, 1999; Houck & Jefferson, 1999; Jefferson, 1991; Jefferson et al., 2008a; Williams & Thomas, 2007; Zagzebski et al., 2006). Dall's porpoise is found from northern Baja California, Mexico, north to the northern Bering Sea and south to southern Japan, including the Japan Sea (Jefferson et al., 2015). This species is typically found in waters at temperatures less than 63° F (17° C) with depths of more than 180 m (Houck & Jefferson, 1999; Reeves et al., 2002). Two major color forms of Dall's porpoise are currently recognized as separate subspecies: *Phocoenoides dalli dalli* occurs throughout the North Pacific and *P.d. truei* migrates between the Pacific coast of Japan and the Okhotsk Sea (Jefferson et al., 2015).

Dall's porpoise is managed by NMFS in Pacific waters as two stocks: (1) a California, Oregon, and Washington stock and (2) an Alaskan stock (Carretta et al., 2023).

Given their known distribution patterns in the North Pacific, Dall's porpoises are only expected to occur in SURTASS modeling site 1 (East of Japan), site 5 (Sea of Japan), site 8 (Offshore Japan/Western North Pacific 25° to 40° N), and site 15 (Northeast of Japan). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.32-1, following the modeling site descriptions. Figure 2.32-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.32.1 Modeling Site 1 – East of Japan

Density data for Dall's porpoise were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.32.2 Modeling Site 5 – Sea of Japan

Density data for Dall's porpoise were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.32.3 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Dall's porpoise were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

2.32.4 Modeling Site 15 – Northeast of Japan

Density data for Dall's porpoise were based on density surface models derived from sighting data collected during line-transect surveys in the North Pacific between 1983 and 2006 (Kanaji et al., 2017). These spatially explicit abundance estimates were available for the entirety of this modeling site (see Figure 1.2-1). Given the lack of seasonal data for this species, the Navy applied these density estimates year round.

Table 2.32-1: Summary of Density Values for Dall's Porpoise in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	S	S	S	S
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

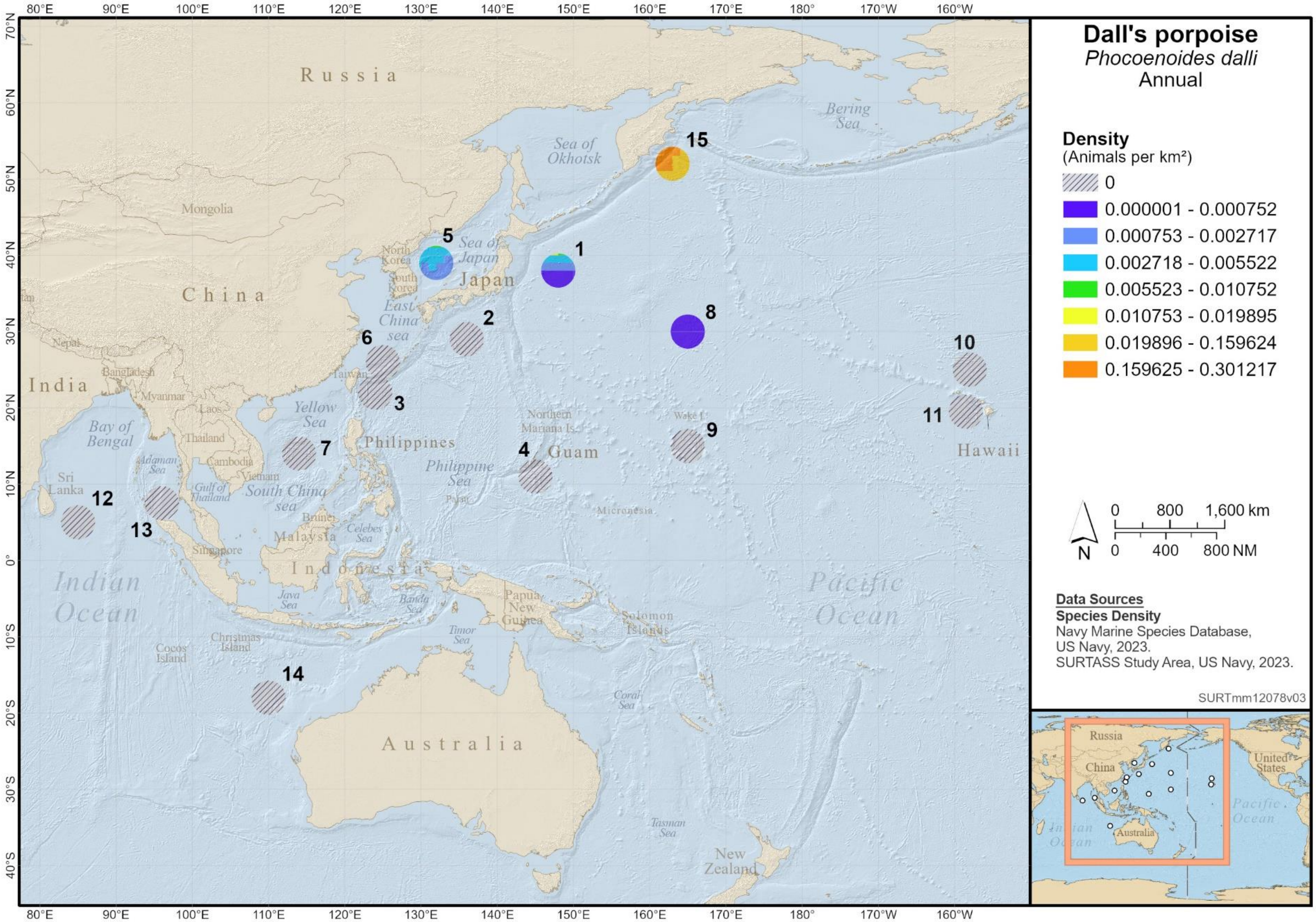


Figure 2.32-1: Annual Distribution of Dall's Porpoise in the SURTASS LFA Study Area

2.33 *Berardius bairdii*, Baird's Beaked Whale

Baird's beaked whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Taylor & Brownell Jr, 2020).

Baird's beaked whale occurs mainly in deep waters over the continental slope, near oceanic seamounts, and areas with submarine escarpments, although they may be seen close to shore where deep water approaches the coast (Jefferson et al., 2008a; Kasuya, 2009). This species is generally found throughout the colder waters of the North Pacific, ranging from off Baja California, Mexico, to the Aleutian Islands of Alaska (Jefferson et al., 2008a; MacLeod & D'Amico, 2006), although they are found mainly north of 28° N in the eastern Pacific (Kasuya & Miyashita, 1997; Reeves et al., 2003).

Baird's beaked whale is managed by NMFS in Pacific waters as two stocks: (1) Alaska and (2) California, Oregon, and Washington (Carretta et al., 2023).

Given their known distribution patterns in the North Pacific, Baird's beaked whale are only expected to occur in SURTASS modeling site 1 (East of Japan), site 5 (Sea of Japan), site 8 (Offshore Japan/Western North Pacific 25° to 40° N), and site 15 (Northeast of Japan). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.33-1, following the modeling site descriptions. Figure 2.33-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.33.1 Modeling Site 1 – East of Japan

Density estimates for Baird's beaked whale were derived from line-transect analyses of survey data collected in waters off the Pacific coast of Japan from 2008 to 2017 (Sasaki et al., 2023), in the vicinity of Site 1. Their most recent (2017) density estimate of 0.02338 animals/km^2 was based on a total abundance estimate of 4,301 Baird's beaked whales (CV = 0.82) and a total survey area of 183,974.5 km^2. Given the long dive times of Baird's beaked whale, the estimate includes a g(0) correction factor of 0.836 to correct for availability bias (Sasaki et al., 2023). The Navy applied these density estimates year round.

2.33.2 Modeling Site 5 – Sea of Japan

Density estimates for Baird's beaked whale were derived from line-transect analyses of survey data collected in waters within the Sea of Japan from 1983 to 1989 (Miyashita, 1990). The density estimate of 0.01780 animals/km^2 was based on a total abundance estimate of 1,468 Baird's beaked whales (CV = 0.389) and a total survey area of 82,489.19 km^2. Given the long dive times of Baird's beaked whale, the estimate includes a g(0) correction factor of 0.839 to correct for availability bias (Miyashita, 1990). The Navy applied these density estimates year round.

2.33.3 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density estimates for Baird's beaked whale were derived from line-transect analyses of survey data collected in waters off the Pacific coast of Japan from 2008 to 2017 (Sasaki et al., 2023). While this modeling site is located southeast of the survey area, these are the best available density data for this region. Their most recent (2017) density estimate of 0.02338 animals/km^2 was based on a total abundance estimate of 4,301 Baird's beaked whales (CV = 0.82) and a total survey area of 183,974.5

km^2. Given the long dive times of Baird's beaked whale, the estimate includes a g(0) correction factor of 0.836 to correct for availability bias (Sasaki et al., 2023). The Navy applied these density estimates year round.

2.33.4 MODELING SITE 15 – NORTHEAST OF JAPAN

Density estimates for Baird's beaked whale were derived from line-transect analyses of survey data collected in waters off the Pacific coast of Japan from 2008 to 2017 (Sasaki et al., 2023). While this modeling site is located northeast of the survey area, these are the best available density data for this region. Their most recent (2017) density estimate of 0.02338 animals/km^2 was based on a total abundance estimate of 4,301 Baird's beaked whales (CV = 0.82) and a total survey area of 183,974.5 km^2. Given the long dive times of Baird's beaked whale, the estimate includes a g(0) correction factor of 0.836 to correct for availability bias (Sasaki et al., 2023). The Navy applied these density estimates year round.

Table 2.33-1: Summary of Density Values for Baird's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.02338	0.02338	0.02338	0.02338
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.01780	0.01780	0.01780	0.01780
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.02338	0.02338	0.02338	0.02338
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.02338	0.02338	0.02338	0.02338

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

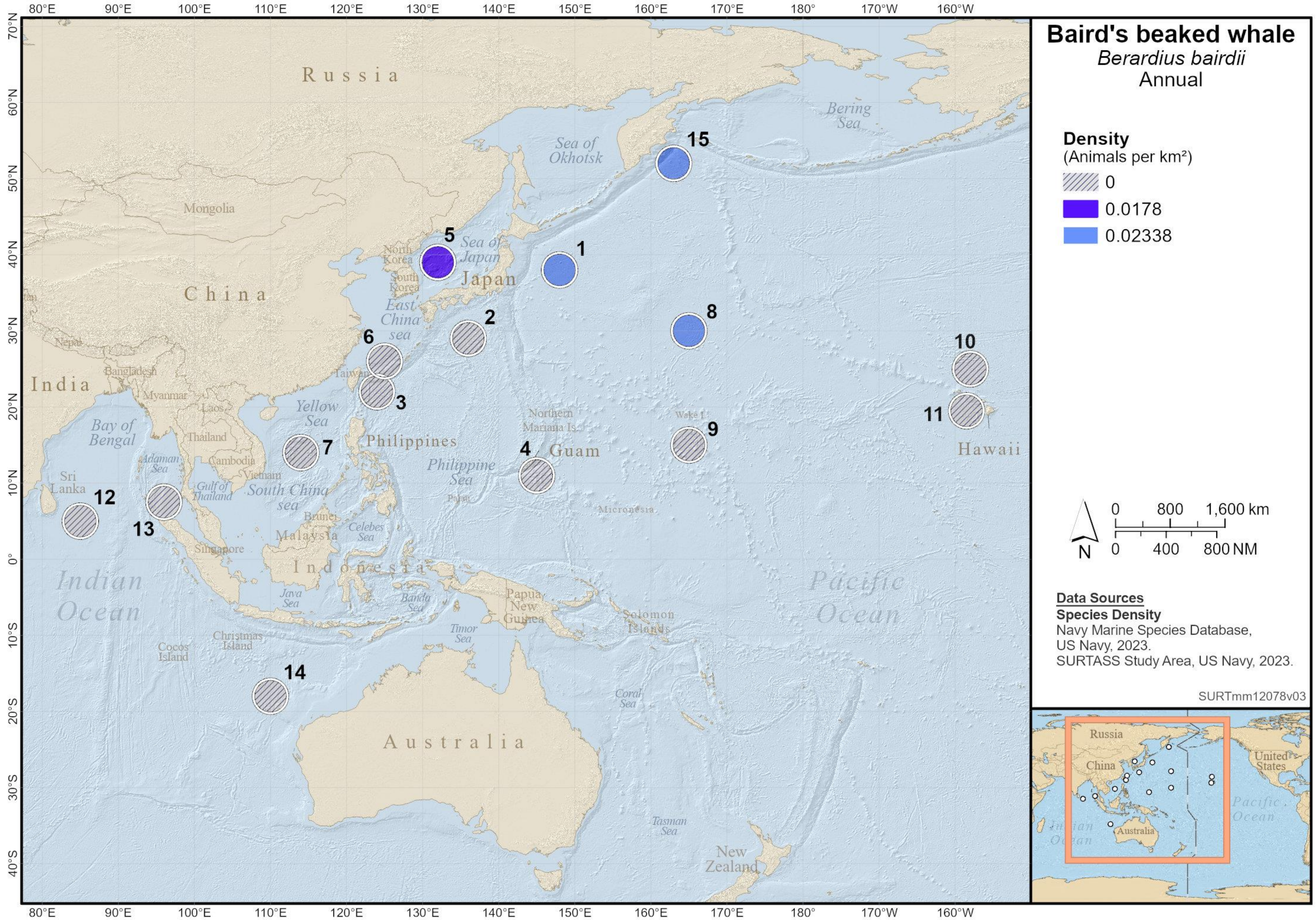


Figure 2.33-1: Annual Distribution of Baird's Beaked Whale in the SURTASS LFA Study Area

2.34 *INDOPACETUS PACIFICUS*, LONGMAN'S BEAKED WHALE

Longman's beaked whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Pitman & Brownell Jr, 2020c).

Longman's beaked whale is found in warm tropical waters, with most sightings occurring in waters with sea surface temperatures warmer than 78 °F (26°C) (Anderson et al., 2006; MacLeod et al., 2006; MacLeod & D'Amico, 2006). Although the full extent of this species' distribution is not fully understood, there have been many recorded sightings at various locations in tropical waters of the Pacific and Indian Oceans (Afsal et al., 2009; Dalebout et al., 2002; Dalebout et al., 2003; Moore, 1972). Based on sighting records, Longman's beaked whale appears to be more common in the western Pacific and western Indian Oceans than in eastern tropical Pacific and Hawaiian waters (Jefferson et al., 2015).

There is only one stock of Longman's beaked whale recognized by NMFS in the Pacific, the Hawaii Stock (Carretta et al., 2023). This stock includes animals found within the Hawaiian Islands EEZ and adjacent high sea waters.

Longman's beaked whales are expected to occur in all the SURTASS modeling sites except site 1 (East of Japan), site 5 (Sea of Japan), and site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.34-1, following the modeling site descriptions. Figure 2.34-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.34.1 MODELING SITE 2 – NORTH PHILIPPINE SEA

Density data for Longman's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00104 animals/km^2 (CV = 0.67) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.34.2 MODELING SITE 3 – WEST PHILIPPINE SEA

Density data for Longman's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00104 animals/km^2 (CV = 0.67) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.34.3 MODELING SITE 4 – GUAM

Longman's beaked whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area and were based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0075 animals/km^2 (CV = 1.09) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.34.4 Modeling Site 6 – East China Sea

Density data for Longman's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00104 animals/km^2 (CV = 0.67) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.34.5 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Longman's beaked whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.34.6 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Longman's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00104 animals/km^2 (CV = 0.67) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.34.7 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Longman's beaked whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. The estimate was based on line-transect analyses of sighting data collected during systematic surveys of the waters off Guam and the CNMI (Bradford et al., In Prep.). The estimate of 0.0075 animals/km^2 (CV = 1.09) for the most recent survey year (2021) was used to represent density year round at this modeling site.

2.34.8 Modeling Site 10 – Hawaii North

Longman's beaked whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00104 animals/km^2 (CV = 0.67) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.34.9 Modeling Site 11 – Hawaii South

Longman's beaked whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00104 animals/km^2 (CV = 0.67) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.34.10 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Longman's beaked whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.34.11 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Longman's beaked whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.34.12 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Longman's beaked whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.34-1: Summary of Density Values for Longman's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.00104	0.00104	0.00104	0.00104
Modeling Site 3	0.00104	0.00104	0.00104	0.00104
Modeling Site 4	0.0075	0.0075	0.0075	0.0075
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00104	0.00104	0.00104	0.00104
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00104	0.00104	0.00104	0.00104
Modeling Site 9	0.0075	0.0075	0.0075	0.0075
Modeling Site 10	0.00104	0.00104	0.00104	0.00104
Modeling Site 11	0.00104	0.00104	0.00104	0.00104
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

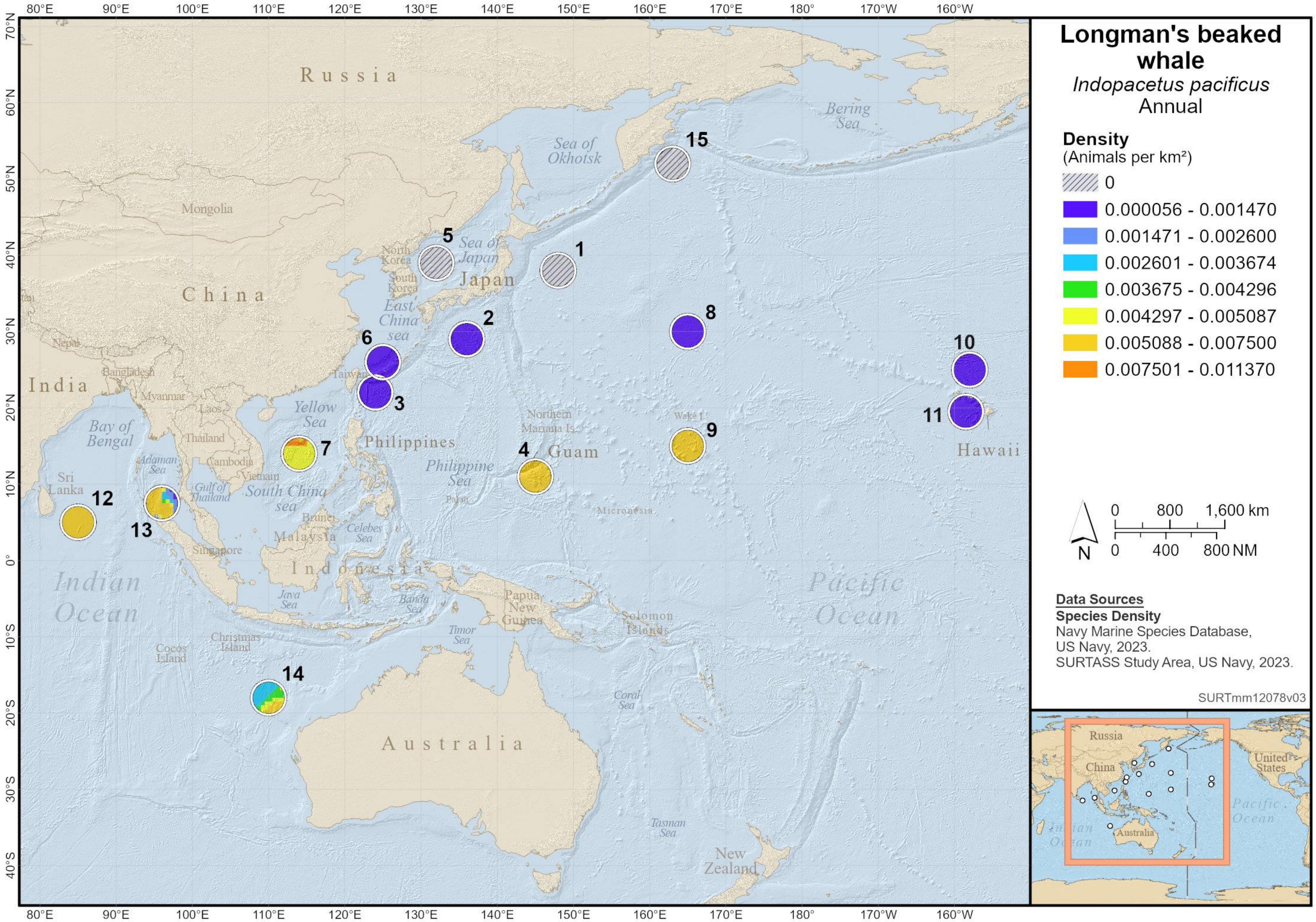


Figure 2.34-1: Annual Distribution of Longman's Beaked Whale in the SURTASS LFA Study Area

2.35 *Mesoplodon carlshubbsi*, Hubbs' Beaked Whale

Hubbs' beaked whale is not an ESA-listed species. It is listed as a Data Deficient species by the IUCN Red List of Threatened Species (Pitman & Brownell Jr, 2020d).

Based mainly on stranding data, the distribution of Hubbs' beaked whale is apparently limited to cold-temperate waters of the North Pacific Ocean (MacLeod & Mitchell, 2006; Mead, 1989). Their range appears to include waters from central British Columbia to Southern California on the east, and is assumed to be continuous across the Pacific to the coast of Japan on the west (Jefferson et al., 2015). There have been limited at-sea sightings of Hubbs' beaked whale, but it is presumed to be an oceanic species (Jefferson et al., 2015).

Due to the difficulty in distinguishing the different *Mesoplodon* species from one another, NMFS has combined six *Mesoplodon* species to make up the California, Oregon, and Washington stock of *Mesoplodon* beaked whales (Carretta et al., 2023). This group of six beaked whales known to occur in waters off the U.S. west coast includes Hubbs' beaked whale (*Mesoplodon carlshubbsi*), Blainville's beaked whale (*M. densirostris*), ginkgo-toothed beaked whale (*M. ginkgodens)*, Perrin's beaked whale (*M. perrini*), pygmy beaked whale (aka Peruvian, *M. peruvianus*), and Stejneger's beaked whale (*M. stejnegeri*).

Given what is currently known of the distribution of Hubbs' beaked whale, they are only expected to occur in SURTASS modeling sites 1 (East of Japan) and 8 (Offshore Japan/Wester North Pacific). For all other sites, a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.35-1, following the modeling site descriptions. Figure 2.35-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.35.1 Modeling Site 1 – East of Japan

Density data for Hubbs' beaked whale specific to this area were not available. To provide a representative estimate, density estimates derived from Bayesian trend analyses for the group of *Mesoplodon* beaked whales in the California Current (including Hubbs' beaked whale) were used (Moore & Barlow, 2017). The most recent (2014) estimate of 0.00267 animals/km^2 (CV = 0.54) was incorporated into the NMSDD for this species. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data, the Navy applied this density estimate year round.

2.35.2 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Hubbs' beaked whale specific to this area were not available. In order to provide a representative estimate, density estimates derived from Bayesian trend analyses for the group of *Mesoplodon* beaked whales in the California Current (including Hubbs' beaked whale) were used (Moore & Barlow, 2017). The most recent (2014) estimate of 0.00267 animals/km^2 (CV = 0.54) was incorporated into the NMSDD for this species. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data, the Navy applied this density estimate year round.

Table 2.35-1: Summary of Density Values for Hubbs' Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00267	0.00267	0.00267	0.00267
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.00267	0.00267	0.00267	0.00267
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

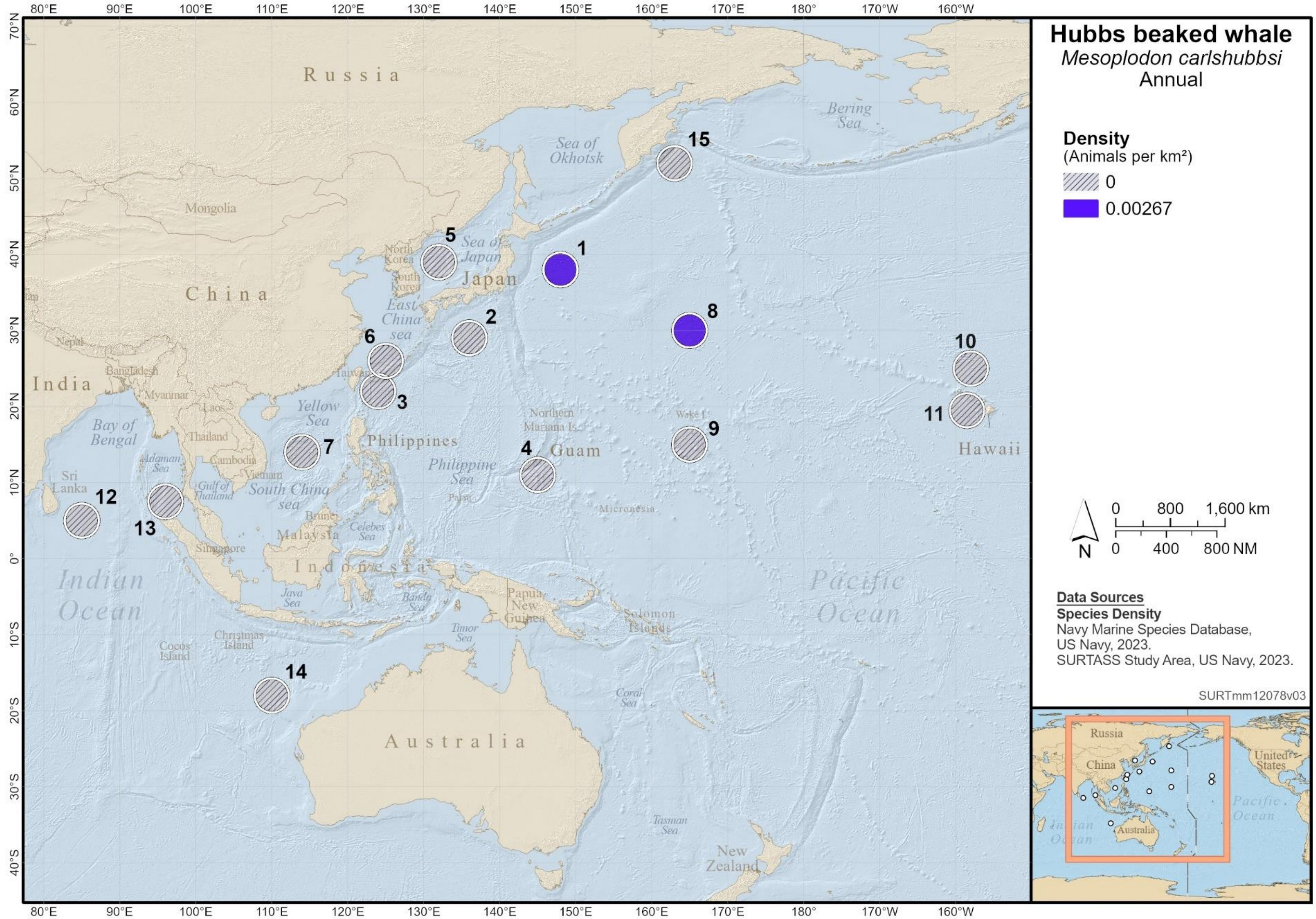


Figure 2.35-1: Annual Distribution of Hubbs' Beaked Whale in the SURTASS LFA Study Area

2.36 *Mesoplodon densirostris*, Blainville's Beaked Whale

Blainville's beaked whale is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Pitman, 2020).

Blainville's beaked whales are one of the most widely distributed of the distinctive toothed whales in the *Mesoplodon* genus (Jefferson et al., 2015; MacLeod & Mitchell, 2006). This species is observed in offshore temperate and tropical waters and are globally distributed in lower and mid-latitudes (Hildebrand et al., 2015). Blainville's beaked whale is considered one of the most tropical of any of the *Mesoplodon* beaked whales (Jefferson et al., 2015).

Due to the difficulty in distinguishing the different *Mesoplodon* species from one another, NMFS has combined six *Mesoplodon* species to make up the California, Oregon, and Washington stock of *Mesoplodon* beaked whales (Carretta et al., 2023). This group of six beaked whales known to occur in waters off the U.S. west coast includes Hubbs' beaked whale (*Mesoplodon carlshubbsi*), Blainville's beaked whale (*M. densirostris*), ginkgo-toothed beaked whale (*M. ginkgodens)*, Perrin's beaked whale (*M. perrini*), pygmy beaked whale (aka Peruvian, *M. peruvianus*), and Stejneger's beaked whale (*M. stejnegeri*). Based on the number of sightings and genetic analysis of individuals around the Hawaiian Islands, NMFS also recognizes a Hawaiian stock of Blainville's beaked whale (Carretta et al., 2018; Carretta et al., 2015; Carretta et al., 2023; Oleson et al., 2013b). This stock includes animals found within the Hawaiian Islands EEZ and adjacent high sea waters.

Blainville's beaked whales are expected to occur in all the SURTASS modeling sites except site 1 (East of Japan), site 5 (Sea of Japan), and site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.36-1, following the modeling site descriptions. Figure 2.36-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.36.1 Modeling Site 2 – North Philippine Sea

Density data for Blainville's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00046 animals/km^2 (CV = 0.99) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.36.2 Modeling Site 3 – West Philippine Sea

Density data for Blainville's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00046 animals/km^2 (CV = 0.99) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.36.3 Modeling Site 4 – Guam

Blainville's beaked whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Passive acoustic data collected from Drifting Acoustic

Spar Buoy Recorders (DASBRs) during surveys in 2018 and 2021 of waters off Guam and the CNMI were used to estimate density for both Blainville's and Cuvier's beaked whales (Badger et al., 2023). In addition to providing the first density estimates of Cuvier's and Blainville's beaked whales in the Mariana Islands region, the analysis of the DASBR data revealed a substantial latitudinal difference in the encounter rate and therefore estimated density of both species in the study area (Badger et al., 2023; McCullough et al., 2021). In waters north of 15.5 °N, Blainville's beaked whales were detected almost 7x more often than in the southern strata. The resulting density estimates were 0.0285 animals/km^2 (CV = 0.207) in the northern stratum and 0.00415 animals/km^2 (CV = 0.494) in the southern stratum (Badger et al., 2023). These data were used to characterize annual Blainville's beaked whale density.

2.36.4 Modeling Site 6 – East China Sea

Density data for Blainville's beaked whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00046 animals/km^2 (CV = 0.99) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.36.5 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Blainville's beaked whale density estimates for modeling site 7 were not available. Recent sighting and acoustic data confirm the occurrence of Blainville's beaked whale in the northern South China Sea (Dong et al., 2024). Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. The RES model estimates were seasonal, with the same density data provided for summer, fall, and winter, and zero density predicted for spring at this site.

2.36.6 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Blainville's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00046 animals/km^2 (CV = 0.99) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.36.7 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Blainville's beaked whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. The estimate was based on passive acoustic data collected from DASBRs during surveys in 2018 and 2021 of waters off Guam and the CNMI. These data were used to estimate density for both Blainville's and Cuvier's beaked whales (Badger et al., 2023). In addition to providing the first density estimates of Cuvier's and Blainville's beaked whales in the Mariana Islands region, the analysis of the DASBR data revealed a substantial latitudinal difference in the encounter rate and therefore estimated density of both species in the study area (Badger et al., 2023; McCullough et al., 2021). In waters north of 15.5 °N, Blainville's beaked whales were detected almost 7x more often than in the southern strata. The resulting density estimates were 0.0285 animals/km^2 (CV = 0.207) in the northern stratum and 0.00415 animals/km^2 (CV = 0.494) in the southern stratum (Badger et al., 2023). These data were used to characterize annual Blainville's beaked whale density.

2.36.8 Modeling Site 10 – Hawaii North

Blainville's beaked whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00046 animals/km^2 (CV = 0.99) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.36.9 Modeling Site 11 – Hawaii South

Blainville's beaked whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00046 animals/km^2 (CV = 0.99) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.36.10 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Blainville's beaked whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. The RES model estimates were seasonal, with the same density data provided for summer, fall, and winter, and zero density predicted for spring at this site.

2.36.11 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Blainville's beaked whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. The RES model estimates were seasonal, with the same density data provided for summer, fall, and winter, and zero density predicted for spring at this site.

2.36.12 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Blainville's beaked whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site. The RES model estimates were seasonal, with the same density data provided for summer, fall, and winter, and zero density predicted for spring at this site.

Table 2.36-1: Summary of Density Values for Blainville's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.00046	0.00046	0.00046	0.00046
Modeling Site 3	0.00046	0.00046	0.00046	0.00046
Modeling Site 4 (north of 15.5 °N)	0.0285	0.0285	0.0285	0.0285
Modeling Site 4 (south of 15.5 °N)	0.00415	0.00415	0.00415	0.00415
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00046	0.00046	0.00046	0.00046
Modeling Site 7	0	S	S	S
Modeling Site 8	0.00046	0.00046	0.00046	0.00046
Modeling Site 9 (north of 15.5 °N)	0.0285	0.0285	0.0285	0.0285
Modeling Site 9 (south of 15.5 °N)	0.00415	0.00415	0.00415	0.00415
Modeling Site 10	0.00046	0.00046	0.00046	0.00046
Modeling Site 11	0.00046	0.00046	0.00046	0.00046
Modeling Site 12	0	S	S	S
Modeling Site 13	0	S	S	S
Modeling Site 14	0	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

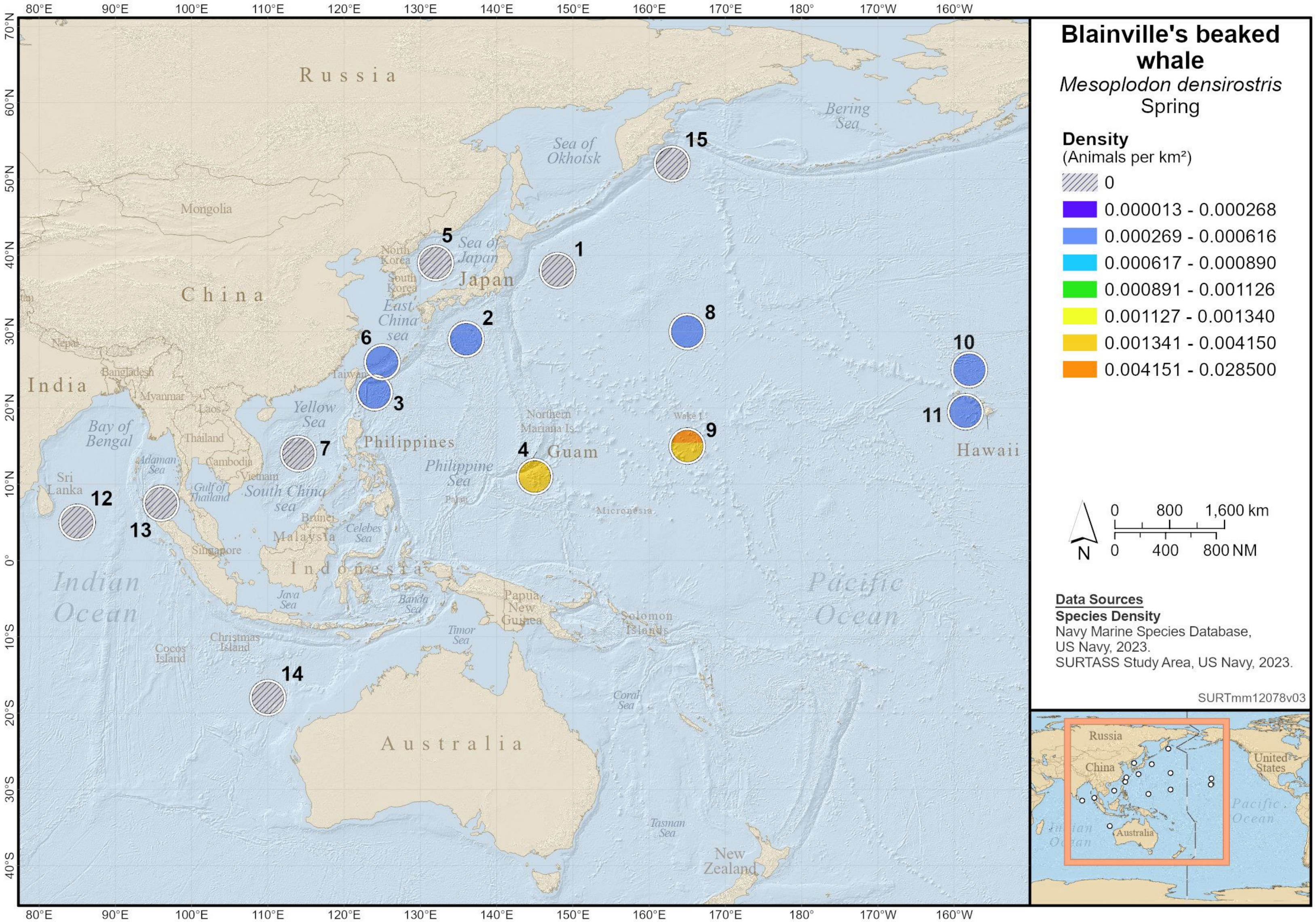


Figure 2.36-1: Spring Distribution of Blainville's Beaked Whale in the SURTASS LFA Study Area

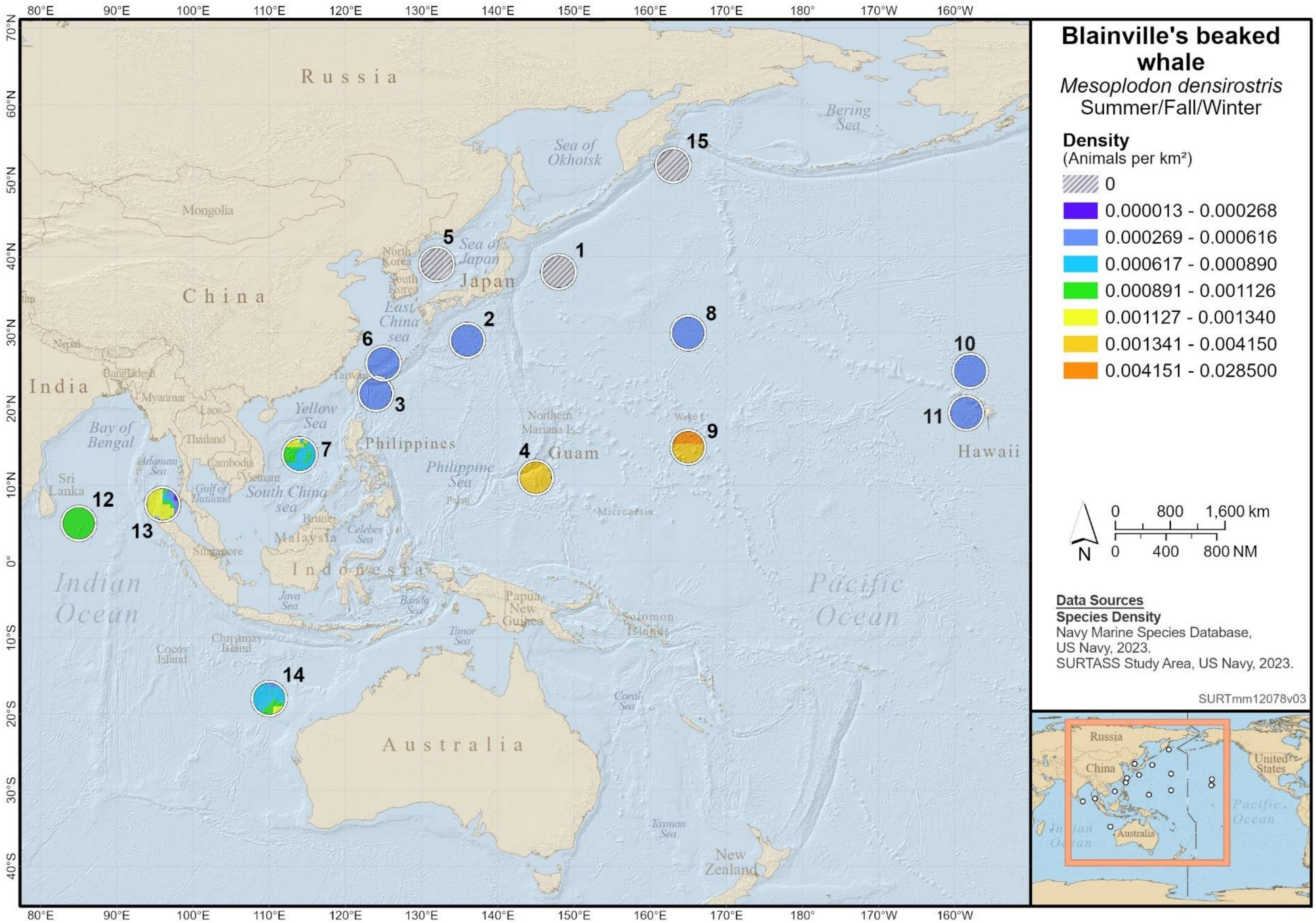


Figure 2.36-2: Summer/Fall/Winter Distribution of Blainville's Beaked Whale in the SURTASS LFA Study Area

2.37 *Mesoplodon ginkgodens*, Ginkgo-Toothed Beaked Whale

Ginkgo-toothed beaked whale is not an ESA-listed species. It is listed as a Data Deficient species by the IUCN Red List of Threatened Species (Pitman & Brownell Jr, 2020b).

Similar to other beaked whale species, ginkgo-toothed beaked whales are expected to inhabit continental slope and deep ocean waters (greater than 200 m) and only occasionally occur in waters over the continental shelf (Cañadas et al., 2002; Ferguson et al., 2006; MacLeod & Mitchell, 2006; Pitman, 2009; Waring et al., 2001). Based largely on stranding records, the distribution of ginkgo-toothed beaked whales is presumed to include temperate and tropical waters continuous across the Pacific Ocean and possibly into the Indian Ocean (Jefferson et al., 2015). There are no confirmed sightings or strandings of ginkgo-toothed beaked whales in Hawaiian waters, although an echolocation signal detected from an autonomous recorder located at Cross Seamount, Hawaii was hypothesized to have been produced by a ginkgo-toothed beaked whale (Baumann-Pickering et al., 2014). However, the current assumed distribution of ginkgo-toothed beaked whale does not include waters within the Hawaiian Islands EEZ (Baumann-Pickering et al., 2014; Jefferson et al., 2015; Pitman & Brownell Jr, 2020b).

Due to the difficulty in distinguishing the different *Mesoplodon* species from one another, NMFS has combined six *Mesoplodon* species to make up the California, Oregon, and Washington stock of *Mesoplodon* beaked whales (Carretta et al., 2023). This group of six beaked whales known to occur in waters off the U.S. west coast includes ginkgo-toothed beaked whale (*M. ginkgodens)*, Hubbs' beaked whale (*Mesoplodon carlshubbsi*), Blainville's beaked whale (*M. densirostris*), ginkgo-toothed beaked whale (*M. ginkgodens)*, Perrin's beaked whale (*M. perrini*), pygmy beaked whale (aka Peruvian, *M. peruvianus*), and Stejneger's beaked whale (*M. stejnegeri*).

Ginkgo-toothed beaked whales are expected to occur in all the SURTASS modeling sites except site 5 (Sea of Japan), site 10 (Hawaii North), site 11 (Hawaii South), site 14 (Northwest of Australia), and site 15 (Northeast of Japan), where a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.37-1, following the modeling site descriptions. Figure 2.37-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.37.1 Modeling Site 1 – East of Japan

Density data for ginkgo-toothed beaked whale are not available for any region. In order to provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.2 Modeling Site 2 – North Philippine Sea

Density data for ginkgo-toothed beaked whale are not available for any region. In order to provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV =

0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.3 Modeling Site 3 – West Philippine Sea

Density data for ginkgo-toothed beaked whale are not available for any region. In order to provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.4 Modeling Site 4 – Guam

Ginkgo-toothed beaked whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Since density data for ginkgo-toothed beaked are not available, to provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.5 Modeling Site 6 – East China Sea

Density data for ginkgo-toothed beaked whale are not available for any region. To provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.6 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and ginkgo-toothed beaked whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.37.7 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for ginkgo-toothed beaked whale are not available for any region. To provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.8 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for ginkgo-toothed beaked whale are not available for any region. To provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.37.9 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and ginkgo-toothed beaked whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.37.10 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and ginkgo-toothed beaked whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.37-1: Summary of Density Values for Ginkgo-Toothed Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00119	0.00119	0.00119	0.00119
Modeling Site 2	0.00119	0.00119	0.00119	0.00119
Modeling Site 3	0.00119	0.00119	0.00119	0.00119
Modeling Site 4	0.00119	0.00119	0.00119	0.00119
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00119	0.00119	0.00119	0.00119
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00119	0.00119	0.00119	0.00119
Modeling Site 9	0.00119	0.00119	0.00119	0.00119
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

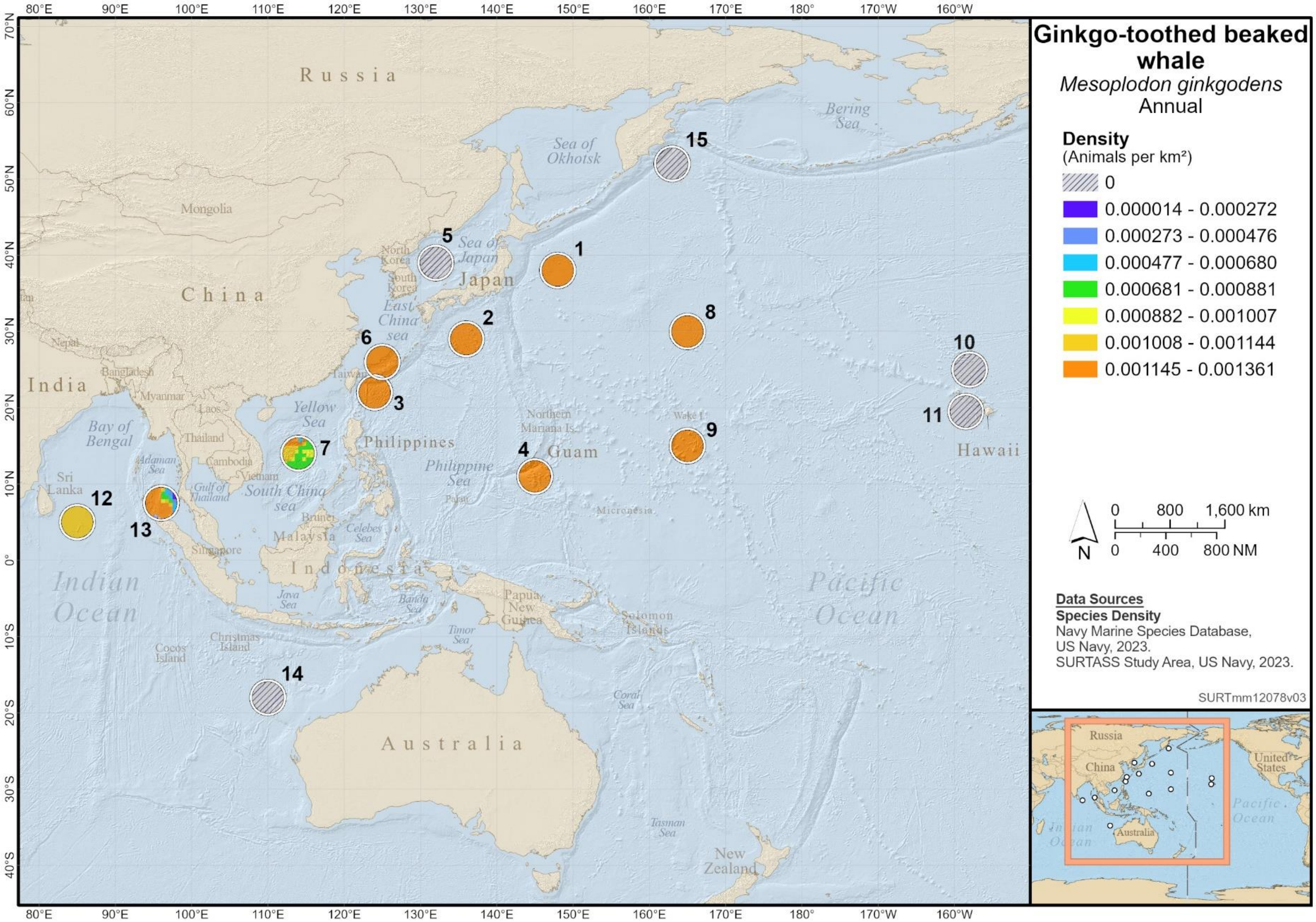


Figure 2.37-1: Annual Distribution of Ginkgo-Toothed Beaked Whale in the SURTASS LFA Study Area

2.38 *Mesoplodon hotaula*, Deraniyagala's Beaked Whale

Deraniyagala's beaked whale is not an ESA-listed species. It is listed as a Data Deficient species by the IUCN Red List of Threatened Species (Pitman & Brownell Jr, 2020a).

There are no known live sightings of Deraniyagala's beaked whale. This species is currently known from fewer than 12 stranded individuals in the tropical Indo-Pacific Ocean, suggesting a distribution in warm tropical waters from the western Indian Ocean to the central Pacific, although its range may extend across the entire tropical Pacific (Jefferson et al., 2015).

Based on their current assumed distribution, Deraniyagala's beaked whales are expected to occur in SURTASS modeling site 3 (West Philippine Sea), site 4 (Offshore Guam), site 7 (South China Sea), site 9 (Offshore Japan/Western North Pacific), site 12 (Offshore Sri Lanka), and site 13 (Andaman Sea). In all other sites a zero density is assumed. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.38-1, following the modeling site descriptions. Figure 2.38-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.38.1 Modeling Site 3 – West Philippine Sea

Density data for Deraniyagala's beaked whale are not available for any region. To provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.38.2 Modeling Site 4 – Guam

Deraniyagala's beaked whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Since density data for Deraniyagala's beaked are not available, in order to provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.38.3 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Deraniyagala's beaked whale density estimates for modeling site 7 were not available. Density data derived from the Kaschner et al. (2006) RES models for ginkgo-toothed beaked whale were the only representative quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.38.4 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Density data for Deraniyagala's beaked whale are not available for any region. To provide a representative estimate, a recent design-based estimate for unidentified *Mesoplodon* for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00119 animals/km^2 (CV = 0.61) was based on 2017 survey data. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.38.5 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Deraniyagala's beaked whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models for ginkgo-toothed beaked whale were the only representative quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.38.6 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Deraniyagala's beaked whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models for ginkgo-toothed beaked whale were the only representative quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

Table 2.38-1: Summary of Density Values for Deraniyagala's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0.00119	0.00119	0.00119	0.00119
Modeling Site 4	0.00119	0.00119	0.00119	0.00119
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	S	S	S	S
Modeling Site 8	0	0	0	0
Modeling Site 9	0.00119	0.00119	0.00119	0.00119
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

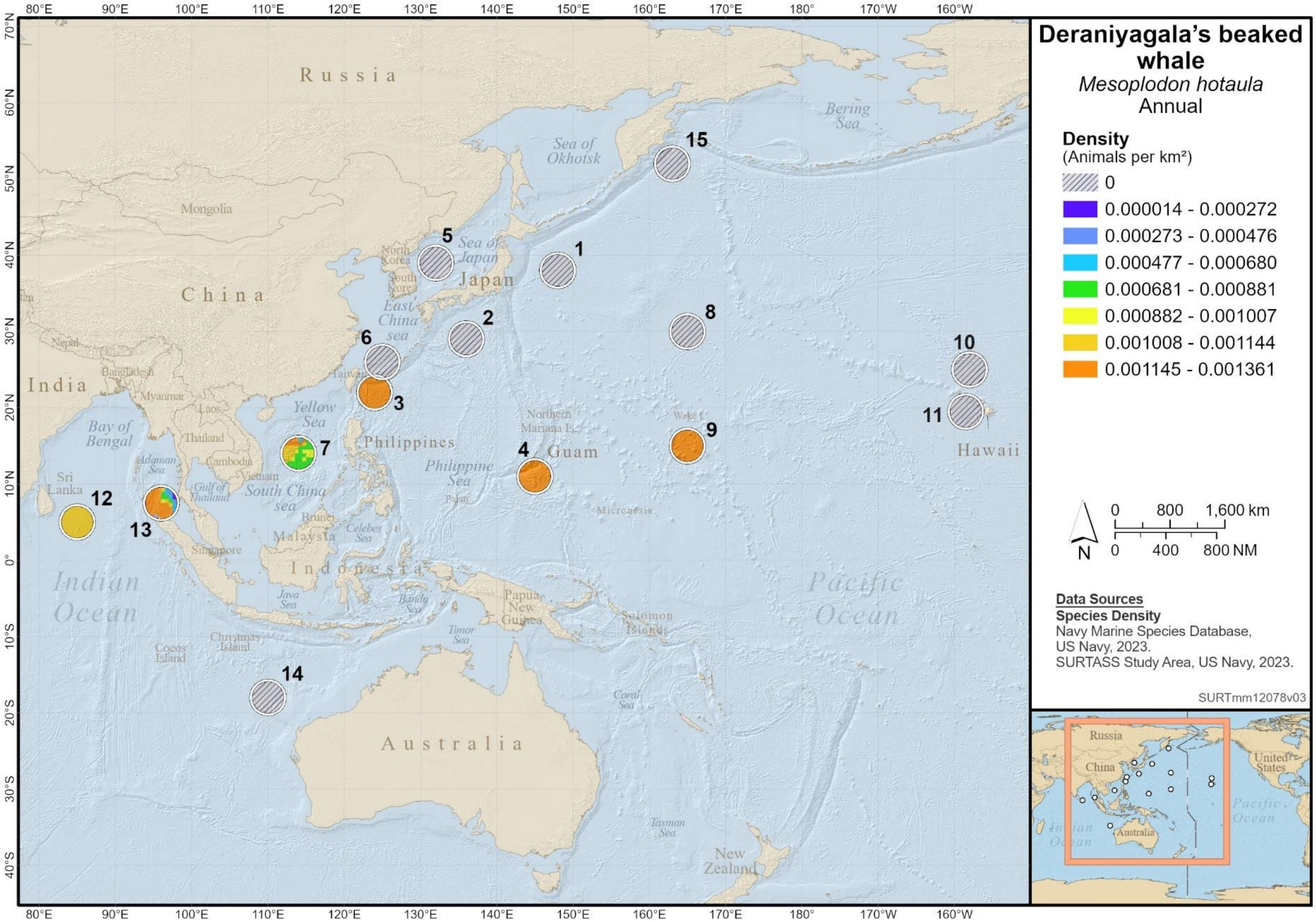


Figure 2.38-1: Annual Distribution of Deraniyagala's Beaked Whale in the SURTASS LFA Study Area

2.39 *MESOPLODON STEJNEGERI*, STEJNEGER'S BEAKED WHALE

Stejneger's beaked whale is not an ESA-listed species. It is listed as a Near Threatened species by the IUCN Red List of Threatened Species (Pitman & Brownell Jr, 2020e).

Stejneger's beaked whale occurs mainly in continental slope and oceanic regions of the North Pacific, primarily in cold temperate to subarctic waters (Jefferson et al., 2015). Their distribution extends from central California north to the Bering Sea, and south to the Sea of Japan. Stejneger's beaked whale is the only *Mesoplodon* species found in Alaskan waters.

Due to the difficulty in distinguishing the different *Mesoplodon* species from one another, NMFS has combined six *Mesoplodon* species to make up the California, Oregon, and Washington stock of *Mesoplodon* beaked whales (Carretta et al., 2023). This group of six beaked whales known to occur in waters off the U.S. west coast includes Stejneger's beaked whale (*M. stejnegeri*), ginkgo-toothed beaked whale (*M. ginkgodens)*, Hubbs' beaked whale (*Mesoplodon carlshubbsi*), Blainville's beaked whale (*M. densirostris*), ginkgo-toothed beaked whale (*M. ginkgodens)*, Perrin's beaked whale (*M. perrini*), and pygmy beaked whale (aka Peruvian, *M. peruvianus*).

Given their known distribution patterns in cold waters of the North Pacific, Stejneger's beaked whale are only expected to occur in SURTASS modeling site 1 (East of Japan), site 5 (Sea of Japan), site 8 (Offshore Japan/Western North Pacific 25° to 40° N), and site 15 (Northeast of Japan). A zero density is assumed for all other modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.39-1, following the modeling site descriptions. Figure 2.39-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.39.1 MODELING SITE 1 – EAST OF JAPAN

Density data for Stejneger's beaked whale specific to this area were not available. To provide a representative estimate, density estimates derived from Bayesian trend analyses for the group of *Mesoplodon* beaked whales in the California Current (including Stejneger's beaked whale) were used (Moore & Barlow, 2017). The most recent (2014) estimate of 0.00267 animals/km^2 (CV = 0.54) was incorporated into the NMSDD for this species. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data, the Navy applied this density estimate year round.

2.39.2 MODELING SITE 5 – SEA OF JAPAN

Density data for Stejneger's beaked whale specific to this area were not available. In order to provide a representative estimate, density estimates derived from Bayesian trend analyses for the group of *Mesoplodon* beaked whales in the California Current (including Stejneger's beaked whale) were used (Moore & Barlow, 2017). The most recent (2014) estimate of 0.00267 animals/km^2 (CV = 0.54) was incorporated into the NMSDD for this species. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data, the Navy applied this density estimate year round.

2.39.3 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Stejneger's beaked whale specific to this area were not available. In order to provide a representative estimate, density estimates derived from Bayesian trend analyses for the group of *Mesoplodon* beaked whales in the California Current (including Stejneger's beaked whale) were used (Moore & Barlow, 2017). The most recent (2014) estimate of 0.00267 animals/km^2 (CV = 0.54) was incorporated into the NMSDD for this species. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data, the Navy applied this density estimate year round.

2.39.4 Modeling Site 15 – Northeast of Japan

Density data for Stejneger's beaked whale specific to this area were not available. In order to provide a representative estimate for this northern SURTASS modeling site, density estimates derived from design-based estimates for the group of *Mesoplodon* beaked whales (including Stejneger's beaked whale) in waters off Washington and Oregon were used (Barlow, 2016). The estimate of 0.00118 animals/km^2 (CV = 0.68) was incorporated into the NMSDD for this species. Since this estimate was derived for a guild of multiple species, it is likely biased high for a single species. Given the lack of seasonal data, the Navy applied this density estimate year round.

Table 2.39-1: Summary of Density Values for Stejneger's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00267	0.00267	0.00267	0.00267
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.00267	0.00267	0.00267	0.00267
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.00267	0.00267	0.00267	0.00267
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.00118	0.00118	0.00118	0.00118

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

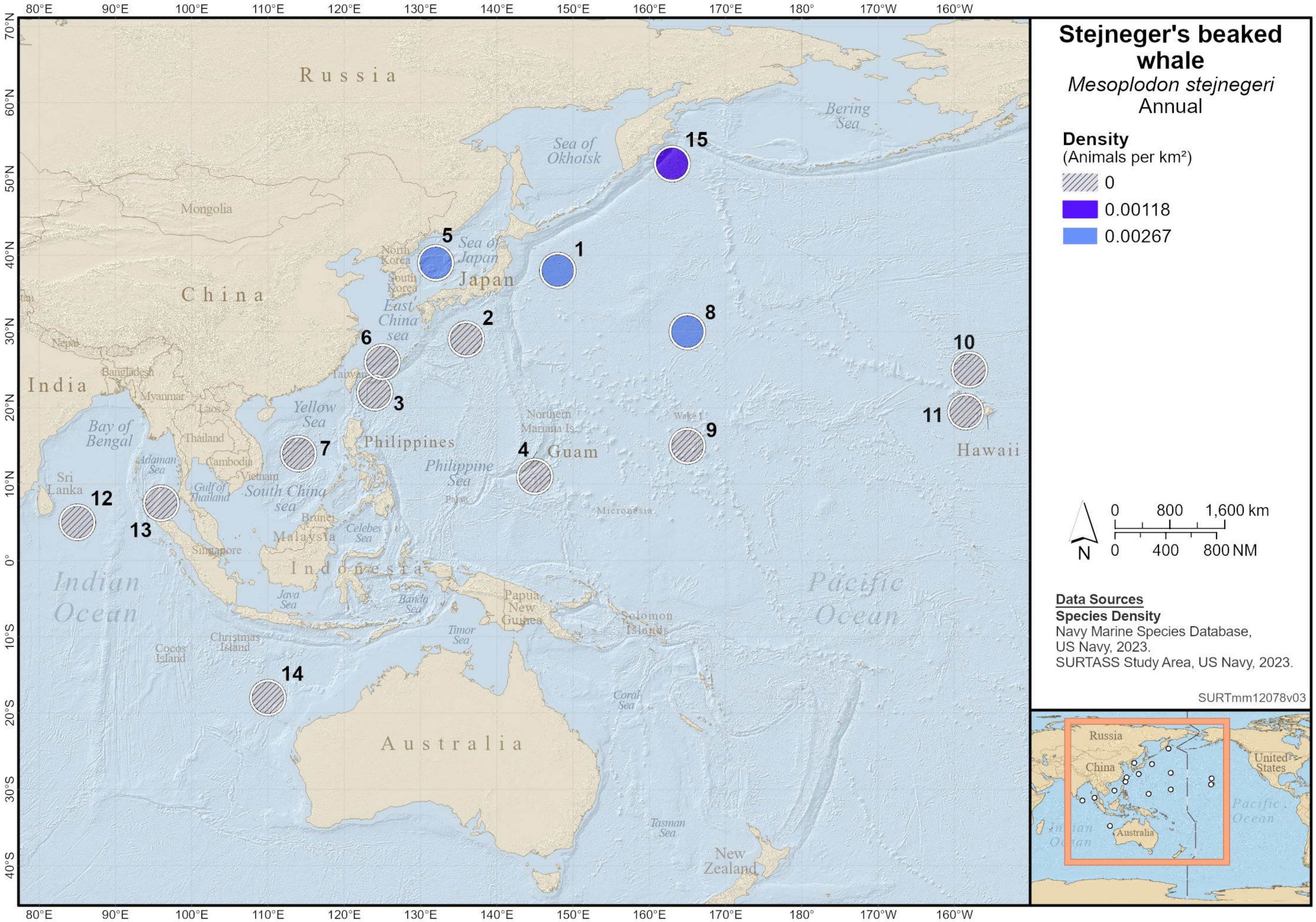


Figure 2.39-1: Annual Distribution of Stejneger's Beaked Whale in the SURTASS LFA Study Area

2.40 *Ziphius cavirostris*, Cuvier's Beaked Whale

Cuvier's beaked whale (also known as goose-beaked whale) is not an ESA-listed species. It is listed as a species of Least Concern by the IUCN Red List of Threatened Species (Baird et al., 2020).

Cuvier's beaked whales have the most cosmopolitan range of any beaked whale species (Bradford et al., 2013; Falcone et al., 2009; Jefferson et al., 2015). Their extensive range includes all oceans, from the tropics to the polar waters of both hemispheres. Similar to other beaked whale species, this oceanic species generally occurs in waters past the edge of the continental shelf and occupies almost all temperate, subtropical, and tropical waters of the world, as well as subpolar and even polar waters in some areas (Jefferson et al., 2015). Cuvier's beaked whales are generally sighted in waters with a bottom depth greater than 200 m and are frequently recorded in waters with bottom depths greater than 1,000 m (Bradford et al., 2013; Falcone et al., 2009; Jefferson et al., 2015). Acoustic sampling of bathymetrically featureless areas off Southern California detected many beaked whales over an abyssal plain, which counters a common misperception that beaked whales are primarily found over slope waters, in deep basins, or over seamounts (Griffiths & Barlow, 2016). They are also found in many semi-enclosed seas, such as the Gulf of California, Gulf of Mexico, Caribbean Sea, Sea of Japan, and the Sea of Okhotsk (Jefferson et al., 2015).

NMFS recognizes two stocks of Cuvier's beaked whale within the Pacific EEZ, a California/Oregon/Washington stock, and a Hawaii stock that includes animals found within the Hawaiian Islands EEZ and adjacent high sea waters (Carretta et al., 2023).

Cuvier's beaked whales are expected to occur in all the SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.40-1, following the modeling site descriptions. Figure 2.40-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.40.1 Modeling Site 1 – East of Japan

Density data for Cuvier's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.2 Modeling Site 2 – North Philippine Sea

Density data for Cuvier's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.3 Modeling Site 3 – West Philippine Sea

Density data for Cuvier's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used

(Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.4 Modeling Site 4 – Guam

Cuvier's beaked whale density estimates for modeling site 4 were consistent with those used in the Navy's Phase IV analyses for the MITT Study Area. Passive acoustic data collected from DASBRs during surveys in 2018 and 2021 of waters off Guam and the CNMI were used to estimate density for both Cuvier's and Blainville's beaked whales (Badger et al., 2023). In addition to providing the first density estimates of Cuvier's and Blainville's beaked whales in the Mariana Islands region, the analysis of the DASBR data revealed a substantial latitudinal difference in the encounter rate and therefore estimated density of both species in the study area (Badger et al., 2023; McCullough et al., 2021). In waters north of 15.5 °N, Cuvier's beaked whales were detected almost 2x more often than in the southern strata. The resulting density estimates were 0.00872 animals/km^2 (CV = 0.228) in the northern stratum and 0.00478 animals/km^2 (CV = 0.412) in the southern stratum (Badger et al., 2023). These data were used to characterize annual Cuvier's beaked whale density.

2.40.5 Modeling Site 5 – Sea of Japan

Density data for Cuvier's beaked whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.6 Modeling Site 6 – East China Sea

Density data for Cuvier's beaked whale specific to this area were not available. To provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.7 Modeling Site 7 – South China Sea

Survey data are extremely limited in the South China Sea (Kaschner et al., 2012), and Cuvier's beaked whale density estimates for modeling site 7 were not available. Recent acoustic data confirm the occurrence of Cuvier's beaked whale in the northern South China Sea (Dong et al., 2023). Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.40.8 Modeling Site 8 – Offshore Japan/Western North Pacific 25° to 40° N

Density data for Cuvier's beaked whale specific to this area were not available. In order to provide a representative estimate, a recent design-based estimate for the Hawaiian Islands EEZ was used (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.9 Modeling Site 9 – Offshore Japan/Western North Pacific 10° to 25° N

Cuvier's beaked whale density estimates for modeling site 9 were taken from those used in the Navy's Phase IV analyses for the MITT Study Area, given the similar latitude of these sites in the western North Pacific. The estimate was based on passive acoustic data collected from DASBRs during surveys in 2018 and 2021 of waters off Guam and the CNMI. These data were used to estimate density for both Cuvier's and Blainville's beaked whales (Badger et al., 2023). In addition to providing the first density estimates of Cuvier's and Blainville's beaked whales in the Mariana Islands region, the analysis of the DASBR data revealed a substantial latitudinal difference in the encounter rate and therefore estimated density of both species in the study area (Badger et al., 2023; McCullough et al., 2021). In waters north of 15.5 °N, Cuvier's beaked whales were detected almost 2x more often than in the southern strata. The resulting density estimates were 0.00872 animals/km^2 (CV = 0.228) in the northern stratum and 0.00478 animals/km^2 (CV = 0.412) in the southern stratum (Badger et al., 2023). These data were used to characterize annual Blainville's beaked whale density.

2.40.10 Modeling Site 10 – Hawaii North

Cuvier's beaked whale density estimates for modeling site 10 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.11 Modeling Site 11 – Hawaii South

Cuvier's beaked whale density estimates for modeling site 11 were consistent with those used in the Navy's Phase IV analyses for the HCTT Study Area, which were based on a recent design-based estimate for the Hawaiian Islands EEZ (Bradford et al., 2021). The most recent estimate of 0.00181 animals/km^2 (CV = 0.41) was based on 2017 survey data. Given the lack of seasonal data for this species, the Navy applied this density estimate year round.

2.40.12 Modeling Site 12 – Offshore Sri Lanka

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Cuvier's beaked whale density estimates for modeling site 12 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.40.13 Modeling Site 13 – Andaman Sea

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Cuvier's beaked whale density estimates for modeling site 13 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.40.14 Modeling Site 14 – Northwest of Australia

Survey data are extremely limited in the Indian Ocean (Kaschner et al., 2012), and Cuvier's beaked whale density estimates for modeling site 14 were not available. Density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available, and these spatially explicit estimates were incorporated into the NMSDD for this site.

2.40.15 Modeling Site 15 – Northeast of Japan

Density data for Cuvier's beaked whale specific to this area were not available. To provide a representative estimate for this northern SURTASS modeling site, given their similar latitudes, density estimates for Cuvier's beaked whales in the Gulf of Alaska were used. The estimate was derived from design-based analyses of passive acoustic data collected on line-transect surveys conducted during the summer of 2013 (Yack et al., 2015). The estimate of 0.0021 animals/km^2 (CV = 0.28) was incorporated into the NMSDD for this species. Given the lack of seasonal data, the Navy applied this density estimate year round.

Table 2.40-1: Summary of Density Values for Cuvier's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00181	0.00181	0.00181	0.00181
Modeling Site 2	0.00181	0.00181	0.00181	0.00181
Modeling Site 3	0.00181	0.00181	0.00181	0.00181
Modeling Site 4 (north of 15.5 °N)	0.00872	0.00872	0.00872	0.00872
Modeling Site 4 (south of 15.5 °N)	0.00478	0.00478	0.00478	0.00478
Modeling Site 5	0.00181	0.00181	0.00181	0.00181
Modeling Site 6	0.00181	0.00181	0.00181	0.00181
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00181	0.00181	0.00181	0.00181
Modeling Site 9 (north of 15.5 °N)	0.00872	0.00872	0.00872	0.00872
Modeling Site 9 (south of 15.5 °N)	0.00478	0.00478	0.00478	0.00478
Modeling Site 10	0.00181	0.00181	0.00181	0.00181
Modeling Site 11	0.00181	0.00181	0.00181	0.00181
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0.0021	0.0021	0.0021	0.0021

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

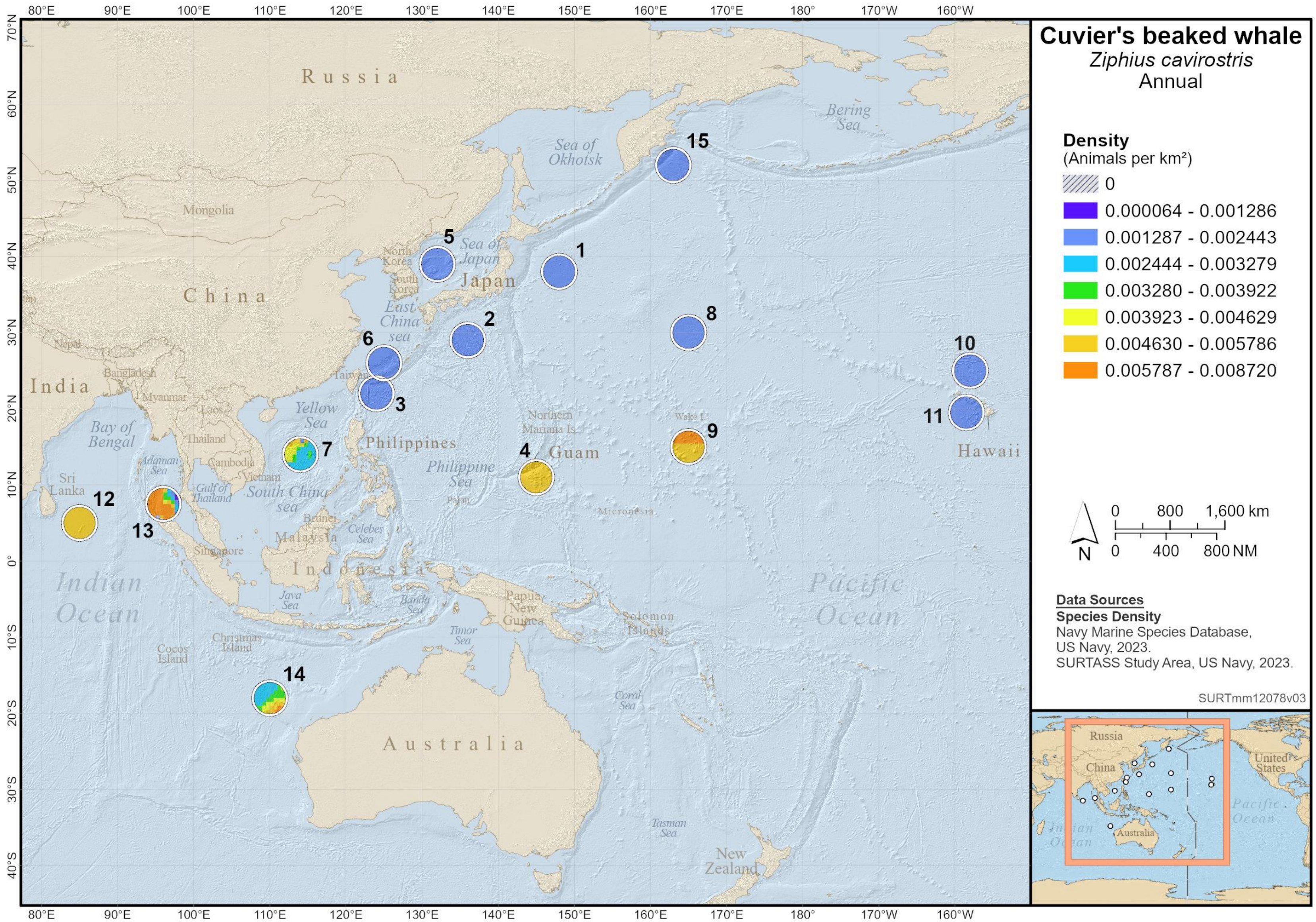


Figure 2.40-1: Annual Distribution of Cuvier's Beaked Whale in the SURTASS LFA Study Area

2.41 *CALLORHINUS URSINUS*, NORTHERN FUR SEAL

The northern fur seal is not an ESA-listed species. It is listed as a Vulnerable species by the IUCN Red List of Threatened Species (Gelatt et al., 2015).

Northern fur seals range throughout the North Pacific from central California along the west coast of North America across the Bering Sea and west to the Sea of Okhotsk and as far south as Honshu Island, Japan (Horimoto et al., 2016; Jefferson et al., 2015; Kanaji et al., 2023b; Young, 2023). Two stocks of northern fur seals are recognized in United States waters: the Eastern Pacific stock and the California stock (Young, 2023). Northern fur seals from the Eastern Pacific stock would occur in the SURTASS LFA Study Area.

In the western North Pacific, northern fur seals move south along the coast of Russia and northern Japan in winter but are also distributed farther offshore south of the Aleutian Islands (Buckland et al., 1993; Kanaji et al., 2023a). In spring, the fur seals make a return migration northward to summer breeding sites on the Pribilof Islands in the Bering Sea or in the Sea of Okhotsk, Russia. The abundance of the Eastern Pacific stock is estimated to be 626,618 fur seals.

Northern fur seals are expected to occur in SURTASS modeling site 1 (East of Japan), site 5 (Sea of Japan), and site 15 (Northeast of Japan). A zero density is assumed for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.41-2, following the modeling site descriptions. Figures 2.41-1 and 2.41-2, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.41.1 MODELING SITE 1 – EAST OF JAPAN

Kanaji et al. (2023b) and Kanaji et al. (2023a) estimated abundance, density, and distribution of northern fur seals off northern Japan using multi-year survey data. The densities ranged from 0.2420 to 1.0583 fur seals/km^2 depending on the survey year (Kanaji et al., 2023a). The areas surveyed did not extend to the 250 km buffer at site 1, and the fur seals appeared to prefer shallower depths with highest concentrations in the survey area near the 100 m depth contour where their prey are expected to be concentrated. While these densities confirm the that northern fur seal is one of the most commonly occurring marine mammal species off Japan, the densities are not representative of fur seal distribution at site 1.

Line-transect surveys conducted by Buckland et al. (1993) were used to estimate the abundance and range of northern fur seals that included pelagic areas across the North Pacific Ocean and were considered more appropriate for estimating a density in the 250 km buffer at site 1. An average density of 0.01525 fur seals/km^2 (CV=1.44) was calculated to represent the distribution of fur seals in pelagic habitat in the western North Pacific and was applied to site 1. The density derivation is described in Section 2.4.1.3 for site 15. The density estimate is considered conservative, because northern fur seals prefer to forage near the shelf break, at about the 400 m depth contour, and over the continental slope (Belonovich et al., 2016; Horimoto et al., 2016; Kanaji et al., 2023a). Depths inside the 250 km buffer at site 1 range from 4,000 to greater than 6,700 m. Additionally, the stock abundance estimate for the Eastern Pacific Stock in 1994 was approximately 1 million fur seals (Young, 2023), which implies that the density estimates from Buckland et al. (1993) are conservatively high for a population that is now estimated to be 40 percent smaller.

2.41.2 Modeling Site 5 – Sea of Japan

Horimoto et al. (2016) reported densities for northern fur seals in the northern Sea of Japan on the west side of the Oshima Peninsula in spring and winter. Surveys were conducted from 2010 – 2012 in January, February, April, and November. Sightings peaked in February and declined through April as the fur seals moved north to breeding grounds on Tuleny Island and the Kuril Islands in Russia and broadly into the northern Sea of Okhotsk (Permyakov et al., 2023). Horimoto et al. (2017) analyzed stranding and occurrence data from 2005 – 2014 on northern fur seals off Hokkaido, Japan, which showed higher abundance along the Pacific coast than along the western coast of Hokkaido in the Sea of Japan.

Horimoto et al. (2016) reported highest densities of fur seals over the narrow shelf and slope in the northern Sea of Japan at depths of approximately 2,000 m. Kim (2021) documented sightings and stranding of northern fur seals off the Korean peninsula in the southern Sea of Japan, suggesting a wider distribution and supporting a density distribution throughout the sea.

Two uniform densities were estimated for winter and spring at site 5 in the Sea of Japan by averaging the densities reported by Horimoto et al. (2016). The three densities from April (0.2, 0.23, and 0.043 fur seals/km^2) were averaged resulting in a density of 0.1577 (CV-0.40) fur seals/km^2 in spring, and the densities from January (0.096 fur seals/km^2) and February (0.64 fur seals/km^2) were averaged resulting in a winter density of 0.3680 (CV=0.43) fur seals/km^2. The densities were extrapolated throughout the Sea of Japan.

2.41.3 Modeling Site 15 – Northeast of Japan

To calculate a density for northern fur seal at site 15, the abundance estimates derived by Buckland et al. (1993) for survey blocks west of the 180-degree longitude line (i.e., blocks with longitudes from 180 degrees to 140 degrees E in Table 6 of the paper) were divided by the area of the associated survey block (in km^2) to estimate a density within each block. Since the surveys were conducted over multiple years and seasons, the block densities were averaged to calculate a uniform density estimate for the western North Pacific region (Table 2.41-1-1). An average uniform density estimate of 0.01525 fur seals/km^2 was used to represent their distribution at site 15 (and site 1, as noted in Section 2.41.1) in winter and spring. The fur seals are expected to be at breeding sites north of site 15 and in the Sea of Okhotsk in summer and fall. A CV was calculated for each block density based on the standard error in the abundance provided by Buckland et al. (1993) and averaged for a CV of 1.44.

Table 2.41-1. Selected Data from Table 6 in Buckland et al. (1993) and Calculated Densities and CVs Used to Estimate a Density for Site 15 (and Site 1)

Block Number	Block Area (km^2)	Abundance	Standard Error	Density	CV
4	184,832	3,770	2,698	0.02040	1.43
5	187,647	6,631	1,283	0.03534	1.66
6	187,647	4,335	3,573	0.02310	1.43
10	208,263	5,162	7,332	0.02479	1.42
11	208,263	2,107	2,992	0.01012	1.42
12	208,263	2,607	1,531	0.01252	1.44
13	208,263	861	1,223	0.00413	1.42

26	227,299	2,682	1,704	0.01180	1.42
27	227,299	4,276	2,177	0.01881	1.44
28	227,299	1,654	1,363	0.00728	1.43
29	227,299	3,039	1,396	0.01337	1.45
30	227,299	4,199	2,029	0.01847	1.45
31	227,299	2,938	2,400	0.01293	1.41
38	186,323	1,921	1,911	0.01031	1.41
39	244,606	1,312	1,312	0.00536	1.41
			Mean	**0.01525**	**1.44**

Notes: Only survey blocks west of 180 degree longitude were used to estimate fur seals potentially migrating through or occurring in site 15.

The density estimate is considered conservative, because northern fur seals prefer to forage near the shelf break, in waters approximately 400 m deep and shoreward of site 15, and over the continental slope (Belonovich et al., 2016; Horimoto et al., 2016; Kanaji et al., 2023a). Depths in most of the 250 km buffer at site 15 range from 3,000 to greater than 8,000 m. Additionally, as noted above for site 1, the stock abundance estimate for the Eastern Pacific Stock in 1994 was approximately 1 million fur seals (Young, 2023), which implies that the density estimates from Buckland et al. (1993) are conservatively high for a population that is now about 40 percent smaller.

Table 2.41-2: Summary of Density Values for Northern Fur Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.01525	0	0	0.01525
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.1577	0	0	0.3680
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.01525	0	0	0.01525

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

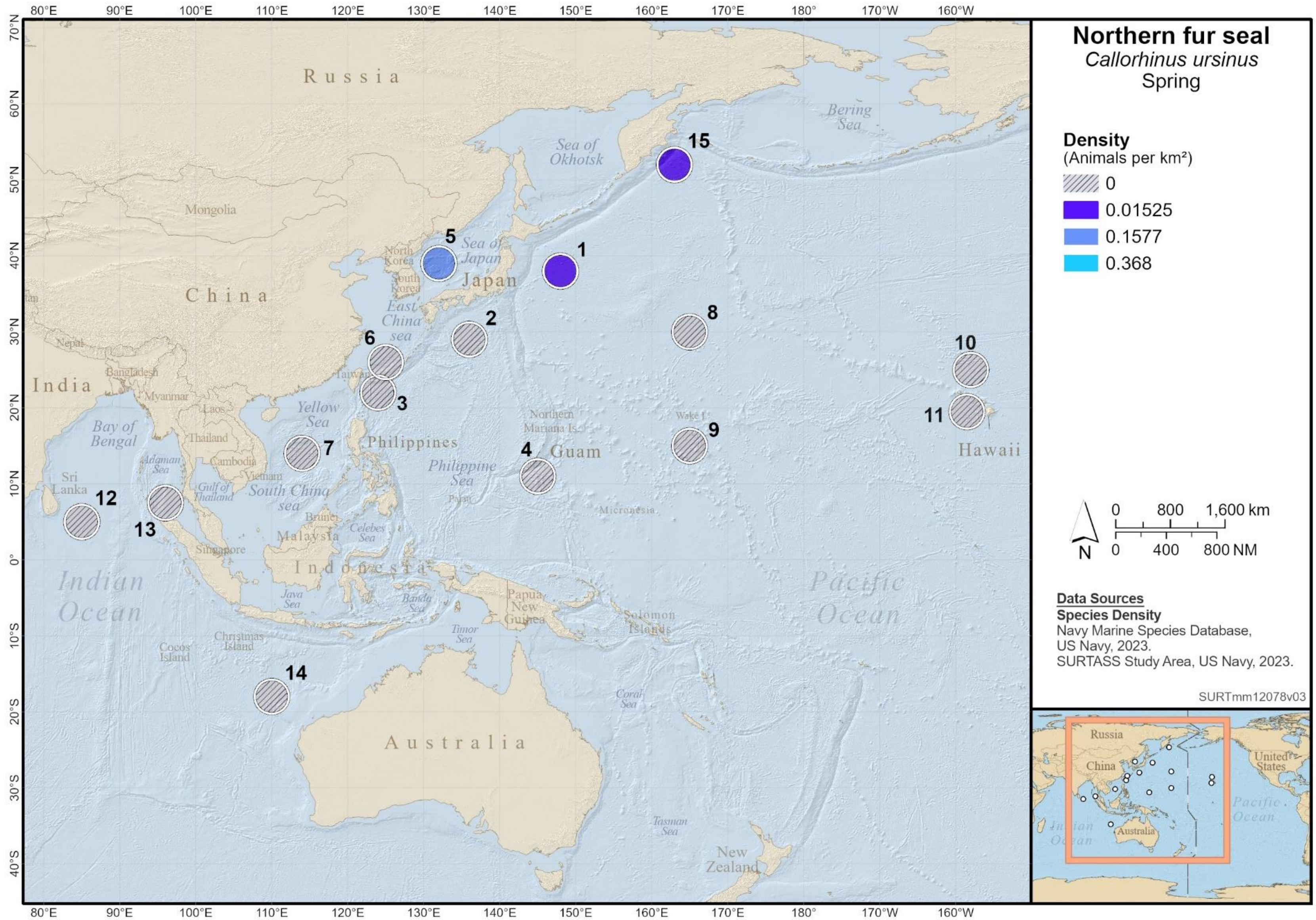


Figure 2.41-1: Spring Distribution of Northern Fur Seal in the SURTASS LFA Study Area

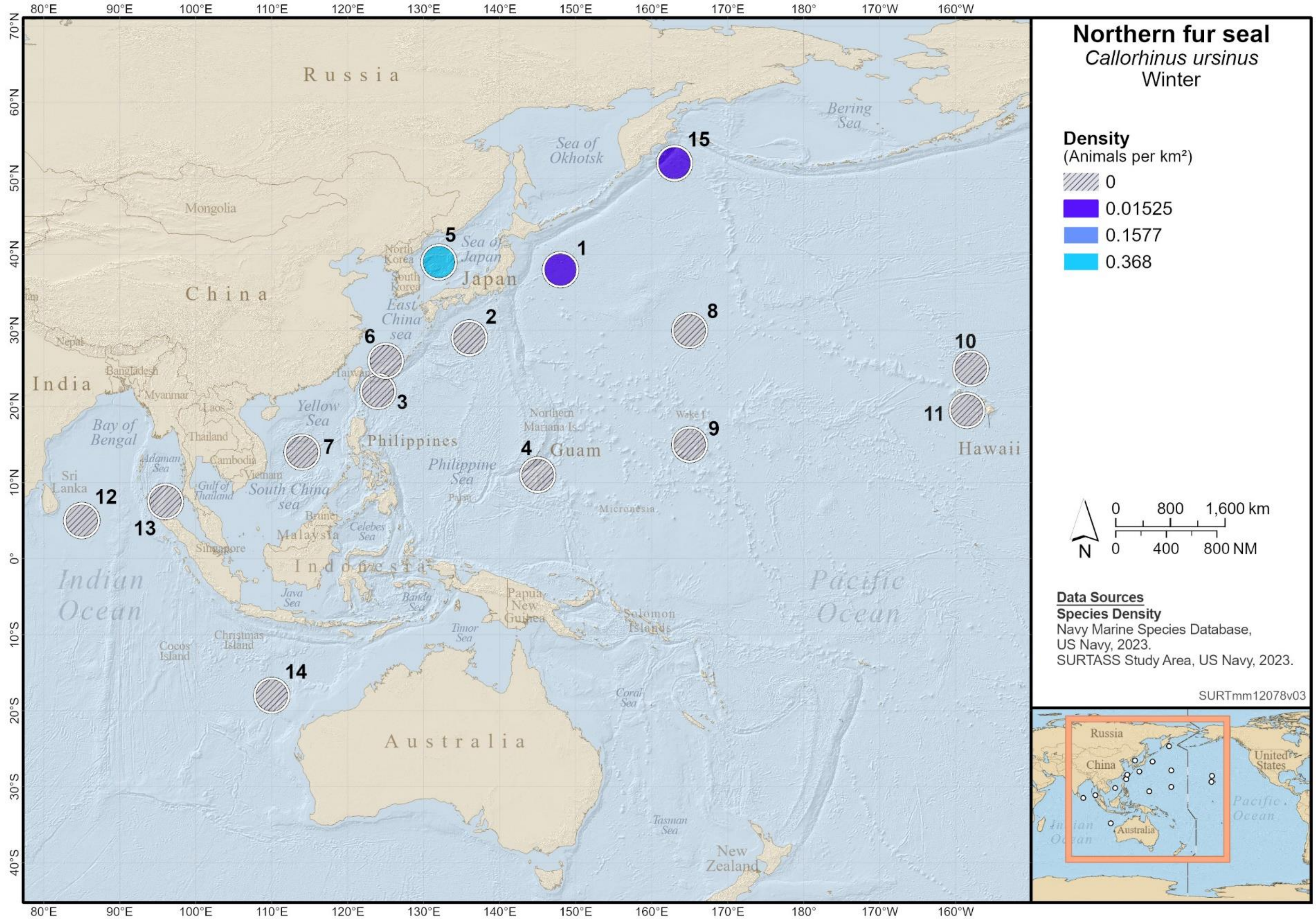


Figure 2.41-2: Winter Distribution of Northern Fur Seal in the SURTASS LFA Study Area

2.42 *MONACHUS SCHAUINSLANDI*, HAWAIIAN MONK SEAL

The Hawaiian monk seal is listed as endangered under the ESA and included as an Endangered species on the IUCN Red List of Threatened Species (Littnan et al., 2015).

The majority of the Hawaiian monk seal population is distributed in the Northwestern Hawaiian Islands with subpopulations on French Frigate Shoals, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Atoll, Kure Atoll, and Necker and Nihoa Islands (Baker et al., 2016; Carretta et al., 2022). A smaller subpopulation in the Main Hawaiian Islands has been increasing in recent years; whereas the larger population in the Northwestern Hawaiian Island was thought to have been in a long-term decline (Antonelis et al., 2006; Baker et al., 2016; Baker et al., 2011; Baker & Johanos, 2004) until a new approach was developed to estimate the abundance range-wide and for individual island-specific subpopulations (Baker et al., 2016). Based on the most recent methodology and modeling results, the range-wide abundance is estimated at 1,564 monk seals (Carretta et al., 2024).

Robinson et al. (2022) provided a comprehensive review of Hawaiian monk seal behavior and social interactions, including habitat use and foraging behavior. The authors note that occurrence is concentrated within the 200 m depth contour with foraging dives typically less than 50 m. Monk seals forage at or near the seafloor and tend to concentrate where bathymetry supports foraging activity, such as at reefs, seamounts, and shallow banks. While this generally means that monk seals are concentrated in shallow waters surrounding natal islands, they are known to travel hundreds of kilometers over deeper waters to reliable foraging sites.

Hawaiian monk seals are expected to occur in SURTASS modeling site 10 (Hawaii North) and site 11 (Hawaii South). A zero density is assumed for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.42-1-1, following the modeling site descriptions. Figure 2.42-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.42.1 MODELING SITE 10 – HAWAII NORTH

Density for the Hawaiian monk seal at site 10 was extrapolated from the offshore density for the MHI calculated in the HCTT Study Area (U.S. Department of the Navy, 2024). The offshore density estimate represented monk seal distribution from the 200 m depth contour to the U.S. EEZ boundary at 200 NM from shore. The density calculation is:

Density = $347_{\text{(MHI abundance)}}$ x $0.58_{\text{(haul-out factor)}}$ x $0.10(_{\text{proportion > 200 m depth contour)}}$ / 800,414 $\text{km}^2_{\text{(area > 200 m depth around the MHI)}}$ = 0.00003 monk seals/km^2

Note that the recently updated abundance estimate in the 2023 draft SAR (Carretta et al., 2024) for the MHI (including Nihau and Lehua) is 375 monk seals. Using this updated abundance estimate in the equation above does not change the density estimate.

2.42.2 MODELING SITE 11 – HAWAII SOUTH

Density estimates for three strata were derived for Hawaiian monk seal at site 11. The offshore density was calculated as shown in Section 2.42.1 for site 10. Nearshore areas defined by strata extending from shore to the 200 m depth contour were used to calculate island-specific densities for the Hawaiian archipelago (U.S. Department of the Navy, 2024).

Table 2.42-1. Summary of Density Values for Hawaiian Monk Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0.00003	0.00003	0.00003	0.00003
Modeling Site 11	S	S	S	S
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = multiple density values throughout the site. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

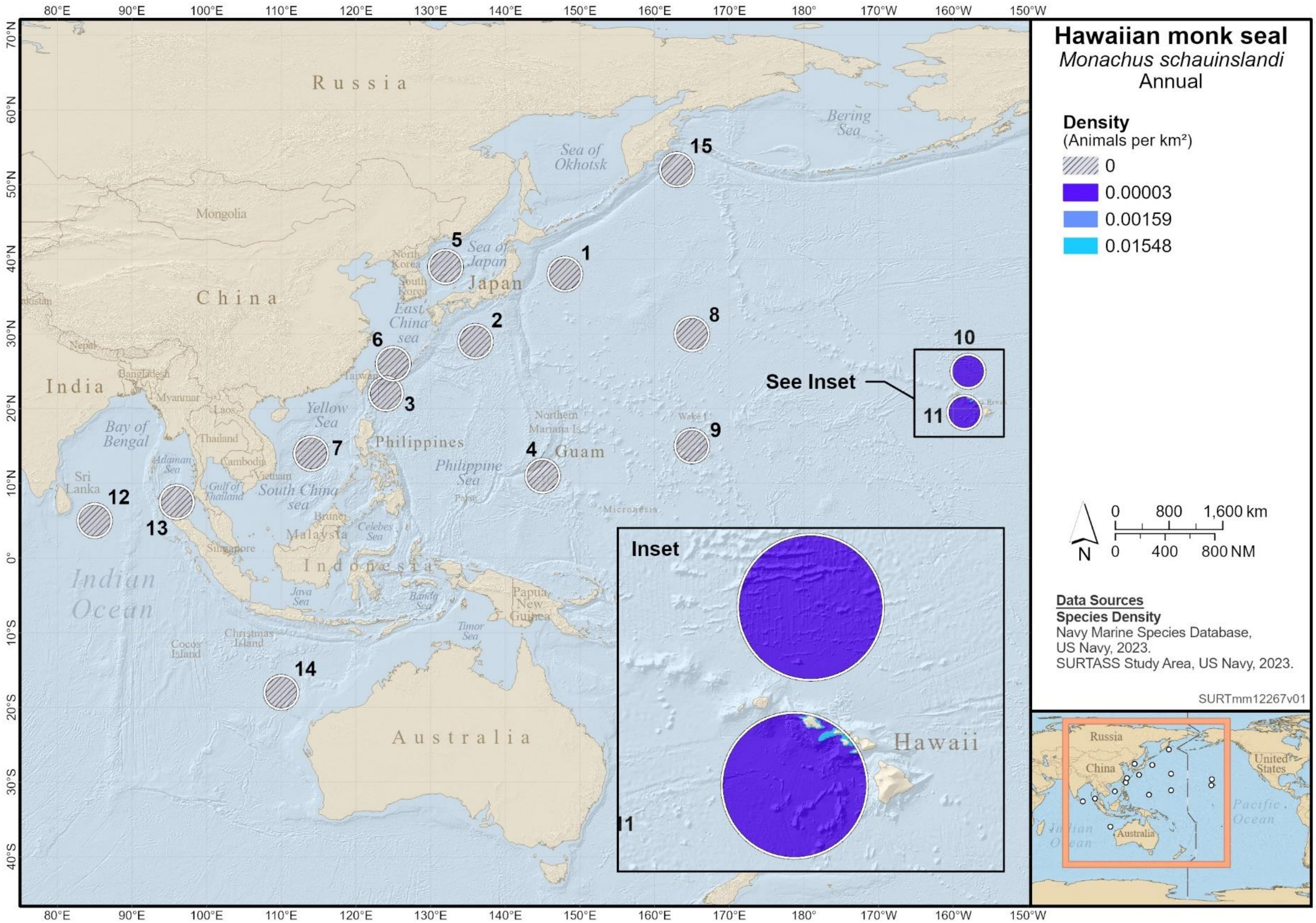


Figure 2.42-1. Annual Distribution of Hawaiian Monk Seal in the SURTASS LFA Study Area

2.43 *PHOCA LARGHA*, SPOTTED SEAL

The spotted seal is not an ESA-listed species. It is considered a species of Least Concern by the IUCN Red List of Threatened Species (Boveng, 2016). The IUCN status is based on an assessment of the entire population of 461,625 seals (Young, 2023); however, isolated populations along the Asian coast are much smaller and at greater risk from pollution, bycatch, and habitat loss (Zhuang et al., 2023).

Spotted seals are distributed along the continental shelf in the Bering, Chukchi, and Beaufort seas, and the Sea of Okhotsk south to the western Sea of Japan and northern Yellow Sea (Young, 2023). NMFS recognizes seals in U.S. waters as the Bering stock. Boveng et al. (2009) identified eight breeding areas for spotted seals and defined three DPSs: Bering, Southern, and Okhotsk. Two breeding sites in the Yellow Sea and western Sea of Japan are used by the Southern DPS, breeding sites in the Tatar Strait in the northern Sea of Japan and two sites in the Sea of Okhotsk are used by the Okhotsk DPS, and three breeding sites in the Bering Sea are used by the Bering DPS.

Spotted seals breed on sea ice in winter and move north in spring following the sea ice retreat. The seals are at sea over 80 percent of the time during the non-breeding season, hauling out on land a few times per month for between 1 and 7 days (Boveng et al., 2009). Based on their distributions, only spotted seals from the Southern DPS would occur at site 5. The abundance of the Southern DPS was estimated from counts at the two Southern DPS breeding sites at Liaodong Bay in the northern Yellow Sea and Peter the Great Bay in the western Sea of Japan. Zhuang et al. (2023) estimated that the population in the Yellow Sea was 0.31 percent of a total population estimate of 320,000 seals which equates to 992 seals. Trukhin (2019) estimated the breeding population in Peter the Great Bay at 3,600 seals for a total abundance estimate of 4,592 seals in the Southern DPS. Spotted seals also occur along western Hokkaido, Japan in the northern Sea of Japan, but these seals are not expected to move south into site 5 (Shibuya & Kobayashi, 2014). A haulout factor was applied to estimate seasonal in-water abundances based on data reported by London et al. (2022) on haulout behavior of ice seals, including spotted seal, in the Bering Sea. To calculate an in-water abundance, the analysis assumes seals would be in the water 75 percent of the time from October – May and 25 percent of the time from June – September. Peak counts of hauled out seals on Hokkaido varied seasonally, so the haulout percentages using data from seals hauled out on sea ice in the Bering Sea should be considered approximations. Nevertheless, the seals are assumed to be in the water 75 percent of the time for 8 months of the year.

Yang et al. (2023) modeled the spatial distributions of the three DPSs based on sightings and habitat covariates. The most influential covariates coinciding with the distribution of the Southern DPS were sea surface temperature and distance from shore. The seals preferred water temperatures between 2 and 15°C and depths less than 800 m.

Spotted seals are only expected to occur in SURTASS modeling site 5 (Sea of Japan). A zero density is assumed for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.43-1, following the modeling site descriptions. Figures 2.43-1 and 2.43-2, which show density estimates for all the modeling sites within the SURTASS LFA Study Area, follow the table.

2.43.1 Modeling Site 5 – Sea of Japan

For site 5, the distribution area was estimated as the area extending from shore to the 800 m depth contour within the Southern DPS range along the mainland coast of Japan depicted by Boveng et al. (2009) to 43°N latitude in the Sea of Japan. Water depths at site 5 do not exceed 800 m except for around the small South Korean island of Ulleungdo and a haulout area called Liancourt Rocks. The total distribution area was approximated as 25,692 km^2.

The densities were calculated as:

$$\text{Density}_{(\text{Oct – May})} = 4{,}592_{(\text{abundance})} \times 0.75_{(\text{haulout factor})} / 25{,}692\ \text{km}^2{}_{(\text{area})} = 0.1340 \text{ seals per km}^2$$

$$\text{Density}_{(\text{Jun – Sep})} = 4{,}592_{(\text{abundance})} \times 0.25_{(\text{haulout factor})} / 25{,}692\ \text{km}^2{}_{(\text{area})} = 0.0447 \text{ seals per km}^2$$

Table 2.43-1. Summary of Density Values for Spotted Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.1340	0.0447	0.1340	0.1340
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

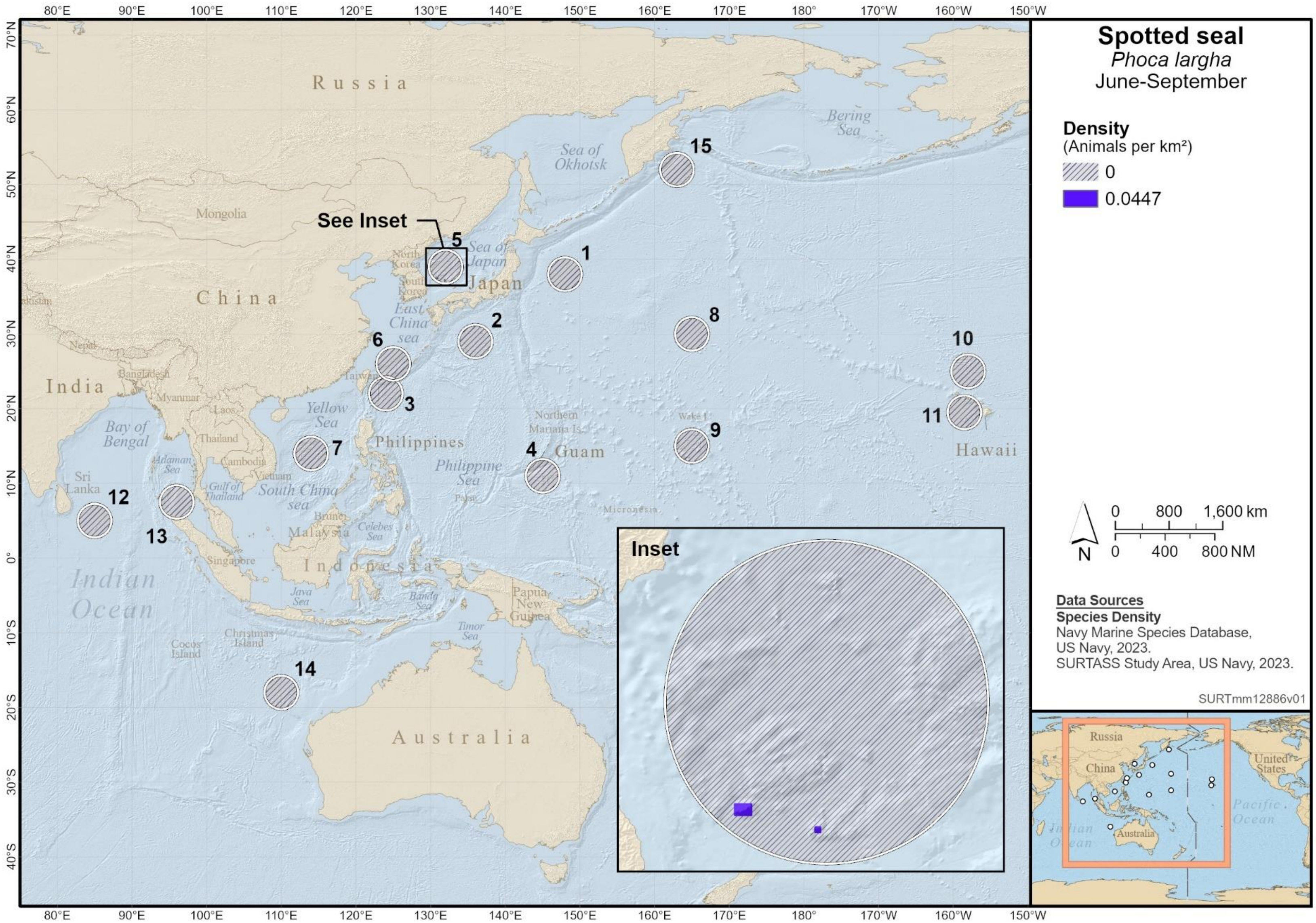


Figure 2.43-1. June Through September Distribution of Spotted Seal in the SURTASS LFA Study Area

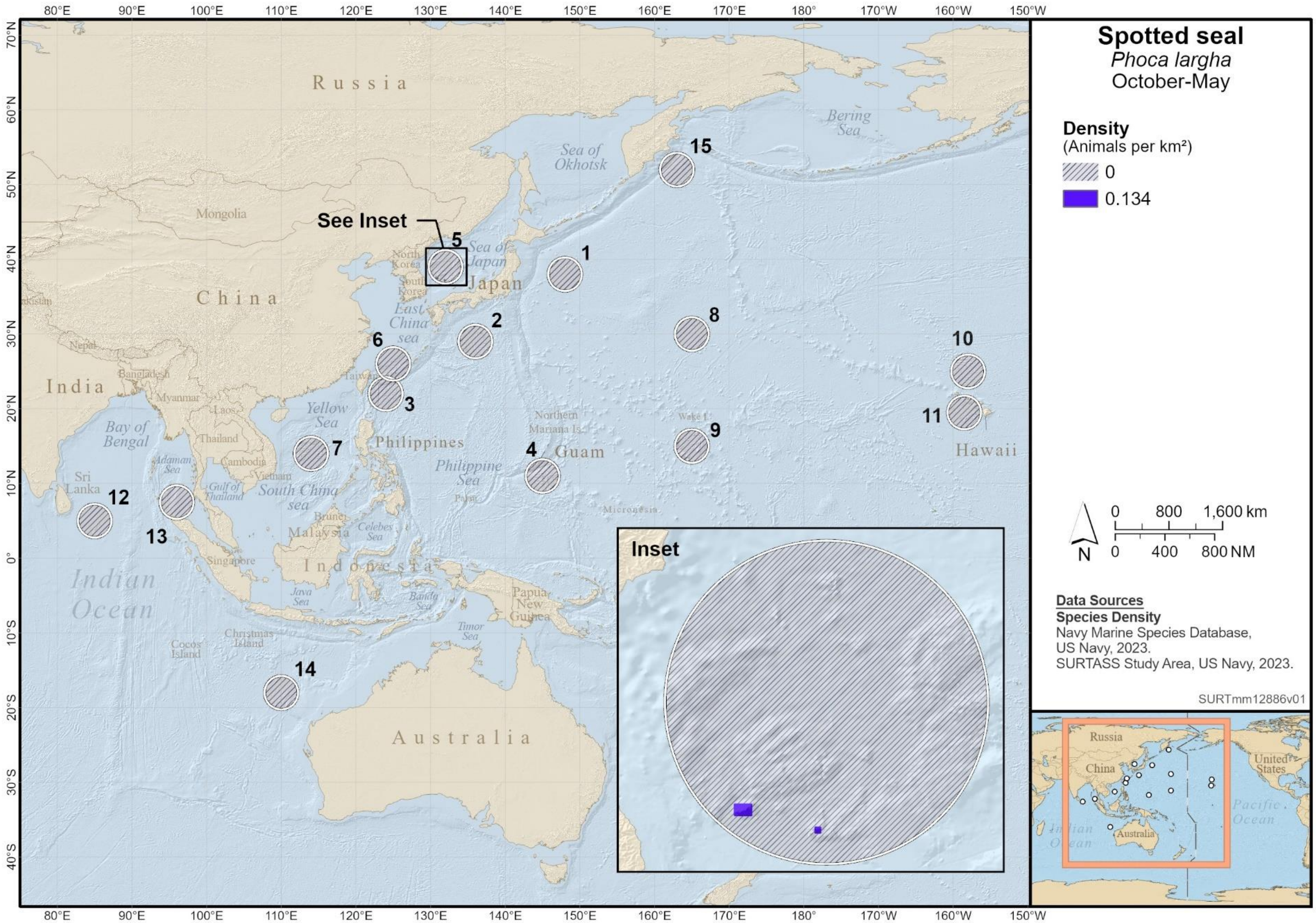


Figure 2.43-2. October Through May Distribution of Spotted Seal in the SURTASS LFA Study Area

2.44 *HISTRIOPHOCA FASCIATA*, RIBBON SEAL

The ribbon seal is not an ESA-listed species. It is considered a species of Least Concern by the IUCN Red List of Threatened Species (Lowry, 2016).

Ribbon seals are distributed throughout the northern North Pacific Ocean, including the Bering Sea, Chukchi Sea, and the Sea of Okhotsk (Boveng et al., 2013). The southernmost extent of their range is Hokkaido, Japan, and the northern Sea of Japan. Ribbon seals are strongly ice-associated seals, hauling out almost exclusively on sea ice and are common at the sea ice front in the Bering Sea. They are rarely seen on shorefast ice or hauled out on land. During the breeding and pupping season from March – June the seals are hauled out sometimes continuously between the sea ice front and about 150 km inland from the front and north of site 15 (Boveng et al., 2013). During the foraging season from July – February, the seals distribute throughout the Bering Sea and Aleutian Islands and remain pelagic.

Boveng et al. (2013) reported 139,000 ribbon seals in the western Bering Sea based on surveys from 1987 conducted by researchers from Russia. Ribbon seals are difficult to count because they are widely distributed and only haulout on sea ice, making comprehensive abundance estimates challenging (Boveng & Lowry, 2018).

Ribbon seals are only expected to occur in SURTASS modeling site 15 (Northeast of Japan). A zero density is assumed for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.44-1, following the modeling site descriptions. Figure 2.44-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.44.1 MODELING SITE 15 – NORTHEAST OF JAPAN

A density for ribbon seals at site 15 during the non-breeding season was calculated using the abundance estimate for seals in the western Bering Sea of 139,000 reported by Boveng et al. (2013). Ninety percent of the seals are assumed to be in the water (10 percent hauled out), and the distribution area is estimated as a single stratum defined by a 1,000 km buffer around site 15 bounded by the Kamchatka Peninsula and Kuril Islands to the west and the range boundary defined by Boveng et al. (2013) to the south. The area is approximately 1,435,459 km^2.

$$\text{Density}_{(\text{Jul -Feb})} = 139{,}000_{(\text{abundance})} \text{ x } 0.90_{(\text{haulout factor})} \,/\, 1{,}435{,}459 \text{ km}^2{}_{(\text{area})} = 0.0871 \text{ seals per km}^2$$

Table 2.44-1. Summary of Density Values for Ribbon Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0.0871	0.0871	0.0871

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

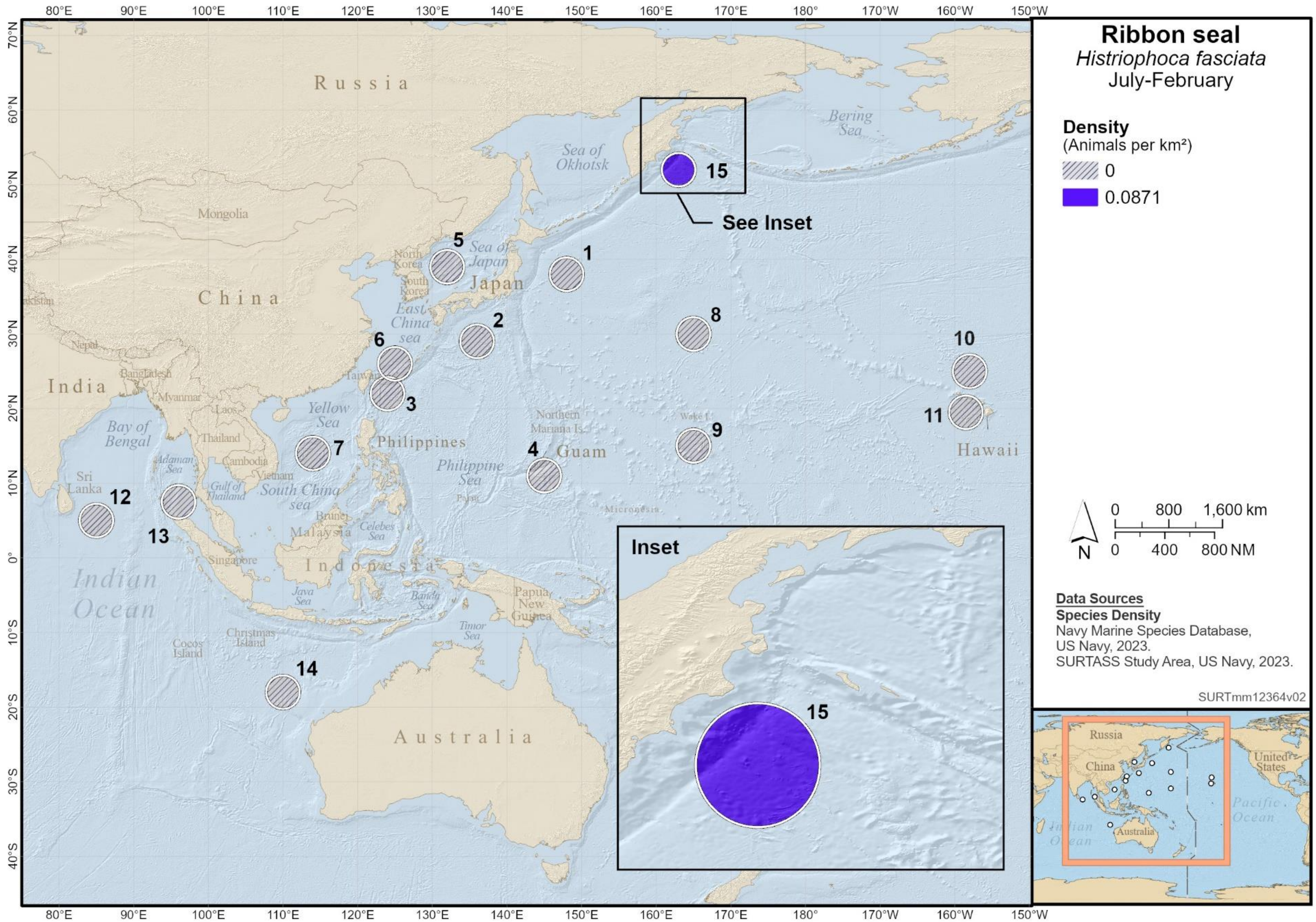


Figure 2.44-1. July Through February Distribution of Ribbon Seal in the SURTASS LFA Study Area

2.45 *Dugong dugon*, Dugong

The dugong is listed as endangered under the ESA and is considered a Vulnerable species on the IUCN Red List of Threatened Species (Marsh & Sobtzick, 2019).

Dugongs are a tropical sirenian species found in shallow, coastal waters where seagrasses are prevalent. They prefer protected bays and channels but can occur farther from shore over the shelf up to depths of 40 m in protected areas, such as the leeward sides of islands or peninsulas (Jefferson et al., 2015).

The largest populations of dugongs in southeast Asia occur in Indonesian waters and off southeast Vietnam and Malaysia, as well as along the coast of Thailand in the Andaman Sea. Their historical range extends north through the Philippines and into coastal waters of Taiwan (Hines et al., 2012; Marsh et al., 2002); however, dugongs are largely extirpated from the northern parts of their range likely due to a combination of factors including habitat loss, increased boating activity, bycatch, hunting, and pollution in coastal waters due to runoff (Marsh et al., 2002; Panyawai & Prathep, 2022). Based on the likely extirpations, limited data on occurrence, and their shallow, coastal habitat, dugongs are not expected to occur at modeling sites 3, 6, 7, 12, or 14.

Dugongs are located along the west coast of Thailand and around Andaman and Nicobar Islands in the Andaman Sea (Panyawai & Prathep, 2022). Along the west coast of Thailand, Panyawai and Prathep (2022) estimated an abundance of 191 dugongs. Suitable habitat extends north of Thailand off the coast of Myanmar; however, only anecdotal reports exist and far fewer are expected to occur there (Panyawai & Prathep, 2022). The abundance estimate of 191 is consistent with an older estimate by Hines et al. (2005) of about 200 animals in the Andaman Islands and a minimum population of 123 animals over the area surveyed. Marsh et al. (2002) reported 100 dugongs in the Andaman Islands citing sources from 1999 and 2000, and Hines et al. (2012) reported the occurrence of 40 dugongs around the Andaman and Nicobar islands based on essentially anecdotal surveys of local fishers and dive boat operators from 1994-1995.

Dugongs are typically encountered in groups of two, typically a mother-calf pair, or small groups of 5 to 15, but single individuals are common and aggregations of over 100 have been reported (not necessarily in the Study Area) (Hines et al., 2012; Jefferson et al., 2015; Panyawai & Prathep, 2022).

Given their limited distribution, dugongs are only expected to occur near the 250 km buffer of SURTASS modeling site 13 (Andaman Sea). A zero density is assumed for all other SURTASS modeling sites. A summary of the density values incorporated into the NMSDD for each of the modeling sites is provided in Table 2.45-1, following the modeling site descriptions. Figure 2.45-1, which shows density estimates for all the modeling sites within the SURTASS LFA Study Area, follows the table.

2.45.1 Modeling Site 13 – Andaman Sea

Two densities at the perimeter of the 250 km butter at site 13 were calculated for the dugong. Along the west coast of Thailand, an abundance of 191 dugongs was distributed over an area extending from shore to the 40 m depth contour along the entire Thai coastline.

The densities were calculated as:

$$\text{Density}_{(\text{annual})} = 191_{(\text{abundance})} / 29{,}244\ \text{km}^2{}_{(\text{area})} = 0.0065 \text{ dugongs per km}^2$$

Along the leeward (west) coast of the Andaman and Nicobar islands an abundance of 100 dugongs was distributed from shore to the 40 m depth contour.

$$\text{Density}_{(annual)} = 100_{(abundance)} / 12{,}507\ \text{km}^2_{(area)} = 0.0080 \text{ dugongs per km}^2$$

Table 2.45-1. Summary of Density Values for the Dugong in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	S	S	S	S
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatially explicit with multiple density strata. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

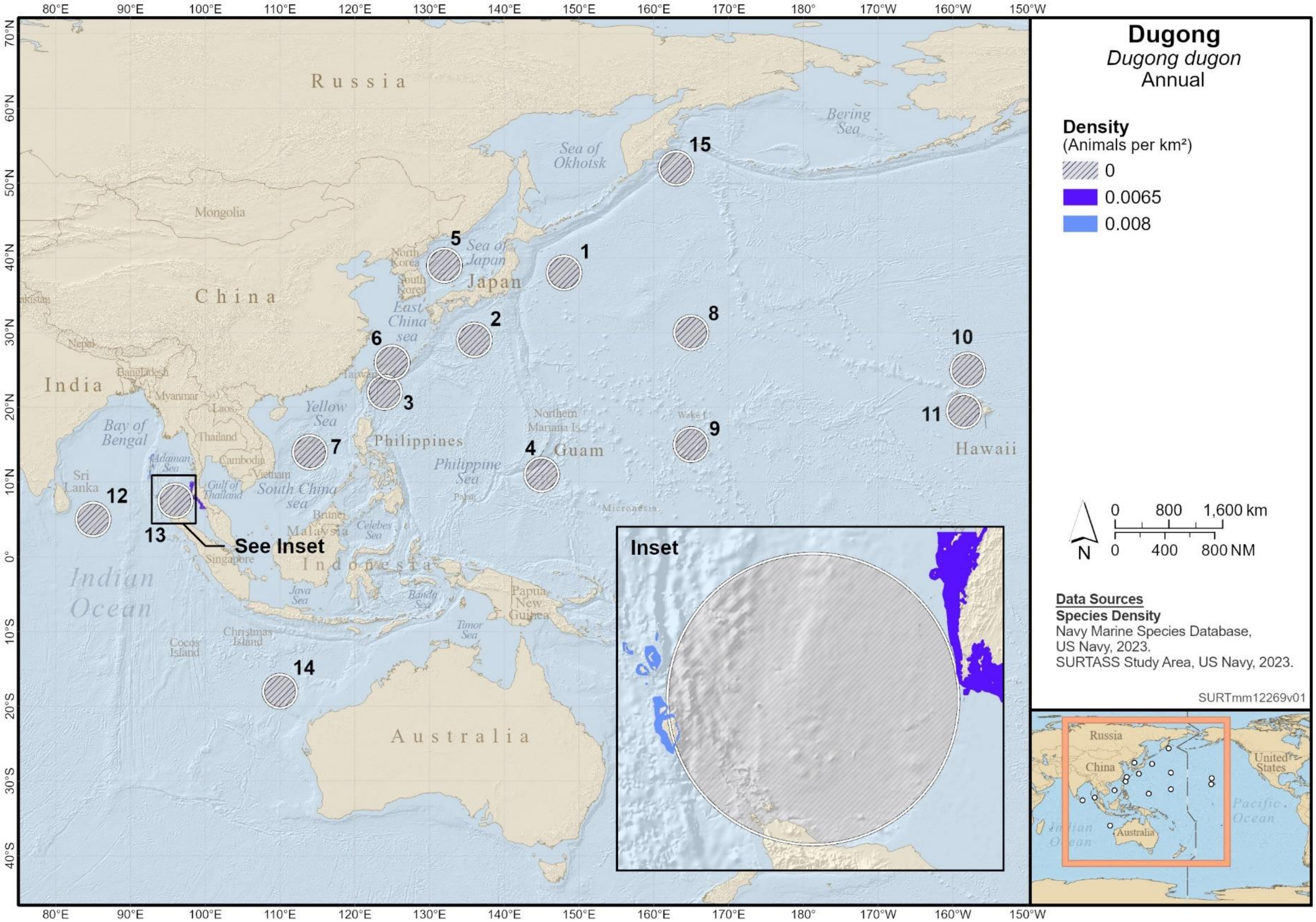


Figure 2.45-1. Annual Distribution of Dugong in the SURTASS LFA Study Area

3 CONCLUSION

The density estimates provided in this report represent the current best available data that were used in modeling the effects of the SURTASS LFA sound sources on marine species. These data have been updated since the Navy's previous analyses (U.S. Department of the Navy, 2019), but still represent a snapshot in time, so that, as science progresses and better estimates become available, the NMSDD will be updated for use in future Navy modeling efforts. As noted throughout this report, survey data are extremely limited in the South China Sea and Indian Ocean (Kaschner et al., 2012), and design- or model-based density estimates for modeling sites 7 (South China Sea), 12 (Offshore Sri Lanka), 13 (Andaman Sea), and 14 (Northwest of Australia) were not available for most species. For these sites where survey data are lacking, density data derived from the Kaschner et al. (2006) RES models were the only quantitative estimates available. For all the other modeling sites, substantial improvements were made to the density estimates since the Navy's previous analyses, as both new and updated design- and model-based estimates have become available, as summarized in Section 1.2, (*Main Sources of Density Data*) of this report.

Scientists from NMFS and the Navy have already identified new methods and projects that will improve and expand the data in the NMSDD for the next time it is called upon as a data source. The goal is to arrive at the most accurate density estimates for every species from the data available at that time. This may be very difficult to achieve for some species, and techniques other than the preferred line-transect sampling to acquire supporting data are necessary. Even when accurate and representative density estimates are achieved, they need to be maintained and updated through regular species monitoring, because the size of marine species populations changes over time and their distributions change with the large-scale dynamics in the world's oceans. It is an ambitious endeavor to maintain accurate information on all the marine species included in the NMSDD; to achieve this goal, the Navy has partnered with marine species scientists at NMFS, universities, and other institutions to pool resources, data, and expertise. The main goal of this collaborative effort is to ensure the Navy uses the most robust marine species density estimates to support their environmental planning efforts.

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