

Seabirds and Marine Mammals on the NMFS Juvenile Rockfish – Ecosystem Survey: 2016 Data Report

William J. Sydeman, PI
Michael P. Force, Jarrod A. Santora, Observers
Marcel Losekoot, Analyst



Farallon Institute,
101 H Street, Suite Q,
Petaluma, CA 94952
www.faralloninstitute.org

20th December 2016

Introduction

Seabird and marine mammal observations are an integral part of the NMFS Juvenile Rockfish – Ecosystem Survey (JRES) and provide data valuable to several issues: 1) measurements provide an upper trophic level perspective to complement the oceanographic and lower- and mid-trophic level data collected by NMFS; 2) estimates of seabird and marine mammal abundance, diversity, and distribution may contribute to various aspects of ecosystem (e.g., marine spatial planning) and fisheries management considerations; and 3) by extending our existing time series, measuring annual variation in the seabird community contributes to understanding the effects of climate variability and change on the California Current ecosystem. This data report summarizes the at-sea survey observations made during the 2016 NMFS JRES cruise and presents basic distribution and abundance estimates for seabirds and marine mammals. A total of 3473 km (1042 km²) of ocean habitat was surveyed over a period of 37 days in 2016.

Methods

At-sea observations are made continuously during daylight ship transits between trawl and hydrographic stations. The observer, located on the bridge approximately 15 meters above sea level, uses hand-held binoculars to assist in the identification and enumeration of birds and

mammals. The observer records all birds seen within a 300-meter strip transect to one side of the vessel while the ship is underway at > 5 knots. Marine mammals are surveyed out to the horizon. Observations are entered into a portable computer using the dedicated application “Dlog2”; the ship’s position is automatically recorded every 50 seconds using an external GPS. Each observation includes the species seen, the number of individuals observed, and their behavior (e.g., flying or sitting on the water for birds). At-sea observation data are post-processed using standardized species codes, validation of positioning data, and binning of observations into along-track sections 3 km in length. The data are then integrated into a survey database containing data from May 1996 to the present. These data are used to derive the summary statistics reported herein.

Species data are presented for both the core region and the extended region surveyed since 2004 (see Sakuma et al. 2006 for a discussion of changes in survey design at that time). Taxa excluded from this summary include fish, terrestrial birds, and most shorebirds with the exception of phalaropes which are largely pelagic. Species density is calculated as the total number of individuals observed per species divided by the area (km²) surveyed. Mammal abundance is estimated as the number of individuals observed by the distance surveyed (100 km). The distribution of seabirds and mammals is illustrated by plotting abundance at each bin’s center position. Abundance is represented by a circle whose diameter is scaled using the Jenks method in ArcGIS version 9.3.

Results

A summary of survey effort is shown in Table 1. The areas surveyed and transects are shown in Figures 1 and 2. A summary of species observations and density is shown in Tables 2 (seabirds) and 3 (mammals). Spatial distribution maps for seabird density (all species) and mammal encounter rate (all species) are shown in Appendix 1. A detailed species list is provided in Appendix 2.

Table 1. Summary of survey effort, seabird and mammal community statistics.

Annual Survey Summary	Core region	Extended region	Total
Survey Vessel	-	-	R/V Laskar
Start Date	4/27/2016	4/27/2016	4/27/2016
End Date	6/7/2016	6/7/2016	6/7/2016
Survey Days	32	7	37
Distance Surveyed (km)	2741	732	3473
Area Surveyed (birds; km ²)	822	219	1042
Number of Bird Species Obs.	49	32	50
Overall Bird Density (per km ²)	16.92	34.26	20.57
Total Birds Observed	13909	7519	21428
Number of Mammal Species	19	19	25
Overall Mammal Encounter Rate (per 100 km surveyed)	132.1	278.1	162.9
Total Mammals Observed	3621	2035	5656

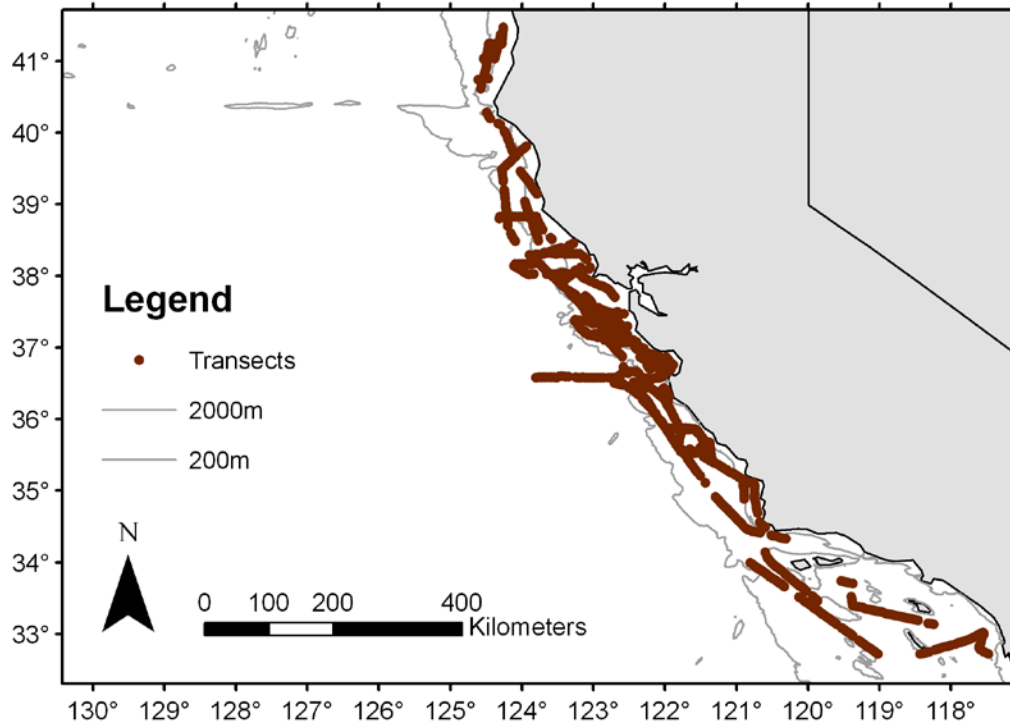


Figure 1. 2016 survey transects for the full region.

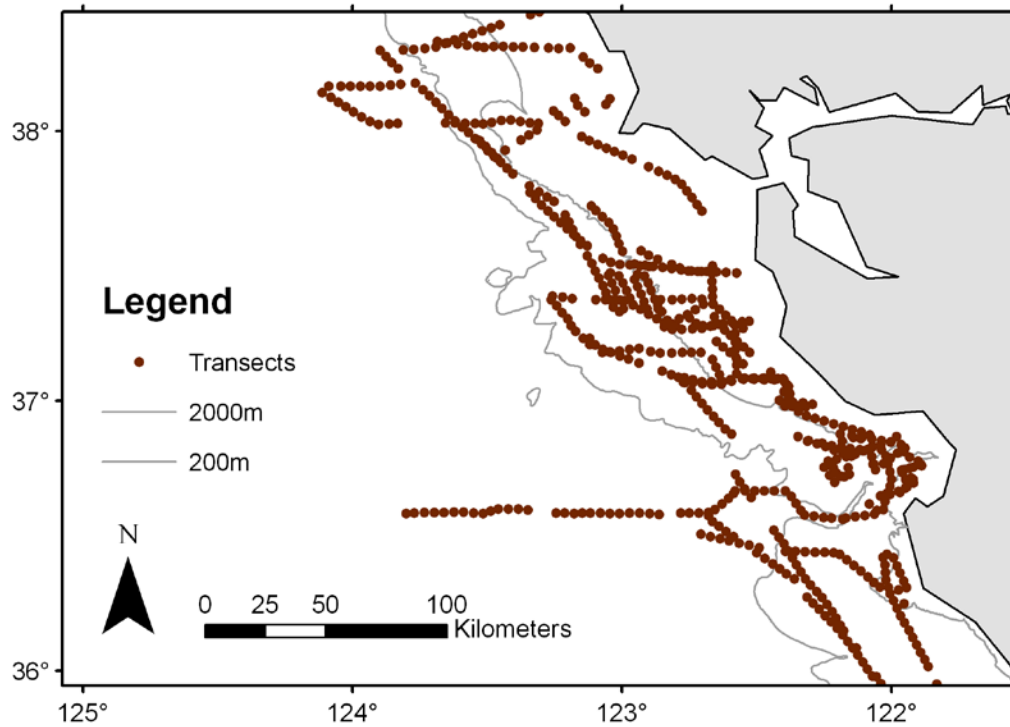


Figure 2. 2016 survey transects for the core region.

Table 2. Bird survey observations, stratified by region and species. Cell values represent the total number of individuals seen / number of species sightings / average density (birds per km²).

Common Name	Scientific Name	Core Region	Extended	Total
American White Pelican	<i>Pelecanus erythrorhynchos</i>			
Ancient Murrelet	<i>Synthliboramphus antiquus</i>			
Arctic Loon	<i>Gavia arctica</i>			
Arctic Tern	<i>Sterna paradisaea</i>		13 / 1 / 0.06	13 / 1 / 0.01
Ashy Storm-Petrel	<i>Oceanodroma homochroa</i>	2 / 2 / 0		2 / 2 / 0
Black Guillemot	<i>Cephus grylle</i>	1 / 1 / 0		1 / 1 / 0
Black Scoter	<i>Melanitta nigra</i>			
Black Storm-Petrel	<i>Oceanodroma melania</i>		2 / 2 / 0.01	2 / 2 / 0
Black-Footed Albatross	<i>Phoebastria nigripes</i>	314 / 253 / 0.38	15 / 12 / 0.07	329 / 265 / 0.32
Black-Legged Kittiwake	<i>Rissa tridactyla</i>			
Black-Vented Shearwater	<i>Puffinus opisthomelas</i>			
Bonaparte's Gull	<i>Larus philadelphia</i>	25 / 12 / 0.03		25 / 12 / 0.02
Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>	16 / 10 / 0.02		16 / 10 / 0.02
Brant	<i>Branta bernicla</i>	9 / 1 / 0.01		9 / 1 / 0.01
Brown Booby	<i>Sula leucogaster</i>	3 / 3 / 0	1 / 1 / 0	4 / 4 / 0
Brown Noddy	<i>Anous stolidus</i>			
Brown Pelican	<i>Pelecanus occidentalis</i>	1 / 1 / 0	3 / 2 / 0.01	4 / 3 / 0
Buller's Shearwater	<i>Puffinus bulleri</i>			
California Gull	<i>Larus californicus</i>	19 / 18 / 0.02	6 / 5 / 0.03	25 / 23 / 0.02
Caspian Tern	<i>Sterna caspia</i>	1 / 1 / 0		1 / 1 / 0
Cassin's Auklet	<i>Ptychoramphus aleuticus</i>	526 / 71 / 0.64	33 / 14 / 0.15	559 / 85 / 0.54
Clark's Grebe	<i>Aechmophorus clarkii</i>			
Common Loon	<i>Gavia immer</i>	4 / 3 / 0	1 / 1 / 0	5 / 4 / 0
Common Murre	<i>Uria aalge</i>	3996 / 1203 / 4.86	205 / 53 / 0.93	4201 / 1256 / 4.03
Common Tern	<i>Sterna hirundo</i>			

Common Name	Scientific Name	Core Region	Extended	Total
Cook's Petrel	<i>Pterodroma cookii</i>	7 / 7 / 0.01	4 / 4 / 0.02	11 / 11 / 0.01
Craveri's Murrelet	<i>Synthliboramphus craveri</i>			
Dark Shearwater	(species group)			
Dark-Rumped Petrel	<i>Pterodroma phaeopygia sandwichensis</i>			
Double-Crested Cormorant	<i>Phalacrocorax auritus</i>	2 / 2 / 0		2 / 2 / 0
Eared Grebe	<i>Podiceps nigricollis</i>		2 / 1 / 0.01	2 / 1 / 0
Elegant Tern	<i>Sterna elegans</i>	26 / 4 / 0.03	64 / 27 / 0.29	90 / 31 / 0.09
Flesh-Footed Shearwater	<i>Puffinus carneipes</i>	1 / 1 / 0		1 / 1 / 0
Fork-Tailed Storm-Petrel	<i>Oceanodroma furcata</i>	2 / 2 / 0		2 / 2 / 0
Forster's Tern	<i>Sterna forsteri</i>	23 / 2 / 0.03		23 / 2 / 0.02
Franklin's Gull	<i>Larus pipixcan</i>			
Glaucous Gull	<i>Larus hyperboreus</i>			
Glaucous-Winged Gull	<i>Larus glaucescens</i>	1 / 1 / 0		1 / 1 / 0
Hawaiian Petrel	<i>Pterodroma sandwichensis</i>			
Heermann's Gull	<i>Larus heermanni</i>	1 / 1 / 0		1 / 1 / 0
Herring Gull	<i>Larus argentatus</i>	3 / 3 / 0	1 / 1 / 0	4 / 4 / 0
Horned Puffin	<i>Fratercula corniculata</i>			
Hybrid Gull	(species group)			
Juan Fernandez Petrel	<i>Pterodroma externa</i>			
Kelp Gull	<i>Larus dominicanus</i>			
Kermadec Petrel	<i>Pterodroma neglecta</i>			
Laughing Gull	<i>Larus atricilla</i>			
Laysan Albatross	<i>Phoebastria immutabilis</i>	2 / 2 / 0	4 / 4 / 0.02	6 / 6 / 0.01
Leach's Storm-Petrel	<i>Oceanodroma leucorhoa</i>	5 / 5 / 0.01		5 / 5 / 0
Least Storm-Petrel	<i>Oceanodroma microsoma</i>		1 / 1 / 0	1 / 1 / 0
Least Tern	<i>Sterna antillarum</i>		1 / 1 / 0	1 / 1 / 0
Long-Tailed Jaeger	<i>Stercorarius longicaudus</i>	1 / 1 / 0		1 / 1 / 0
Marbled Murrelet	<i>Brachyramphus marmoratus</i>			

Common Name	Scientific Name	Core Region	Extended	Total
Mew Gull	<i>Larus canus</i>			
Mottled Petrel	<i>Pterodroma inexpectata</i>			
Murphy's Petrel	<i>Pterodroma ultima</i>	1 / 1 / 0		1 / 1 / 0
Northern Fulmar	<i>Fulmarus glacialis</i>	26 / 26 / 0.03	7 / 7 / 0.03	33 / 33 / 0.03
Osprey	<i>Pandion haliaetus</i>			
Pacific Loon	<i>Gavia pacifica</i>	18 / 13 / 0.02	30 / 15 / 0.14	48 / 28 / 0.05
Parakeet Auklet	<i>Aethia psittacula</i>			
Parasitic Jaeger	<i>Stercorarius parasiticus</i>	1 / 1 / 0		1 / 1 / 0
Parkinson's Petrel	<i>Procellaria parkinsoni</i>			
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	1 / 1 / 0		1 / 1 / 0
Peregrine Falcon	<i>Falco peregrinus</i>	1 / 1 / 0		1 / 1 / 0
Pigeon Guillemot	<i>Cephus columba</i>	13 / 10 / 0.02	6 / 1 / 0.03	19 / 11 / 0.02
Pink-Footed Shearwater	<i>Puffinus creatopus</i>	246 / 157 / 0.3	414 / 96 / 1.89	660 / 253 / 0.63
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	8 / 8 / 0.01	1 / 1 / 0	9 / 9 / 0.01
Red Phalarope	<i>Phalaropus fulicaria</i>	58 / 4 / 0.07		58 / 4 / 0.06
Red-Billed Tropicbird	<i>Phaethon aethereus</i>		1 / 1 / 0	1 / 1 / 0
Red-Footed Booby	<i>Sula sula</i>			
Red-Necked Grebe	<i>Podiceps grisegena</i>			
Red-Necked Phalarope	<i>Phalaropus lobatus</i>	2259 / 54 / 2.75	772 / 22 / 3.52	3031 / 76 / 2.91
Red-Tailed Tropicbird	<i>Pheathon rubricauda</i>			
Red-Throated Loon	<i>Gavia stellata</i>			
Rhinoceros Auklet	<i>Cerorhinca monocerata</i>	51 / 35 / 0.06	6 / 4 / 0.03	57 / 39 / 0.05
Ring-Billed Gull	<i>Larus delawarensis</i>			
Royal Tern	<i>Sterna maxima</i>			
Ruddy Turnstone	<i>Arenaria interpres</i>			
Sabine's Gull	<i>Larus sabini</i>	132 / 12 / 0.16	17 / 2 / 0.08	149 / 14 / 0.14
Scripps's Murrelet	<i>Synthliboramphus scrippsi</i>	10 / 6 / 0.01	13 / 5 / 0.06	23 / 11 / 0.02

Common Name	Scientific Name	Core Region	Extended	Total
Short-Tailed / Slender-Billed Shearwater	<i>Puffinus tenuirostris</i>	1 / 1 / 0		1 / 1 / 0
Short-Tailed Albatross	<i>Phoebastria albatrus</i>			
Solander's Petrel	<i>Pterodroma solandri</i>			
Sooty Shearwater	<i>Puffinus griseus</i>	5558 / 546 / 6.76	5830 / 289 / 26.56	11388 / 835 / 10.93
South Polar Skua	<i>Stercorarius maccormicki</i>	1 / 1 / 0	2 / 2 / 0.01	3 / 3 / 0
Stejneger's Petrel	<i>Pterodroma longirostris</i>			
Surf Scoter	<i>Melanitta perspicillata</i>			
Thayer's Gull	<i>Larus thayeri</i>			
Tufted Puffin	<i>Fratercula cirrhata</i>	12 / 11 / 0.01		12 / 11 / 0.01
Unidentified Albatross	(species group)	1 / 1 / 0	3 / 2 / 0.01	4 / 3 / 0
Unidentified Auklet	(species group)			
Unidentified Cormorant	(species group)			
Unidentified Duck	(species group)			
Unidentified Grebe	(species group)			
Unidentified Gull	(species group)	15 / 14 / 0.02	1 / 1 / 0	16 / 15 / 0.02
Unidentified Jaeger	(species group)			
Unidentified Large Alcid	(species group)			
Unidentified Loon	(species group)	1 / 1 / 0		1 / 1 / 0
Unidentified Murre	(species group)	3 / 2 / 0		3 / 2 / 0
Unidentified Petrel	(species group)			
Unidentified Phalarope	(species group)			
Unidentified Procellarid	(species group)			
Unidentified Shearwater	(species group)	1 / 1 / 0	1 / 1 / 0	2 / 2 / 0
Unidentified Skua	(species group)			
Unidentified Small Alcid	(species group)			
Unidentified Storm-Petrel	(species group)			

Common Name	Scientific Name	Core Region	Extended	Total
Unidentified Tern	(species group)			
Unidentified Tropicbird	(species group)			
Wedge-Rumped Storm-Petrel	<i>Oceanodroma tethys</i>			
Wedge-Tailed Shearwater	<i>Puffinus pacificus</i>			
Western Grebe	<i>Aechmophorus occidentalis</i>			
Western Gull	<i>Larus occidentalis</i>	500 / 380 / 0.61	59 / 52 / 0.27	559 / 432 / 0.54
Wilson's Storm-Petrel	<i>Oceanites oceanicus</i>			
Xantus's / Craveri's Murrelet	(species group)			
Xantus's Murrelet	<i>Synthliboramphus hypoleucus</i>			

Table 3. Mammal survey observation summary, broken down by survey region and by species. Cell values represent the total number of species individuals / number of species sightings / average species encounter rate (individuals per 100 km).

Common Name	Scientific Name	Core Region	Extended	Total
Baird's Beaked Whale	<i>Berardius bairdii</i>		8 / 1 / 0.04	8 / 1 / 0.01
Blue Whale	<i>Balaenoptera musculus</i>	61 / 28 / 0.07	2 / 1 / 0.01	63 / 29 / 0.06
Bottlenose Dolphin	<i>Tursiops truncatus</i>			
California Sea Lion	<i>Zalophus californianus</i>	291 / 47 / 0.35	260 / 29 / 1.18	551 / 76 / 0.53
Common Dolphin	<i>Delphinus delphis</i>			
Cuvier's Beaked Whale	<i>Ziphius cavirostris</i>		1 / 1 / 0	1 / 1 / 0
Dall's Porpoise	<i>Phocoenoides dalli</i>	33 / 7 / 0.04	2 / 1 / 0.01	35 / 8 / 0.03
False Killer Whale	<i>Pseudorca crassidens</i>			
Fin Whale	<i>Balaenoptera physalus</i>	48 / 29 / 0.06	22 / 14 / 0.1	70 / 43 / 0.07
Gray Whale	<i>Eschrichtius robustus</i>			
Green Sea Turtle	<i>Chelonia mydas</i>			
Guadalupe Fur Seal	<i>Arctocephalus townsendi</i>			
Harbor Porpoise	<i>Phocoena phocoena</i>	1 / 1 / 0	1 / 1 / 0	2 / 2 / 0
Harbor Seal	<i>Phoca vitulina</i>			
Humpback Whale	<i>Megaptera novaeangliae</i>	247 / 144 / 0.3	43 / 19 / 0.2	290 / 163 / 0.28
Killer Whale	<i>Orcinus orca</i>	15 / 3 / 0.02		15 / 3 / 0.01
Long-beaked Common Dolphin	<i>Delphinus capensis</i>		22 / 3 / 0.1	22 / 3 / 0.02
Minke Whale	<i>Balaenoptera acutorostrata</i>		1 / 1 / 0	1 / 1 / 0
Northern Elephant Seal	<i>Mirounga angustirostris</i>	5 / 5 / 0.01	3 / 3 / 0.01	8 / 8 / 0.01
Northern Fur Seal	<i>Callorhinus ursinus</i>	2 / 2 / 0		2 / 2 / 0
Northern Right Whale Dolphin	<i>Lissodelphis borealis</i>	1928 / 12 / 2.34	200 / 3 / 0.91	2128 / 15 / 2.04
Pacific White-Sided Dolphin	<i>Lagenorhynchus obliquidens</i>	926 / 49 / 1.13	126 / 11 / 0.57	1052 / 60 / 1.01

Common Name	Scientific Name	Core Region	Extended	Total
Pilot Whale	<i>Globicephala spp.</i>			
Pygmy Sperm Whale	<i>Kogia breviceps</i>			
Ridley Sea Turtle	<i>Lepidochelys olivacea</i>			
Right Whale dolphin	<i>Lissodelphis spp</i>	14 / 2 / 0.02		14 / 2 / 0.01
Risso's Dolphin	<i>Grampus griseus</i>	19 / 3 / 0.02	15 / 1 / 0.07	34 / 4 / 0.03
Sea Otter	<i>Enhydra lutris</i>	1 / 1 / 0	1 / 1 / 0	2 / 2 / 0
Sei Whale	<i>Balaenoptera borealis</i>			
Short-Beaked Common Dolphin	<i>Delphinus delphis</i>		1308 / 15 / 5.96	1308 / 15 / 1.26
Short-Finned Pilot Whale	<i>Globicephala macrorhynchus</i>			
Sperm Whale	<i>Physeter macrocephalus</i>	4 / 2 / 0	2 / 1 / 0.01	6 / 3 / 0.01
Steller Sea Lion	<i>Eumetopias jubatus</i>			
Striped Dolphin	<i>Stenella coeruleoalba</i>		12 / 1 / 0.05	12 / 1 / 0.01
Unidentified Baleinoptera	(species group)	1 / 1 / 0		1 / 1 / 0
Unidentified Beaked Whale	(species group)			
Unidentified Cetacean	(species group)			
Unidentified Dolphin	(species group)	4 / 1 / 0		4 / 1 / 0
Unidentified Large Whale	(species group)			
Unidentified Pinniped	(species group)	2 / 2 / 0		2 / 2 / 0
Unidentified Sea Lion	(species group)			
Unidentified Seal	(species group)			
Unidentified Whale	(species group)	19 / 15 / 0.02	6 / 5 / 0.03	25 / 20 / 0.02

Appendix 1. Distribution maps

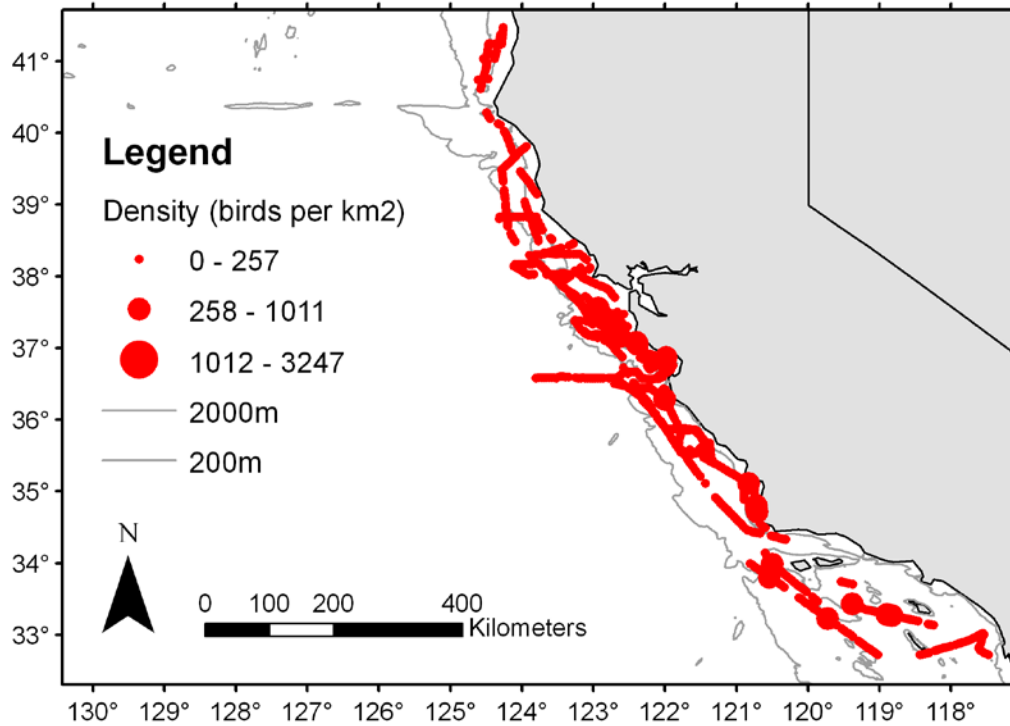


Figure 3. Bird distribution (all species pooled) in the full region.

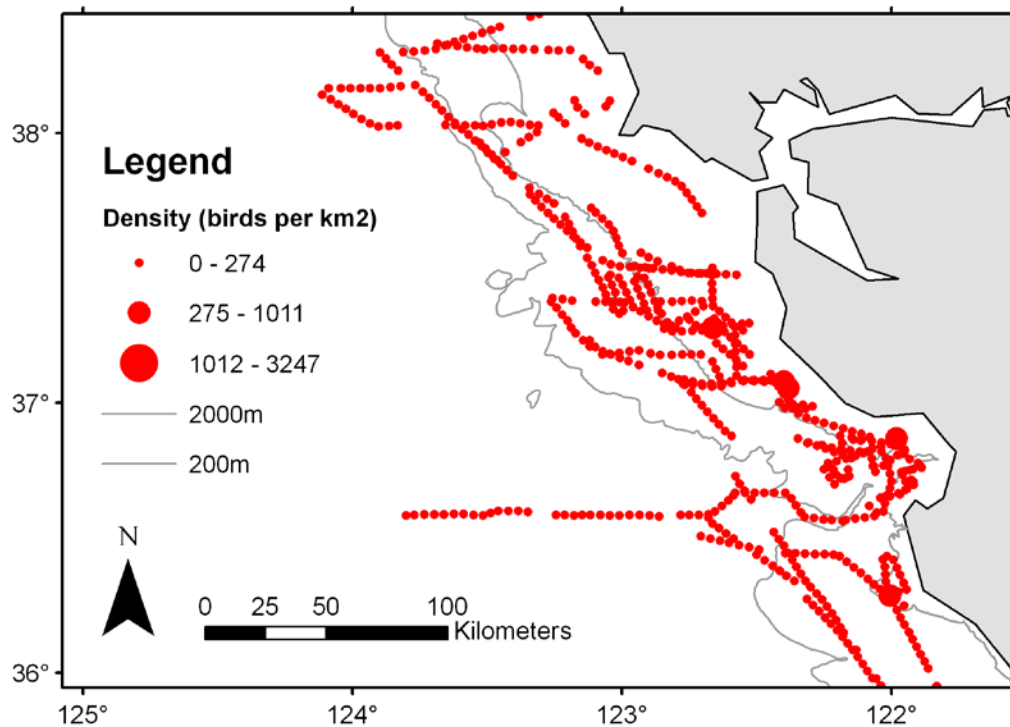


Figure 4. Bird distribution in the core region.

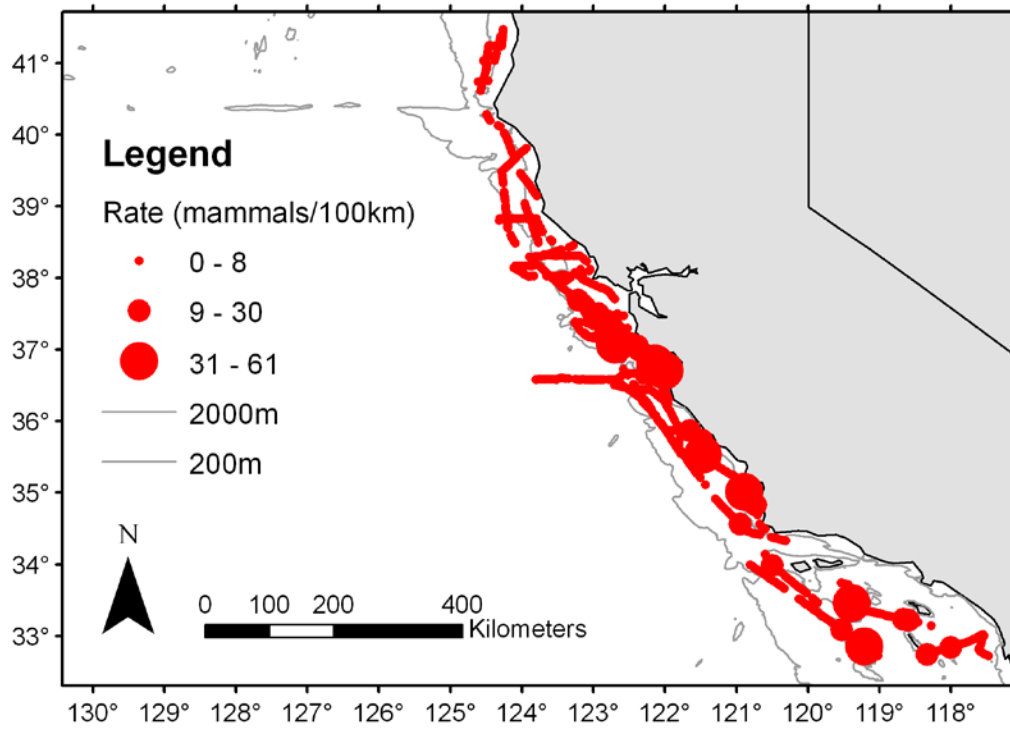


Figure 5. Mammal distribution in the full region.

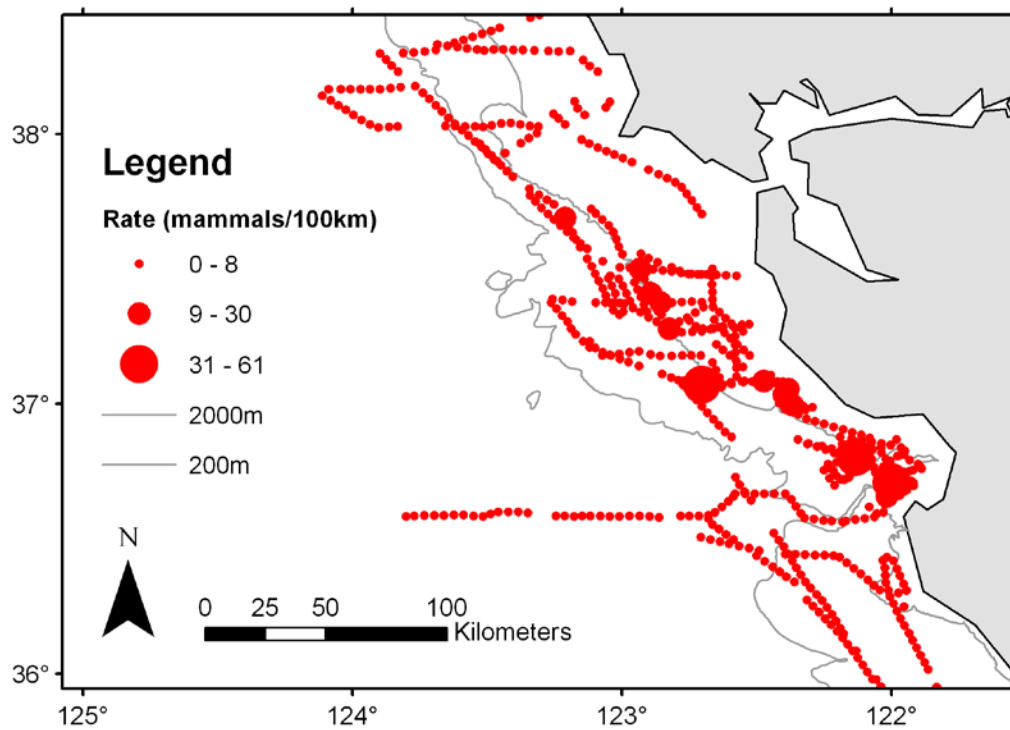


Figure 6. Mammal distribution in the core region.

Appendix 2. Species Lists

Data selection criteria

Table 4. The following criteria were applied to the survey database to select data for the summary.

Behavior codes included	All values
Species categories included	Birds, Mammals, Unidentified
Species categories excluded	Fish, Excluded Species List
Years	2016
Months	All months
Bin length	All bins > 0.1 km
Region	JRS core region and extended region
Seasons	All seasons

Excluded Species List

Table 5. The following species were excluded from the analysis.

Common Name	Scientific Name
American Coot	<i>Fulica americana</i>
Basking Shark	<i>Cetorhinus maximus</i>
Black Oystercatcher	<i>Haematopus bachmani</i>
Black Skimmer	<i>Rynchops niger</i>
Black Tern	<i>Chlidonias niger</i>
Black Turnstone	<i>Arenaria melanocephala</i>
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>
Blue Shark	<i>Prionace glauca</i>
Brewer's Sparrow	<i>Spizella breweri</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Bufflehead	<i>Bucephala albeola</i>
Eurasian Collared dove	<i>Streptopelia decaocto</i>
European Starling	<i>Sturnus vulgaris</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Ardea alba</i>
Green Heron	<i>Butorides virescens</i>
Hammerhead Shark	<i>Sphyrna spp.</i>
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>
Least Sandpiper	<i>Calidris minutilla</i>
Leatherback Turtle	<i>Dermochelys coriacea</i>
Long-billed Curlew	<i>Numenius americanus</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>

Common Name	Scientific Name
Mako Shark	<i>Isurus oxyrinchus</i>
Mallard Duck	<i>Anas platyrhynchos</i>
Marbled Godwit	<i>Limosa fedoa</i>
Mola Mola	<i>Mola mola</i>
Mourning Dove	<i>Zenaida macroura</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>
Sanderling	<i>Calidris alba</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Snow Goose	<i>Chen caerulescens</i>
Snowy Egret	<i>Egretta thula</i>
Townsend's Warbler	<i>Setophaga townsendi</i>
Unidentified Bird	(species group)
Unidentified Crab	(species group)
Unidentified Dowitcher	(species group)
Unidentified Fish	(species group)
Unidentified Goose	(species group)
Unidentified Hummingbird	(species group)
Unidentified Mammal	(species group)
Unidentified Passerine	(species group)
Unidentified Shark	(species group)
Unidentified Shorebird	(species group)
Unidentified Turtle	(species group)
Wandering Tattler	<i>Tringa incana</i>
Western Sandpiper	<i>Calidris mauri</i>
Whimbrel	<i>Numenius phaeopus</i>
White-winged Scoter	<i>Melanitta fusca</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Wilson's Warbler	<i>Cardellina pusilla</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>