

Seabirds on the CalCOFI/CCE-LTER Surveys, 2012: Annual Data Report

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Introduction

Seabird studies are now an integral part of the California Cooperative Oceanic Fisheries Investigation (CalCOFI), California Current Ecosystem - Long-term Ecological Research (CCE-LTER), and Southern California Coastal Ocean Observing System (SCCOOS) programs. The seabird data is valuable for several reasons. First, information on seabird distribution and abundance provides an upper trophic level perspective which complements the lower trophic level plankton and hydrographic data collected by others. Second, estimates of seabird abundance, diversity and distribution contribute to understanding the spatial ecology of the Southern California Bight, a region characterized by substantial habitat heterogeneity and major oceanographic and biogeographic boundaries associated with Point Conception. Third, by extending our existing records (now 26 years and building; 1987-present) and coupling this information with long-term hydrographic and plankton data, seabird data contributes to understanding the effects of natural climate variability and anthropogenic effects on the southern sector of the California Current ecosystem. Anthropogenic impacts include habitat changes due to global warming, coastal development, and contaminants as well as biotic changes due to fishing and other extractive uses of marine life in the region.

This data report summarizes observations made during 3 seasonal CalCOFI/CCE-LTER cruises (winter, spring, and summer 2012). Herein, we present basic data on survey effort as well as summary information on seabird distribution and abundance. A total of 40 days of survey effort, covering 3,214 km (964 km²) of ocean habitat is summarized.

These data are made available for use by the scientific and marine management and policy communities. These data should not to be used by for-profit consulting firms or in litigation. We request that anyone planning to use these data contact the PI by email, wsydeman@comcast.net. Data quality is the responsibility of the data user, not the PI, Farallon Institute, CalCOFI/CCE-LTER or other project funders.

Methods

Observations of seabirds are made continuously during daylight ship transits between oceanographic and plankton sampling 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. The observer records all birds seen within a 300 meter strip transect to one side and front of the vessel while the ship is underway at > 5 knots. Observations are entered into a portable computer using the dedicated application "Dlog"; the ship's position is automatically recorded every 10 seconds from an external GPS. Each observation includes the species, the number of individuals observed, and their behavior (mostly flying or sitting). At-sea observation data are post-processed using standardized species codes, validation of positioning data, and binning of observations into along-track sections of 3 km in length. The data are then integrated into a survey database which includes data from May 1987 to the present. This data is used to derive summary statistics.

This report summarizes observations for all seasonal surveys conducted in 2012 and is limited to the region covered by CalCOFI lines 76 to 93; the seabird species summarized are listed in Table 2. Taxa excluded from this summary include all mammals, fish, terrestrial birds and most shorebirds except phalaropes which are largely pelagic. Species density is calculated as the total number of individuals observed per species divided by the area (km²) surveyed. The overall distribution of seabirds is illustrated by plotting density at each bin's center position. The density 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. Seasonal and overall transects surveyed are shown in Figure 1-4. A summary of species observations is shown in Table 2. Distribution maps for overall seabird density (all species) are shown in Appendix 1 (Figures 5-12). A detailed species list is provided in Appendix 2.

Table 1. Summary of survey effort and seabird statistics, 2012 and 2011.

Annual Survey 2012	Winter	Spring	Summer	Total
Survey Vessel	New Horizon	Shimada	Ocean Starr	
Start Date	1/27/2012	3/25/2012	7/2/2012	-
End Date	2/12/2012	4/3/2012	7/25/2012	-
Number Survey Days	15	9	16	40
Distance Surveyed (km)	1384	675	1154	3214
Area Surveyed (km ²)	415	203	346	964
Number of Bird Species	32	23	27	42
Overall Bird Density (per km ²)	3.37	1.46	4.17	3.25
Total Individuals Counted	1400	295	1443	3138
Annual Survey 2011	Winter	Spring	Summer	Total
Survey Vessel	New Horizon	Shimada	New Horizon	-
Start Date	1/12/2011	4/9/2011	7/27/2011	-
End Date	1/28/2011	4/26/2011	8/12/2011	-
Number Survey Days	17	17	16	50
Distance Surveyed (km)	1391	1,823	1,302	4517
Area Surveyed (km ²)	417	547	391	1355
Number of Bird Species	27	35	28	47
Overall Bird Density (per km ²)	2.84	5.24	1.62	3.45
Total Individuals Counted	1183	2866	633	4682

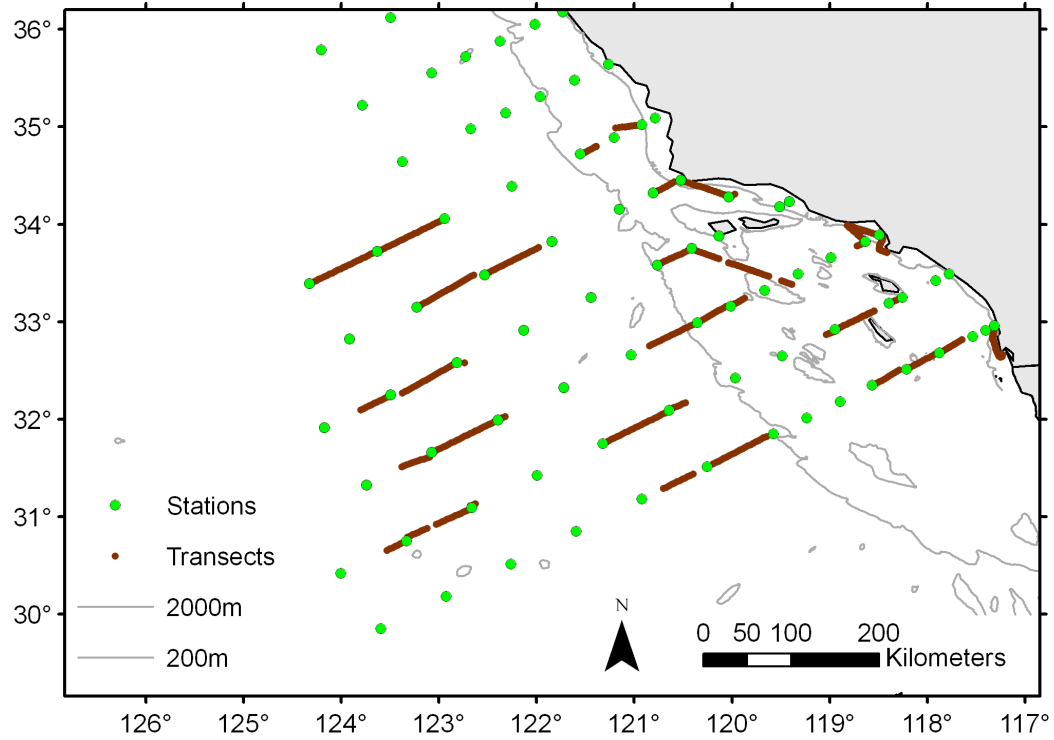


Figure 1. CalCOFI/CCE-LTER hydrographic and plankton sampling stations (green). 2012 transects, winter survey.

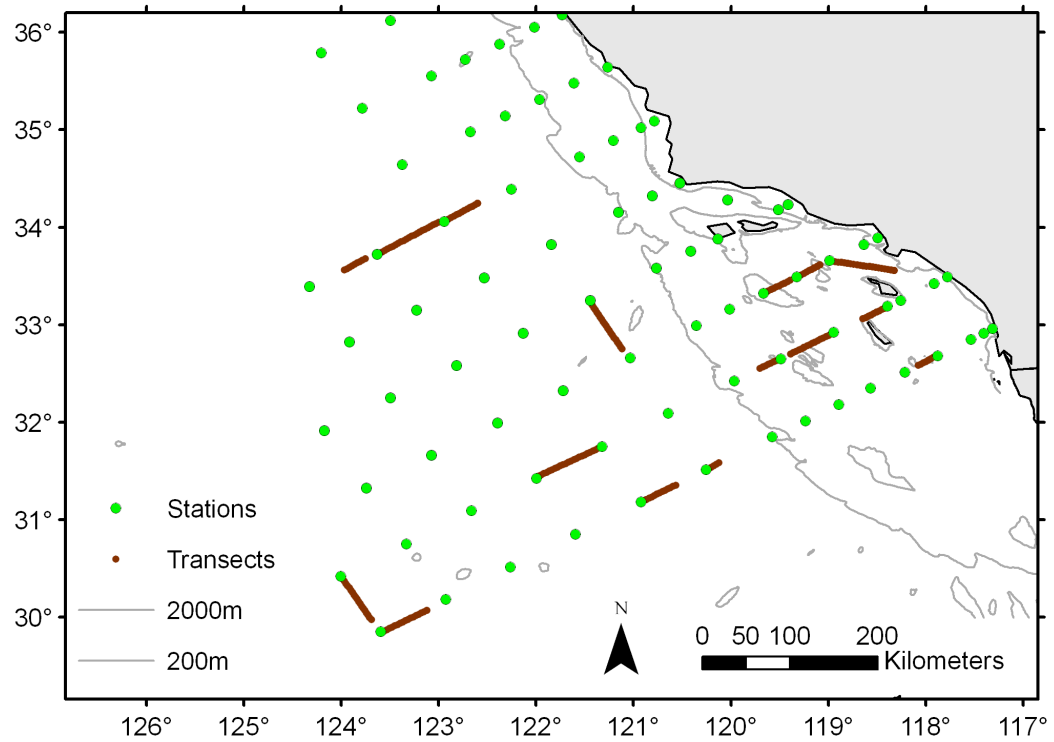


Figure 2. 2012 transects, spring survey.

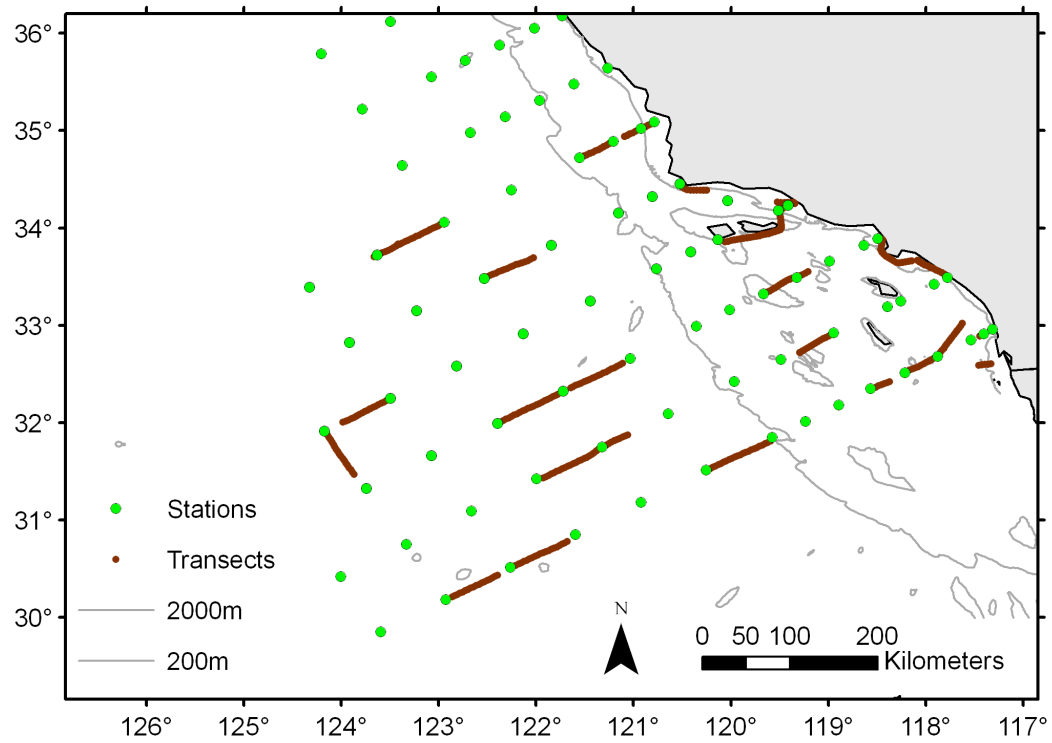


Figure 3. 2012 transects, summer survey.

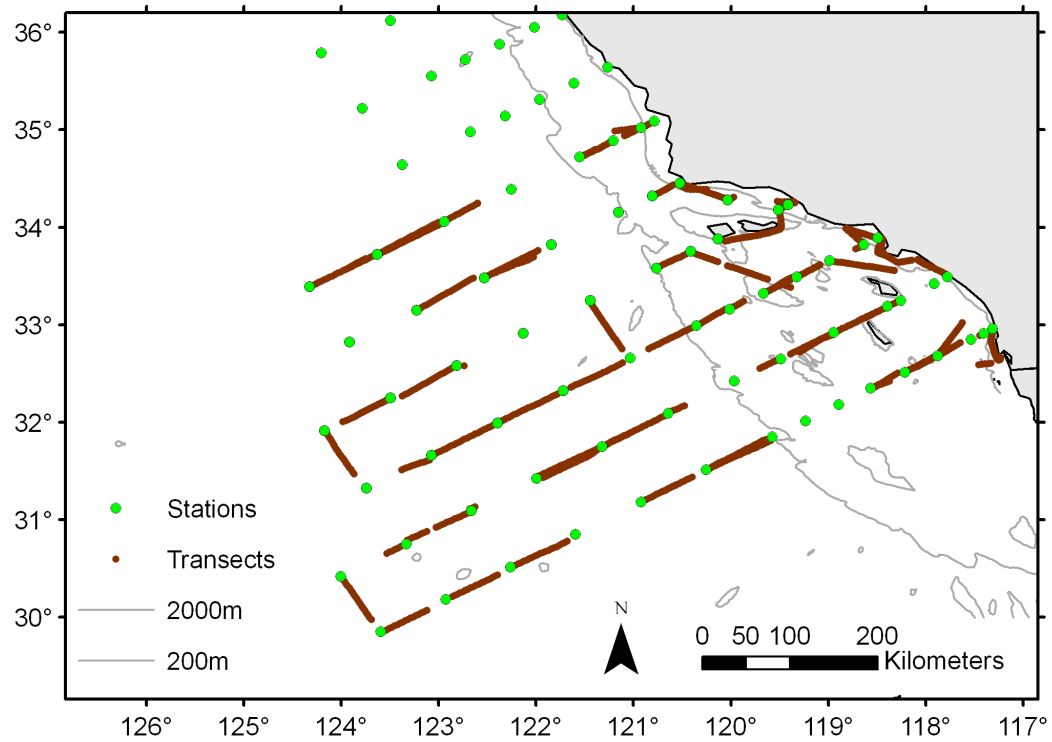


Figure 4. 2012 transects, all seasons.

Table 2. 2012 observations by season and species. Cell values represent: the total number of individuals (ind.) / the number of observations per species (obs.) / species density (number km⁻²).

Common Name	Latin Name	Winter Ind. / obs. / dens.	Spring Ind. / obs. / dens.	Summer Ind. / obs. / dens.
Arctic Tern	<i>Sterna paradisaea</i>			
Ancient Murrelet	<i>Synthliboramphus antiquus</i>			
Arctic Loon	<i>Gavia arctica</i>			2 / 2 / 0
Ashy Storm-Petrel	<i>Oceanodroma homochroa</i>			
American White Pelican	<i>Pelecanus erythrorhynchos</i>			
Black-Footed Albatross	<i>Phoebastria nigripes</i>	1 / 1 / 0	8 / 8 / 0.05	72 / 22 / 0.22
Black-Legged Kittiwake	<i>Rissa tridactyla</i>	25 / 5 / 0.06	1 / 1 / 0.02	
Black Scoter	<i>Melanitta nigra</i>			
Black Storm-Petrel	<i>Oceanodroma melania</i>			2 / 2 / 0.01
Bonaparte's Gull	<i>Larus philadelphia</i>	317 / 24 / 0.82	3 / 1 / 0.01	
Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>	19 / 13 / 0.07	1 / 1 / 0	31 / 15 / 0.07
Brant	<i>Branta bernicla</i>			
Brown Booby	<i>Sula leucogaster</i>			1 / 1 / 0
Brown Noddy	<i>Anous stolidus</i>			
Brown Pelican	<i>Pelecanus occidentalis</i>	34 / 18 / 0.13	12 / 4 / 0.04	95 / 30 / 0.22
Buller's Shearwater	<i>Puffinus bulleri</i>	1 / 1 / 0		
Black-Vented Shearwater	<i>Puffinus opisthomelas</i>			
Cassin's Auklet	<i>Ptychoramphus aleuticus</i>	201 / 82 / 0.5	12 / 7 / 0.04	7 / 2 / 0.01
California Gull	<i>Larus californicus</i>	116 / 47 / 0.36	13 / 5 / 0.06	1 / 1 / 0
Caspian Tern	<i>Sterna caspia</i>	3 / 2 / 0.02		4 / 3 / 0.02
Clark's Grebe	<i>Aechmophorus clarkii</i>			
Common Loon	<i>Gavia immer</i>	1 / 1 / 0.01	1 / 1 / 0	
Common Murre	<i>Uria aalge</i>	46 / 31 / 0.15	8 / 6 / 0.43	5 / 2 / 0.02
Cook's Petrel	<i>Pterodroma cookii</i>	1 / 1 / 0	17 / 8 / 0.05	17 / 15 / 0.04
Common Tern	<i>Sterna hirundo</i>			
Craveri's Murrelet	<i>Synthliboramphus craveri</i>			

Common Name	Latin Name	Winter Ind. / obs. / dens.	Spring Ind. / obs. / dens.	Summer Ind. / obs. / dens.
Double-Crested Cormorant	Phalacrocorax auritus	20 / 3 / 0.06		02/01/00
Dark Shearwater	(species group)			
Dark-Rumped Petrel	Pterodroma phaeopygia			
Eared Grebe	Podiceps nigricollis	1 / 1 / 0	1 / 1 / 0	
Elegant Tern	Sterna elegans	1 / 1 / 0	19 / 8 / 0.09	180 / 59 / 0.45
Flesh-Footed Shearwater	Puffinus carneipes			
Forster's Tern	Sterna forsteri	1 / 1 / 0		
Franklin's Gull	Larus pipixcan			
Fork-Tailed Storm-Petrel	Oceanodroma furcata			
Glaucous Gull	Larus hyperboreus			
Glaucous-Winged Gull	Larus glaucescens			
Hawaiian Petrel	Pterodroma sandwichensis			
Heermann's Gull	Larus heermanni	44 / 11 / 0.12		81 / 40 / 0.23
Herring Gull	Larus argentatus	1 / 1 / 0		
Horned Puffin	Fratercula corniculata			
Hybrid Gull	(species group)			
Juan Fernandez Petrel	Pterodroma externa			
Kelp Gull	Larus dominicanus			
Kermadec Petrel	Pterodroma neglecta			
Laysan Albatross	Phoebastria immutabilis	2 / 2 / 0		
Laughing Gull	Larus atricilla			
Least Tern	Sterna antillarum			
Leach's Storm-Petrel	Oceanodroma leucorhoa	73 / 37 / 0.15	8 / 7 / 0.04	61 / 57 / 0.17
Long-Tailed Jaeger	Stercorarius longicaudus			1 / 1 / 0
Least Storm-Petrel	Oceanodroma microsoma			
Marbled Murrelet	Brachyramphus marmoratus			
Mew Gull	Larus canus	28 / 21 / 0.09		
Mottled Petrel	Pterodroma inexpectata			

Common Name	Latin Name	Winter Ind. / obs. / dens.	Spring Ind. / obs. / dens.	Summer Ind. / obs. / dens.
Murphy's Petrel	<i>Pterodroma ultima</i>			
Northern Fulmar	<i>Fulmarus glacialis</i>	3 / 3 / 0.01		
Osprey	<i>Pandion haliaetus</i>			
Parakeet Auklet	<i>Aethia psittacula</i>			
Parasitic Jaeger	<i>Stercorarius parasiticus</i>			1 / 1 / 0
Pacific Loon	<i>Gavia pacifica</i>	1 / 1 / 0	2 / 1 / 0.01	
Parkinson's Petrel	<i>Procellaria parkinsoni</i>			
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>			
Peregrine Falcon	<i>Falco peregrinus</i>			
Pink-Footed Shearwater	<i>Puffinus creatopus</i>		1 / 1 / 0	182 / 33 / 0.74
Pigeon Guillemot	<i>Cephus columba</i>			1 / 1 / 0.01
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	2 / 2 / 0.01	3 / 3 / 0.01	
Ring-Billed Gull	<i>Larus delawarensis</i>			1 / 1 / 0
Red-Billed Tropicbird	<i>Phaethon aethereus</i>			
Red Phalarope	<i>Phalaropus fulicaria</i>	13 / 5 / 0.03	24 / 13 / 0.09	82 / 22 / 0.26
Red-Footed Booby	<i>Sula sula</i>			
Rhinoceros Auklet	<i>Cerorhinca monocerata</i>	32 / 22 / 0.1	32 / 14 / 0.1	
Red-Necked Grebe	<i>Podiceps grisegena</i>			
Red-Necked Phalarope	<i>Phalaropus lobatus</i>	50 / 13 / 0.19	8 / 3 / 0.02	1 / 1 / 0
Royal Tern	<i>Sterna maxima</i>			7 / 4 / 0.02
Red-Throated Loon	<i>Gavia stellata</i>			
Red-Tailed Tropicbird	<i>Phaethon rubricauda</i>			
Ruddy Turnstone	<i>Arenaria interpres</i>			
Sabine's Gull	<i>Larus sabini</i>	1 / 1 / 0		2 / 2 / 0.01
Short-Tailed / Slender-Billed Shearwater	<i>Puffinus tenuirostris</i>	1 / 1 / 0		
Solander's Petrel	<i>Pterodroma solandri</i>			
Sooty Shearwater	<i>Puffinus griseus</i>		8 / 8 / 0.03	321 / 105 / 1.23
South Polar Skua	<i>Stercorarius maccormicki</i>			

Common Name	Latin Name	Winter Ind. / obs. / dens.	Spring Ind. / obs. / dens.	Summer Ind. / obs. / dens.
Short-Tailed Albatross	Phoebastria albatrus			
Stejneger's Petrel	Pterodroma longirostris			
Surf Scoter	Melanitta perspicillata	24 / 3 / 0.06	4 / 1 / 0.01	
Thayer's Gull	Larus thayeri			
Tufted Puffin	Fratercula cirrhata			
Unidentified Albatross	(species group)			
Unidentified Auklet	(species group)			
Unidentified Cormorant	(species group)			
Unidentified Duck	(species group)			
Unidentified Grebe	(species group)			
Unidentified Gull	(species group)	20 / 19 / 0.06	1 / 1 / 0	
Unidentified Jaeger	(species group)			
Unidentified Large Alcid	(species group)			
Unidentified Loon	(species group)			
Unidentified Murre	(species group)			
Unidentified Procellarid	(species group)			
Unidentified Petrel	(species group)			
Unidentified Phalarope	(species group)		1 / 1 / 0.02	
Unidentified Small Alcid	(species group)			
Unidentified Shearwater	(species group)	1 / 1 / 0		
Unidentified Skua	(species group)			
Unidentified Storm-Petrel	(species group)			
Unidentified Tern	(species group)			
Unidentified Tropicbird	(species group)			
Western Grebe	Aechmophorus occidentalis			
Western Gull	Larus occidentalis	298 / 104 / 0.92	100 / 73 / 0.53	281 / 138 / 0.89
Wilson's Storm-Petrel	Oceanites oceanicus			
Wedge-Rumped Storm-Petrel	Oceanodroma tethys			

Common Name	Latin Name	Winter Ind. / obs. / dens.	Spring Ind. / obs. / dens.	Summer Ind. / obs. / dens.
Wedge-Tailed Shearwater	<i>Puffinus pacificus</i>			
Xantus's Murrelet	<i>Synthliboramphus hypoleucus</i>	18 / 9 / 0.06	7 / 4 / 0.02	2 / 2 / 0
Xantus's / Craveri's Murrelet	(species group)			

Appendix 1. Overall seabird distribution maps by season for 2012 and 2011.

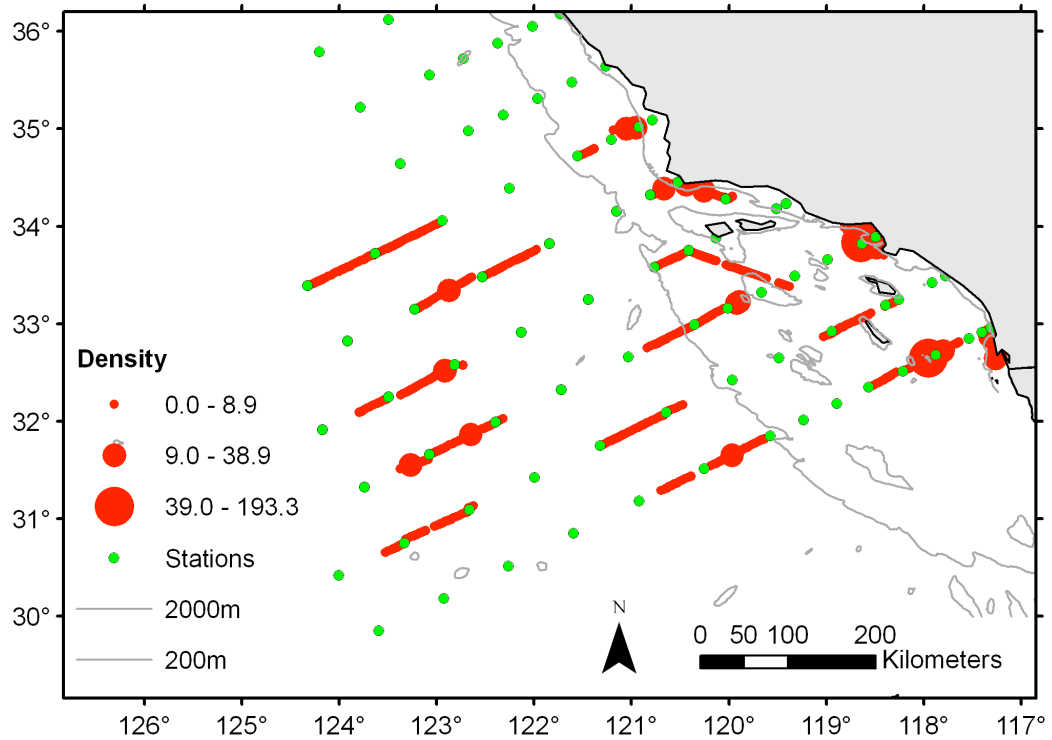


Figure 5. Spatial distribution of all seabird species, winter 2012.

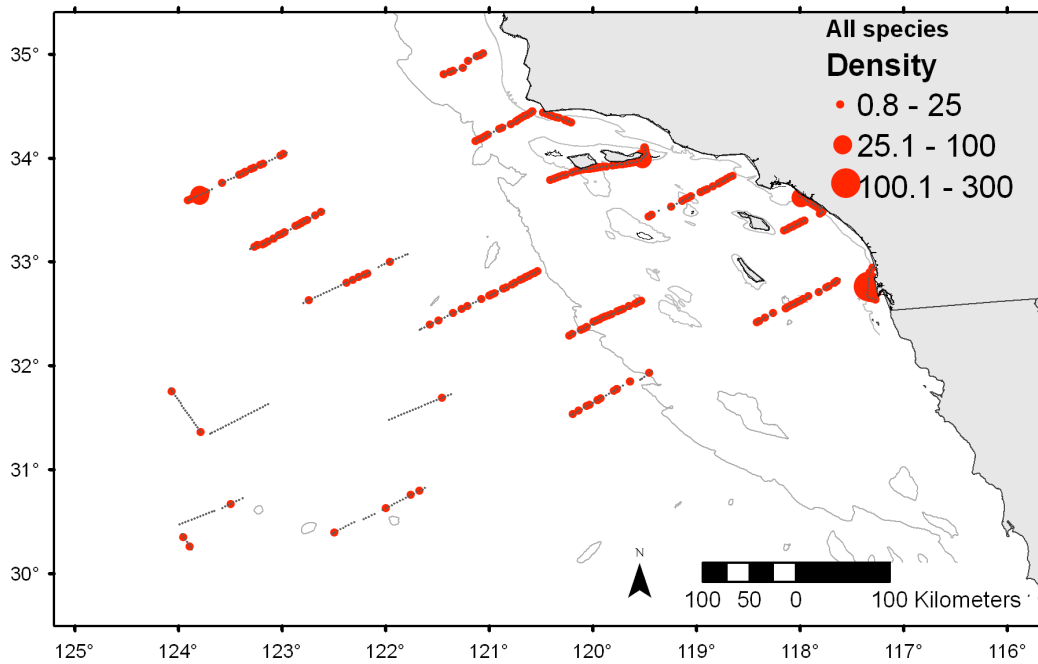


Figure 6. Spatial distribution of all seabird species, winter 2011. Note the difference in scale with 2012.

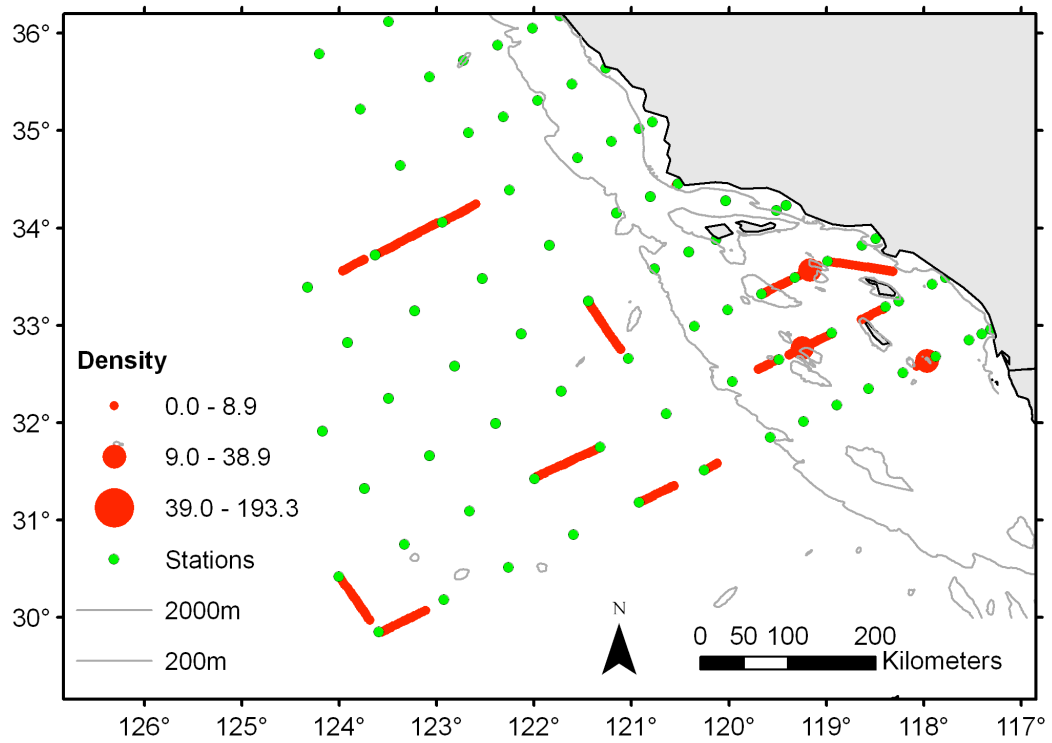


Figure 7. Spatial distribution of all seabird species, spring 2012.

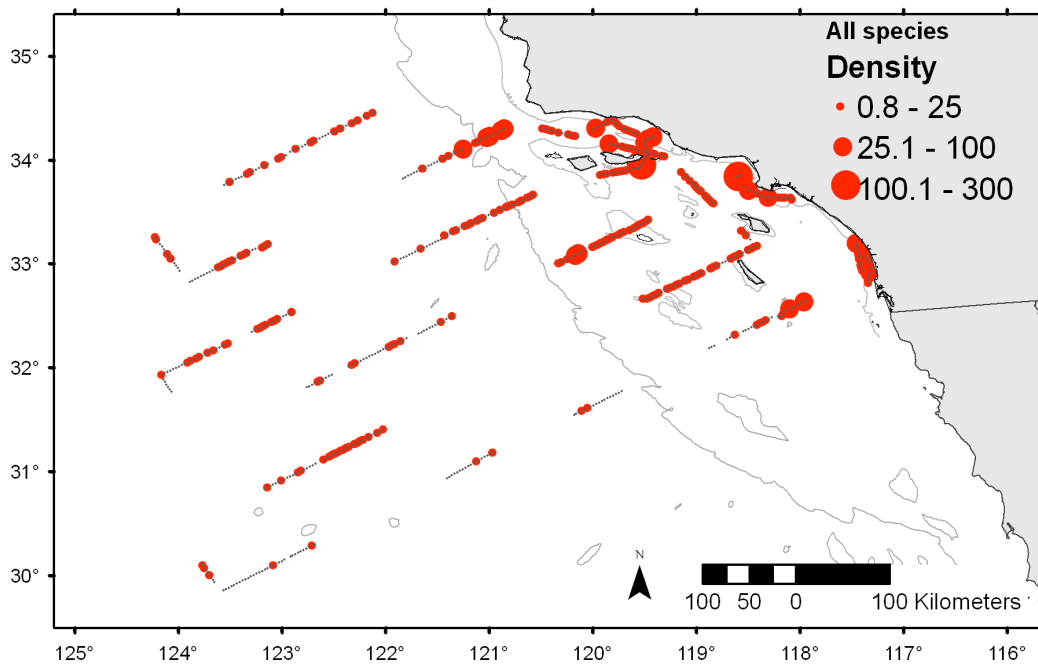


Figure 8. Spatial distribution of all seabird species, spring 2011. Note the difference in scale with 2012.

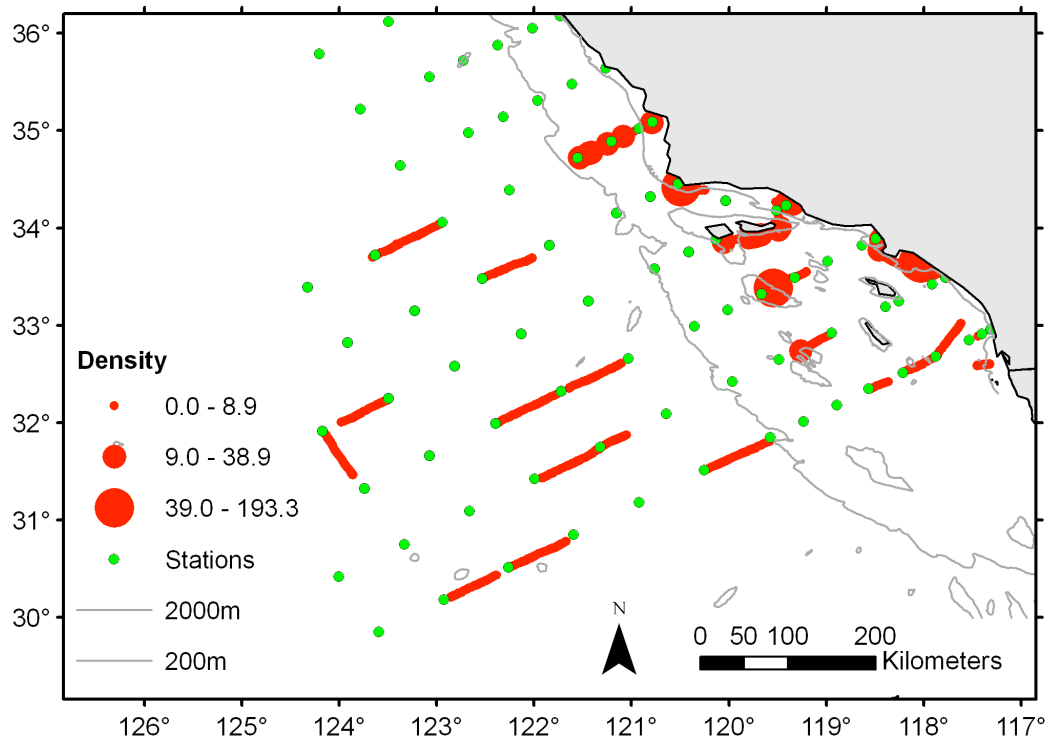


Figure 9. Spatial distribution of all seabird species, summer 2012.

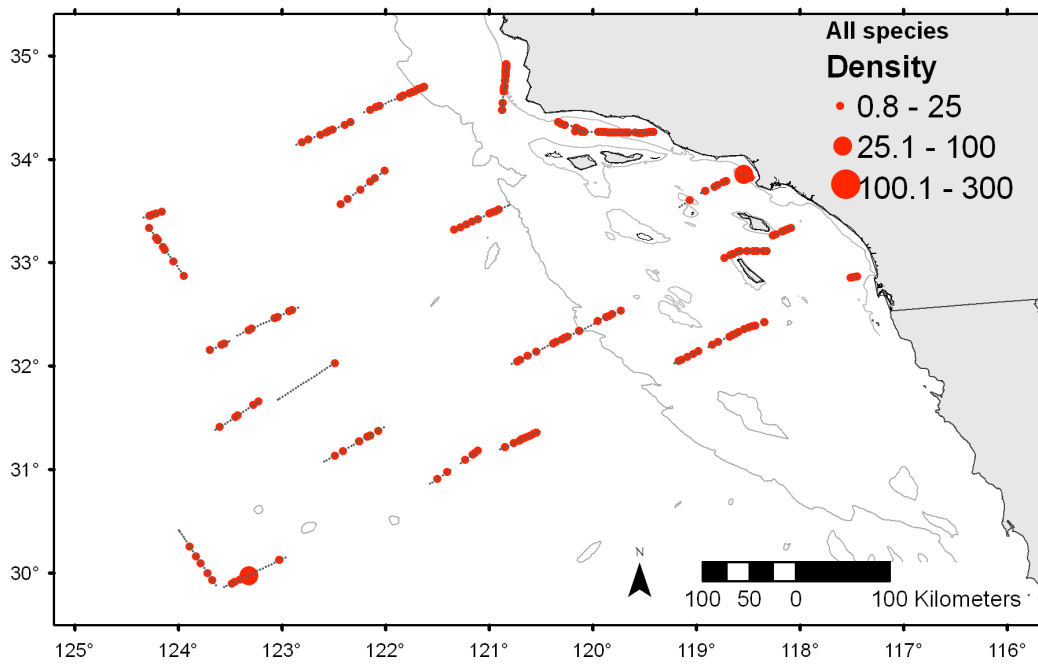


Figure 10. Spatial distribution of all seabird species, summer 2011. Note the difference in scale with 2012.

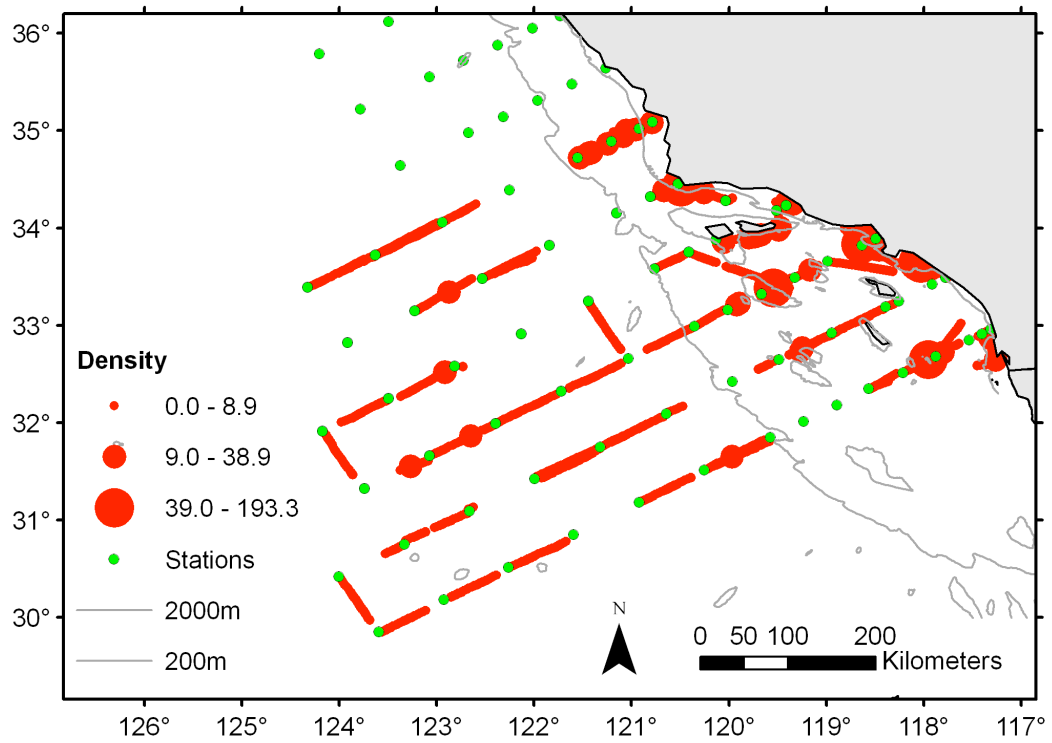


Figure 11. Spatial distribution of all seabird species across all seasons, 2012.

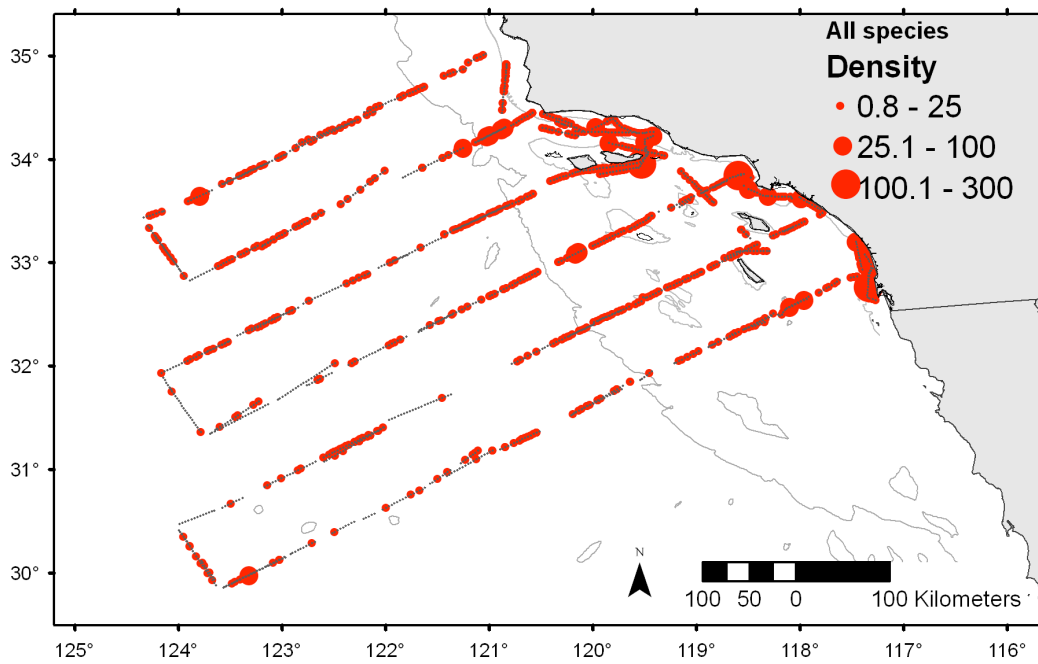


Figure 12. Spatial distribution of all seabird species across all seasons, 2011. Note the difference in scale with 2012.

Appendix 2. Species Lists

Data selection criteria

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

Behavior codes included	All values
Species categories included	Birds, Unidentified
Species categories excluded	Mammals, Fish, Excluded Species List
Years	2012
Months	All months
Bin length	All bins > 0.1km
Region	76 to 93
Seasons	All seasons

Excluded Species List

The following species were excluded from this analysis.

Common Name	Latin Name
American Coot	Fulica americana
Black Oystercatcher	Haematopus bachmani
Black Skimmer	Rynchops niger
Black Tern	Chlidonias niger
Black Turnstone	Arenaria melanocephala
Brewer's Sparrow	Spizella breweri
Bufflehead	Bucephala albeola
European Starling	Sturnus vulgaris
Great Blue Heron	Ardea herodias
Great Egret	Ardea alba
Green Heron	Butorides virescens
Least Sandpiper	Calidris minutilla
Long-billed Curlew	Numenius americanus
Long-billed Dowitcher	Limnodromus scolopaceus
Mallard Duck	Anas platyrhynchos
Marbled Godwit	Limosa fedoa
Mourning Dove	Zenaida macroura
Red-Breasted Merganser	Mergus serrator
Ruddy Duck	Oxyura jamaicensis
Sanderling	Calidris alba
Snow Goose	Chen caerulescens
Snowy Egret	Egretta thula
Unidentified Bird	(species group)
Unidentified Dowitcher	(species group)
Unidentified Goose	(species group)
Unidentified Hummingbird	(species group)
Unidentified Passerine	(species group)
Unidentified Shorebird	(species group)
Western Sandpiper	Calidris mauri

Whimbrel	<i>Numenius phaeopus</i>
White-Winged Scoter	<i>Melanitta fusca</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Yellow-Rumped Warbler	<i>Dendroica coronata</i>
Baird's Beaked Whale	<i>Berardius bairdii</i>
Blue Shark	<i>Prionace glauca</i>
Blue Whale	<i>Balaenoptera musculus</i>
Bottlenose Dolphin	<i>Tursiops truncatus</i>
California Sea Lion	<i>Zalophus californianus</i>
Common Dolphin	<i>Delphinus delphis</i>
Cuvier's Beaked Whale	<i>Ziphius cavirostris</i>
Dall's Porpoise	<i>Phocoenoides dalli</i>
False Killer Whale	<i>Pseudorca crassidens</i>
Fin Whale	<i>Balaenoptera physalus</i>
Gray Whale	<i>Eschrichtius robustus</i>
Green Sea Turtle	<i>Chelonia mydas</i>
Guadalupe Fur Seal	<i>Arctocephalus townsendi</i>
Hammerhead Shark	<i>Sphyrna</i> spp.
Harbor Porpoise	<i>Phocoena phocoena</i>
Harbor Seal	<i>Phoca vitulina</i>
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>
Humpback Whale	<i>Megaptera novaeangliae</i>
Killer Whale	<i>Orcinus orca</i>
Leatherback Turtle	<i>Dermochelys coriacea</i>
Long-beaked Common Dolphin	<i>Delphinus capensis</i>
Mako Shark	<i>Isurus oxyrinchus</i>
Minke Whale	<i>Balaenoptera acutorostrata</i>
Mola Mola	<i>Mola mola</i>
Northern Elephant Seal	<i>Mirounga angustirostris</i>
Northern Fur Seal	<i>Callorhinus ursinus</i>
Northern Right Whale Dolphin	<i>Lissodelphis borealis</i>
Pacific White-Sided Dolphin	<i>Lagenorhynchus obliquidens</i>
Pilot Whale	<i>Globicephala</i> spp.
Pygmy Sperm Whale	<i>Kogia breviceps</i>
Ridley Sea Turtle	<i>Lepidochelys olivacea</i>
Risso's Dolphin	<i>Grampus griseus</i>
Sea Otter	<i>Enhydra lutris</i>
Sei Whale	<i>Balaenoptera borealis</i>
Short-Beaked Common Dolphin	<i>Delphinus delphis</i>
Short-Finned Pilot Whale	<i>Globicephala macrorhynchus</i>
Sperm Whale	<i>Physeter macrocephalus</i>
Steller Sea Lion	<i>Eumetopias jubatus</i>
Striped Dolphin	<i>Stenella coeruleoalba</i>
Unidentified Balaenoptera	(species group)
Unidentified Beaked Whale	(species group)

Unidentified Cetacean	(species group)
Unidentified Dolphin	(species group)
Unidentified Large Whale	(species group)
Unidentified Mammal	(species group)
Unidentified Pinniped	(species group)
Unidentified Sea Lion	(species group)
Unidentified Seal	(species group)
Unidentified Shark	(species group)
Unidentified Turtle	(species group)
Unidentified Whale	(species group)

Included Species List

For a list of species included in the analysis, please refer to Table 2.