

# **Seabird Surveys on the CalCOFI/CCE-LTER Surveys, 2012**

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## **Introduction**

Seabird surveys are an integral part of the CalCOFI/CCE-LTER programs, providing data that is valuable on several fronts: 1) measurements provide an upper trophic level perspective to complement the lower trophic level plankton data collected by CalCOFI; 2) estimates of seabird abundance, diversity and distribution may contribute to marine spatial planning and specifically the planning and implementation of Marine Protected Areas in the Southern California Bight region; and, 3) by extending our existing time series (now 25 years and counting), variation in seasonal and annual variation in the seabird community contributes to understanding of the effects of climate variability and change on the California Current Ecosystem. This data report summarizes the at-sea survey observations made during the 2012 CalCOFI/CCE-LTER cruises, and presents basic distribution and density estimates of seabirds. A total of 3214 km ( $964 \text{ km}^2$ ) of ocean habitat was surveyed on 3 cruises conducted along the CalCOFI grid in winter, spring and summer. A total of 40 days of survey effort is summarized.

## **Methods**

At-sea observations are made continuously during daylight ship transits between oceanographic-plankton measurement stations. The observer is located on the bridge, approximately 15 meters above sea level and uses hand-held binoculars to assist in the identification and enumeration of birds. The observer records all birds (and mammals) 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.

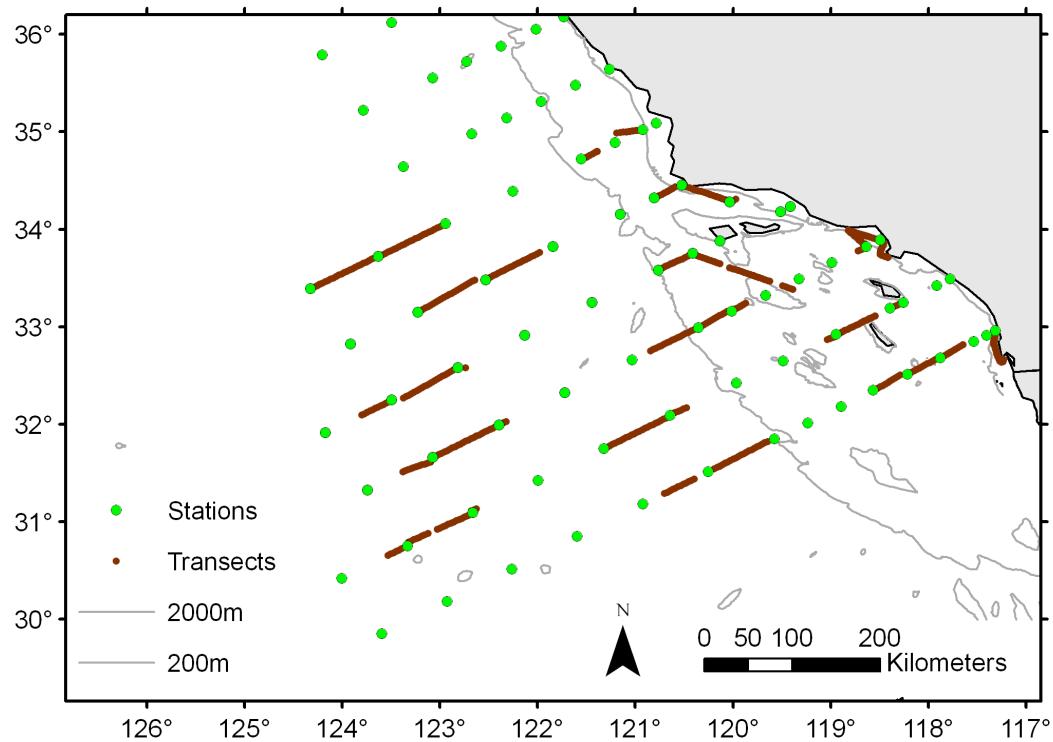
This report summarized observations for all seasonal surveys conducted in 2012 and is limited to the region covered by CalCOFI lines 76 to 93; the relevant seabird species are listed in Table 2. The taxa excluded from this summary are mammals, fish, terrestrial birds and most shorebirds except phalaropes which are largely pelagic. Species density is calculated as the total number of individuals observed per species divided by the area ( $\text{km}^2$ ) 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

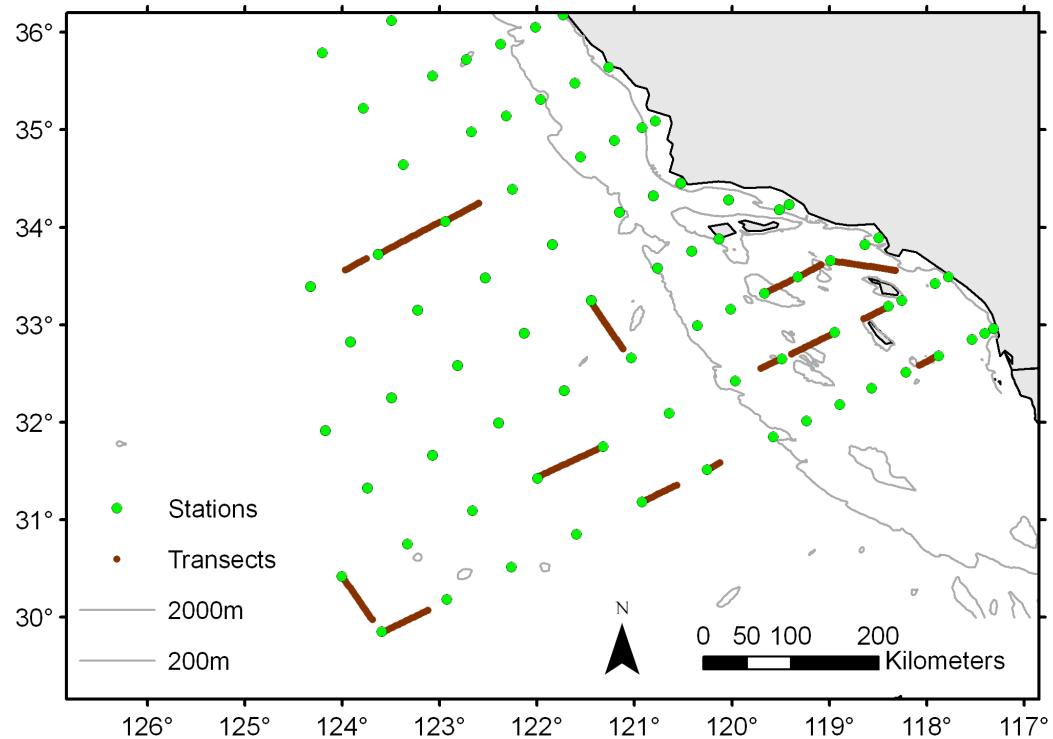
A summary of survey effort is shown in Table 1. Seasonal and overall transects surveyed are shown in Figure 1-4. A summary of species observations is shown in Table 2. Spatial distribution maps for overall seabird density (all species) are shown in Appendix 1. A detailed species list is provided in Appendix 2.

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

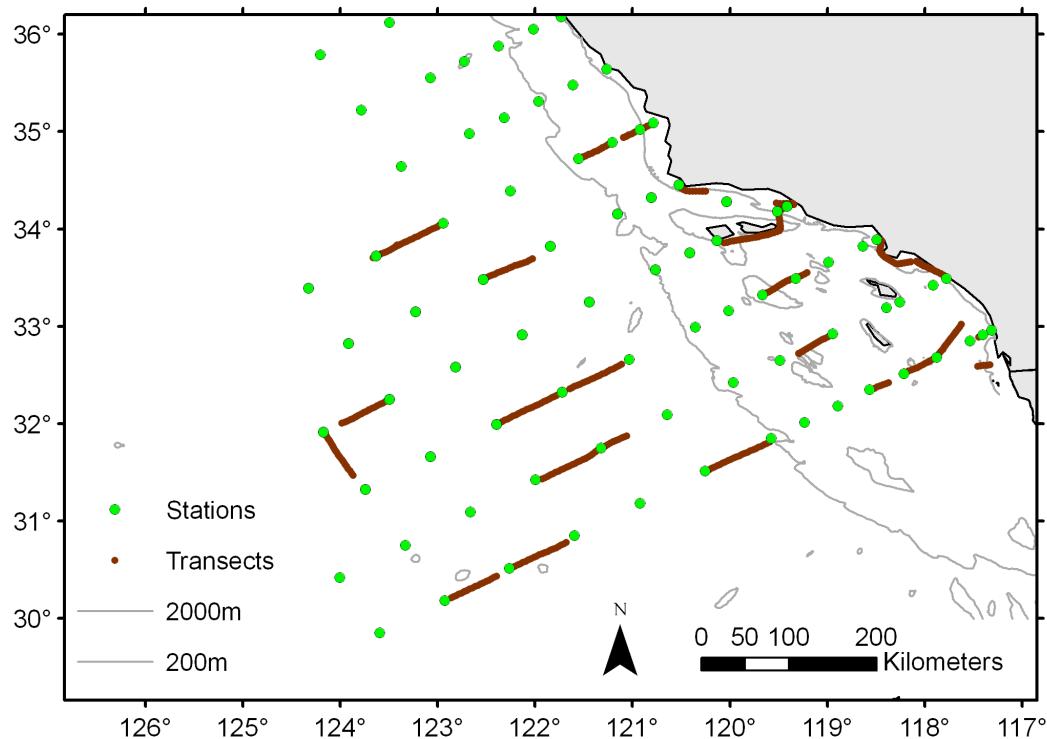
<b>Annual Survey 2012</b>	<b>Winter</b>	<b>Spring</b>	<b>Summer</b>	<b>Total</b>
Survey Vessel				
Start Date	1/27/2012	3/25/2012	7/2/2012	-
End Date	2/12/2012	4/3/2012	7/25/2012	-
Survey Days	15	9	16	40
Surveyed Distance (km)	1384	675	1154	3214
Surveyed Area (km <sup>2</sup> )	415	203	346	964
Number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



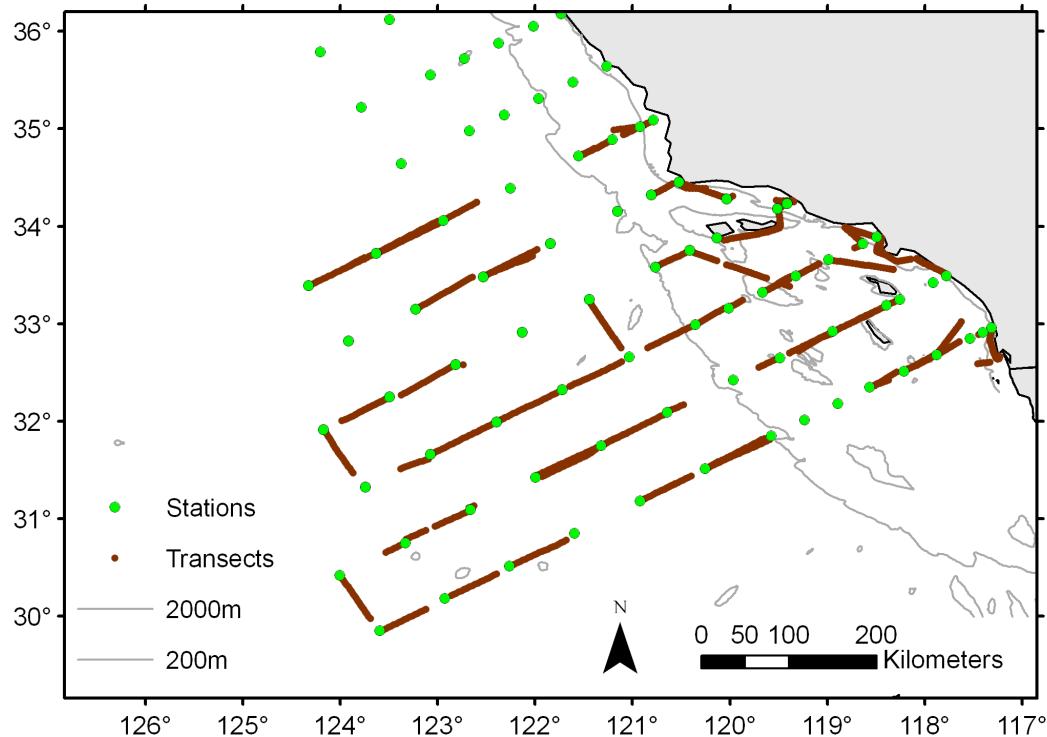
**Figure 1. 2012 Transects, winter survey.**



**Figure 2. 2012 Transects, spring survey.**



**Figure 3. 2012 Transects, summer survey.**



**Figure 4. 2012 Transects, all surveys.**

**Table 2. Annual observation summary, broken down by season and by species. Cell values represent: the total number of individuals (ind.) / the number of observations per species (obs.) / the average species density (number km<sup>-2</sup>).**

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>			

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

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>Pheathon 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	<i>Phoebastria albatrus</i>			
Stejneger's Petrel	<i>Pterodroma longirostris</i>			
Surf Scoter	<i>Melanitta perspicillata</i>	24 / 3 / 0.06	4 / 1 / 0.01	
Thayer's Gull	<i>Larus thayeri</i>			
Tufted Puffin	<i>Fratercula cirrhata</i>			
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	<i>Aechmophorus occidentalis</i>			
Western Gull	<i>Larus occidentalis</i>	298 / 104 / 0.92	100 / 73 / 0.53	281 / 138 / 0.89
Wilson's Storm-Petrel	<i>Oceanites oceanicus</i>			
Wedge-Rumped Storm-Petrel	<i>Oceanodroma tethys</i>			

<b>Common Name</b>	<b>Latin Name</b>	<b>Winter Ind. / obs. / dens.</b>	<b>Spring Ind. / obs. / dens.</b>	<b>Summer Ind. / obs. / dens.</b>
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. Species distribution maps by season for 2012 and 2011

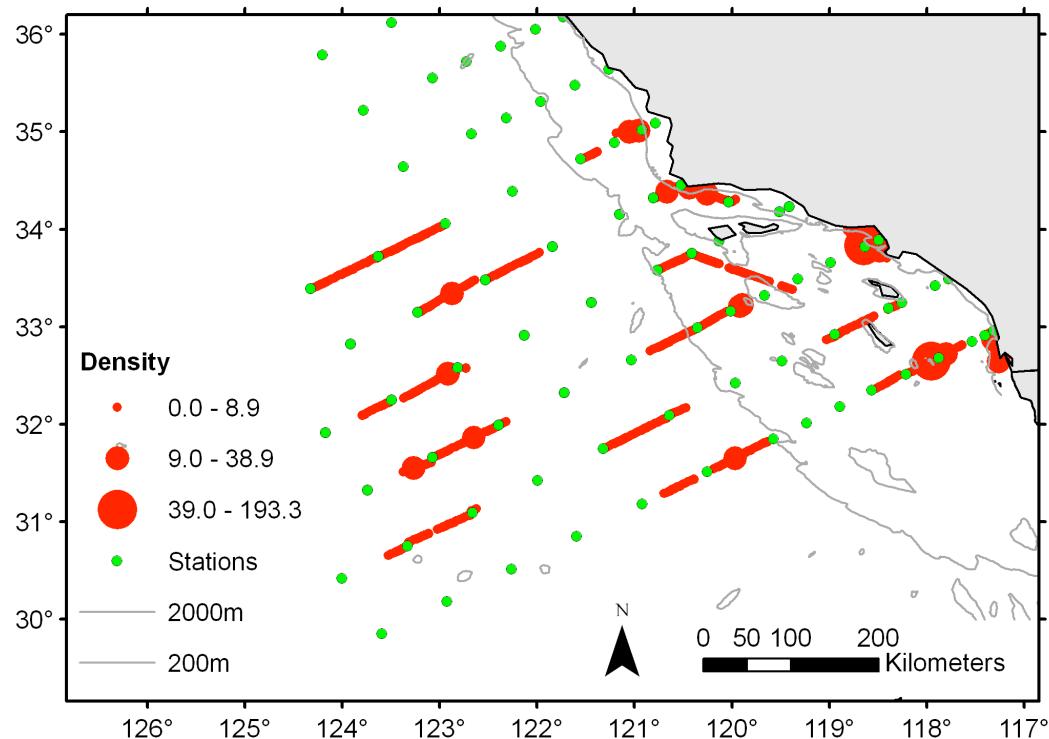


Figure 5. 2012 Spatial distribution of all species, winter survey.

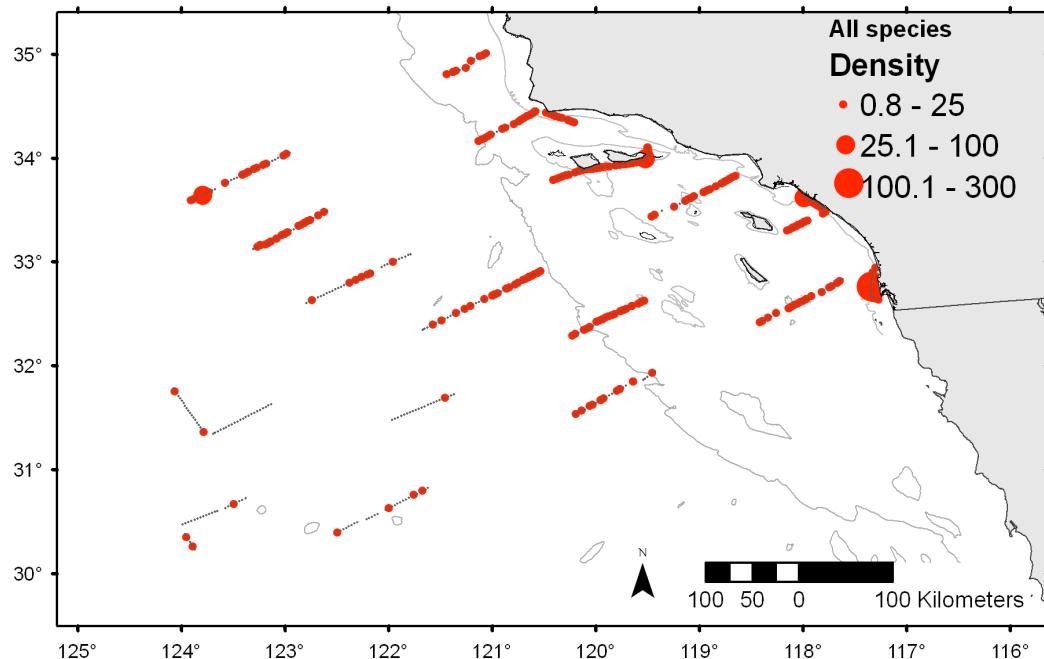


Figure 6. 2011 Spatial distribution of all species, winter survey. Note the difference in scale with 2012.

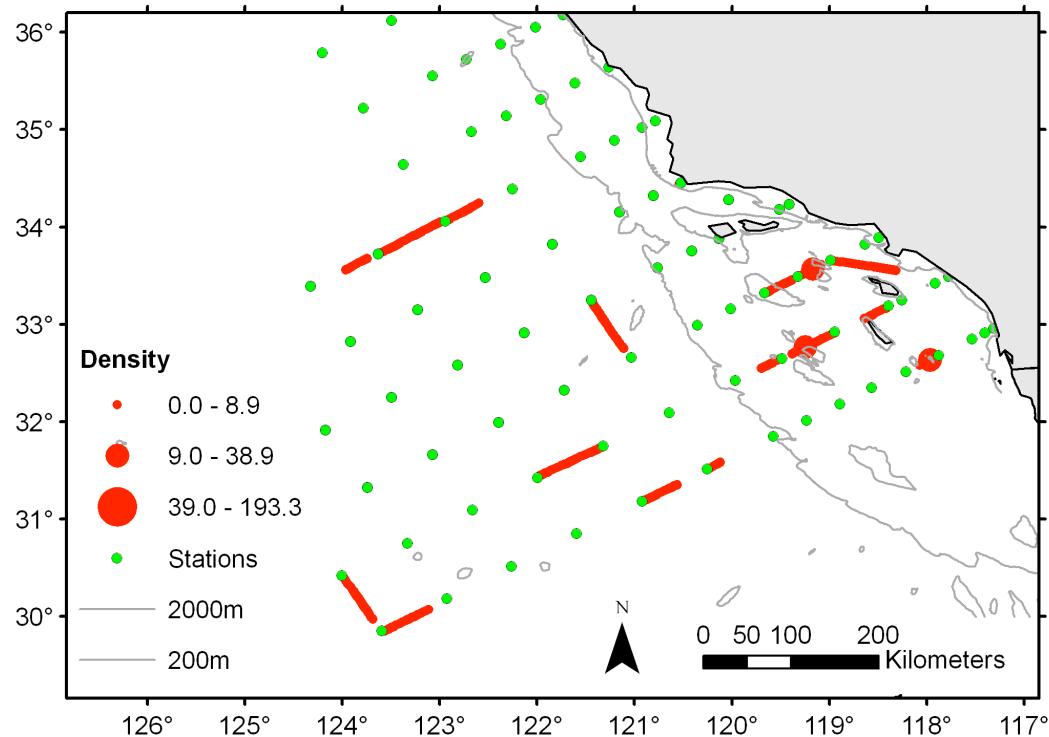


Figure 7. 2012 Spatial distribution of all species, spring survey.

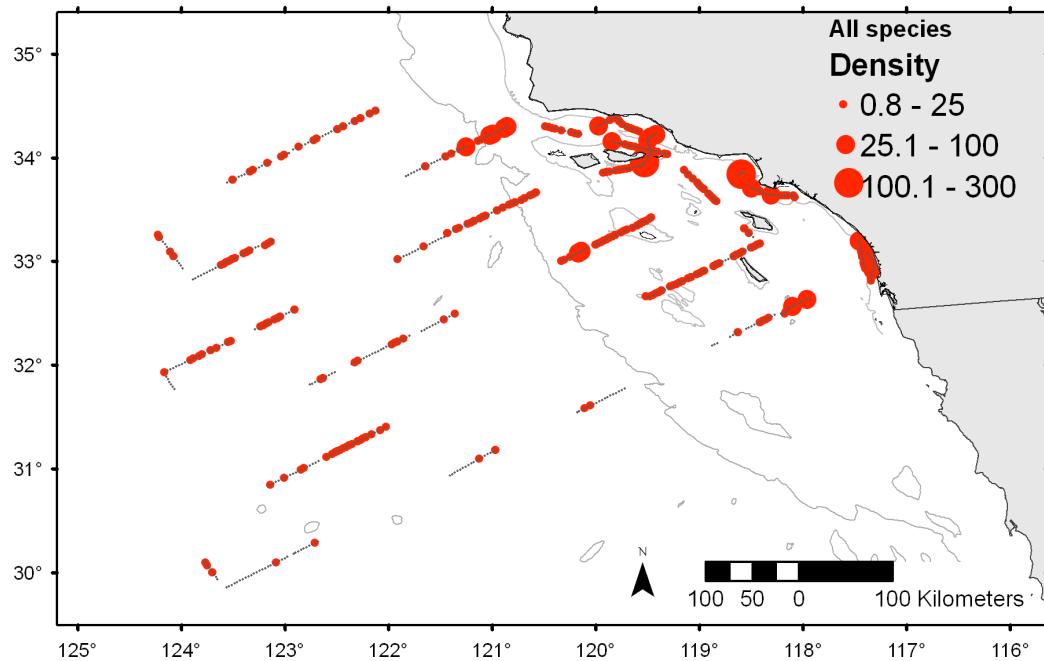
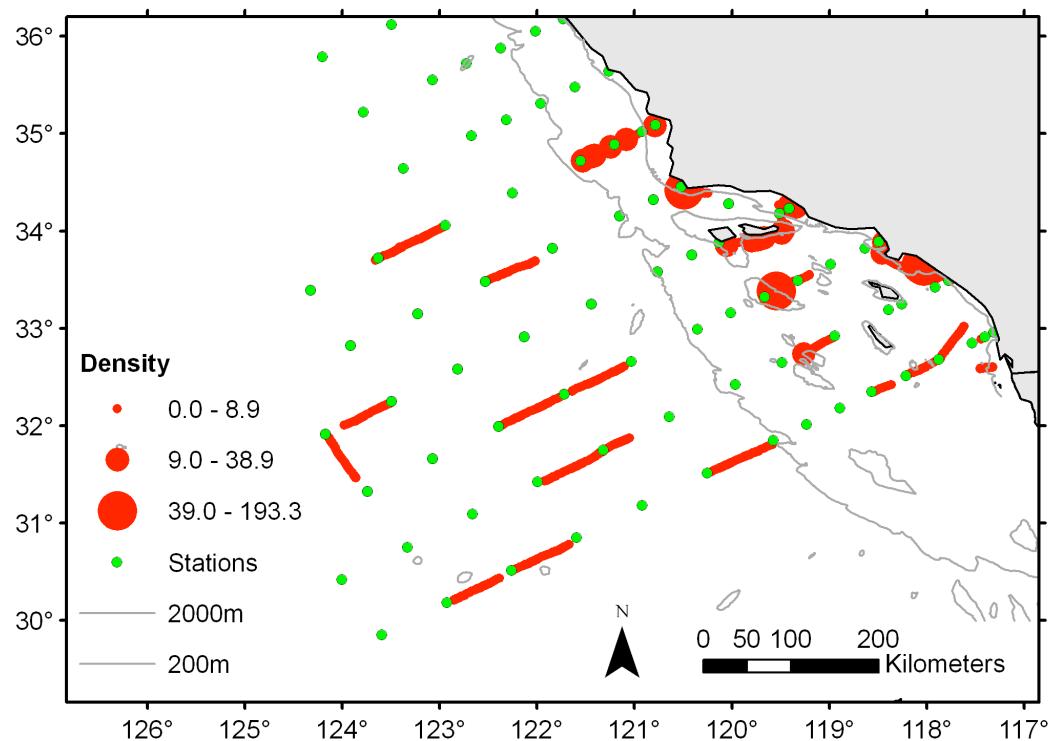
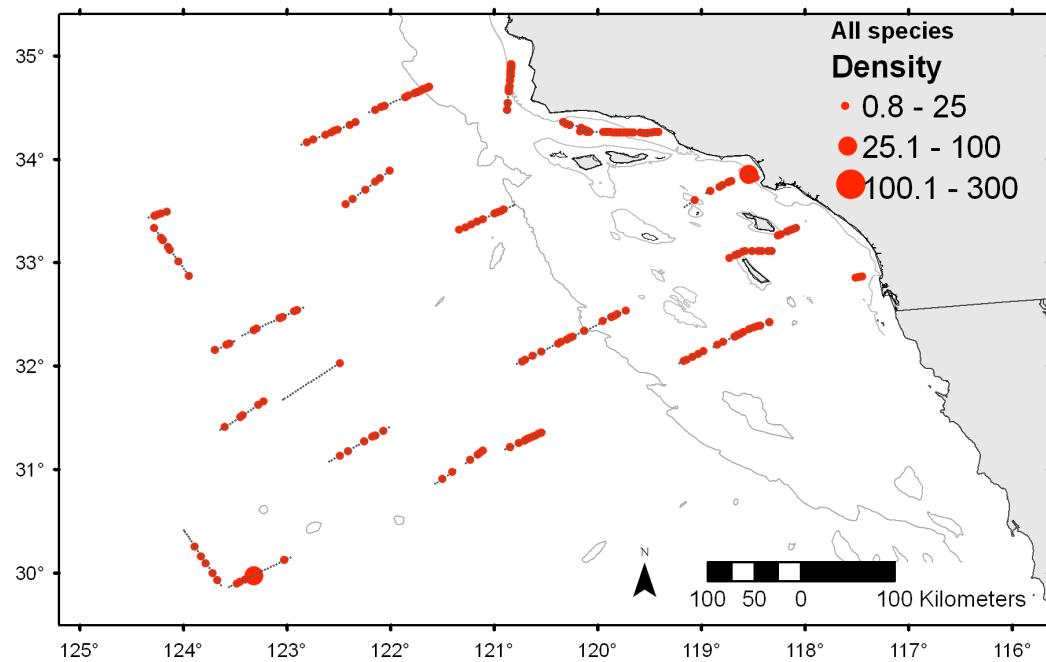


Figure 8. 2011 Spatial distribution of all species, spring survey. Note the difference in scale with 2012.



**Figure 9. 2012 Spatial distribution of all species, summer survey.**



**Figure 10. 2010 Spatial distribution of all species, summer survey. Note the difference in scale with 2012.**

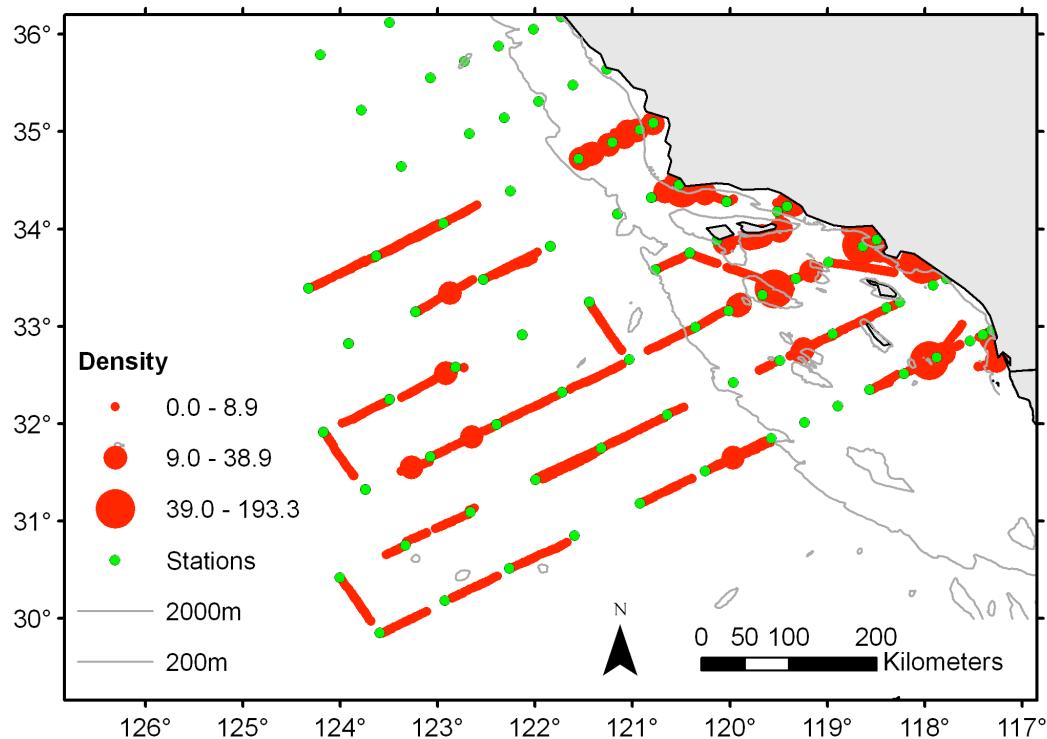


Figure 11. 2012 Spatial distribution of all species, all seasons.

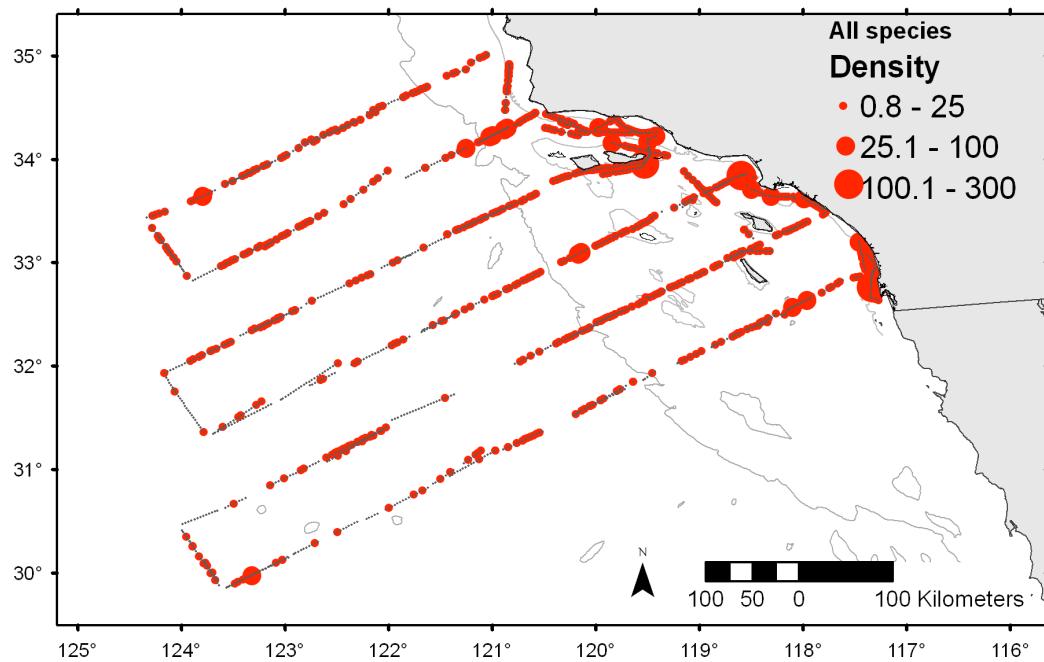


Figure 12. 2011 Spatial distribution of all species, all seasons. Note the difference in scale with 2012.

## 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	All lines
Seasons	All seasons

### Excluded Species List

The following species were excluded from the analysis.

Common Name	Latin Name
American Coot	<i>Fulica americana</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>
Brewer's Sparrow	<i>Spizella breweri</i>
Bufflehead	<i>Bucephala albeola</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>
Least Sandpiper	<i>Calidris minutilla</i>
Long-billed Curlew	<i>Numenius americanus</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>
Mallard Duck	<i>Anas platyrhynchos</i>
Marbled Godwit	<i>Limosa fedoa</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>
Snow Goose	<i>Chen caerulescens</i>
Snowy Egret	<i>Egretta thula</i>
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	<i>Calidris mauri</i>

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>
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>
Guadelupe Fur Seal	<i>Arctocephalus townsendi</i>
Hammerhead Shark	<i>Sphyrna spp.</i>
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 spp.</i>
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 Baleinoptera	(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.