Seabirds on the CalCOFI/CCE-LTER Survey, Summer 2017
Data Report

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Introduction

Seabird studies are 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 are 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 and adjacent marine habitats (e.g., Santora et al. 2017), a region characterized by substantial temporal environmental heterogeneity and a major biogeographic boundary associated with Point Conception. Third, by extending our existing records (currently over 30 years and building; 1987-present) and coupling this information with long-term hydrographic and plankton data, seabird data contribute to understanding the effects of climate variability and change on the southern sector of the CCE (e.g., Veit et al. 1996, Hyrenbach and Veit 2003, Santora and Sydeman 2015, Sydeman et al. 2015). Other anthropogenic impacts for this region include coastal oil and gas development and shipping, as well as other biotic changes due to fisheries and other extractive uses of marine life. Seabirds may be responsive to all of these factors.

This data report summarizes observations made during the 2017 summer CalCOFI/CCE-LTER cruise. We present basic data on survey effort as well as summary information on seabird distribution and abundance.

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 periodically from an external GPS. Each observation includes the species, the number of individuals observed, and their behavior (mostly "flying" or "sitting on the water"). 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. These data are used to derive summary statistics.

Table 1. The following criteria were applied to the survey database to select data for the summary.

Criteria	Value
Behavior codes included	All values
Species categories included	Birds, Unidentified
Species categories excluded	Mammals, Fish, Excluded Species List
Year	2017
Month	All
Bin length	All bins > 0.1 km
Region	Lines 60-93
Season	Summer

Taxa excluded from this summary were 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 (km^2) surveyed. Density over time in the spring is shown for select warm and cold water-affinity seabird species in the "core" survey area (defined as the six lines 77–93), 1987–2017. For summer, we have defined species with warm water-affinity to include black-vented shearwater, Cook's petrel, and elegant tern (Hyrenbach and Veit 2003). Cold water-affinity species include common murre, pink-footed shearwater, and sooty shearwater (Hyrenbach and Veit 2003).

Results

A summary of survey effort is shown in Table 2; transects surveyed are shown in Figure 1. Summarized species observations for all species in the core and extended survey area combined are shown in Table 3 (see Appendix 1 for exclusions). A total of 15 days of survey effort covering 1,700 km (510 km^2) of ocean habitat is summarized. Density over time in the core area for the selected seabird species (listed above) is shown in Figures 2 (warm water-affinity) and 3 (cold water-affinity).

Notable results from the 2017 summer survey for these species were 1) very high density of black-vented shearwater and common murre (highest densities in the survey history (summer)), and 2) higher than average densities of elegant tern and pink-footed shearwater (greater than 1 s.d. of the mean). Interestingly, these species with high occurrence are categorized as warm (black-vented shearwater and elegant tern) and cold species (common murre and sooty shearwater). None of these featured species had density lower than one standard deviation of the mean.

Table 2. Summary of survey effort and seabird statistics, summer 2017.

2017	**Spring**
Survey Vessel	RV Sally Ride
Start Date	8/1/2017
End Date	8/15/2017
Number of Survey Days	15
Distance Surveyed (km)	1,700
Area Surveyed (km^2)	510
Number of Bird Species	39
Overall Bird Density (per km^2)	36.117
Total Individuals Counted	18,423

Figure 1. Transects sampled, summer 2017.

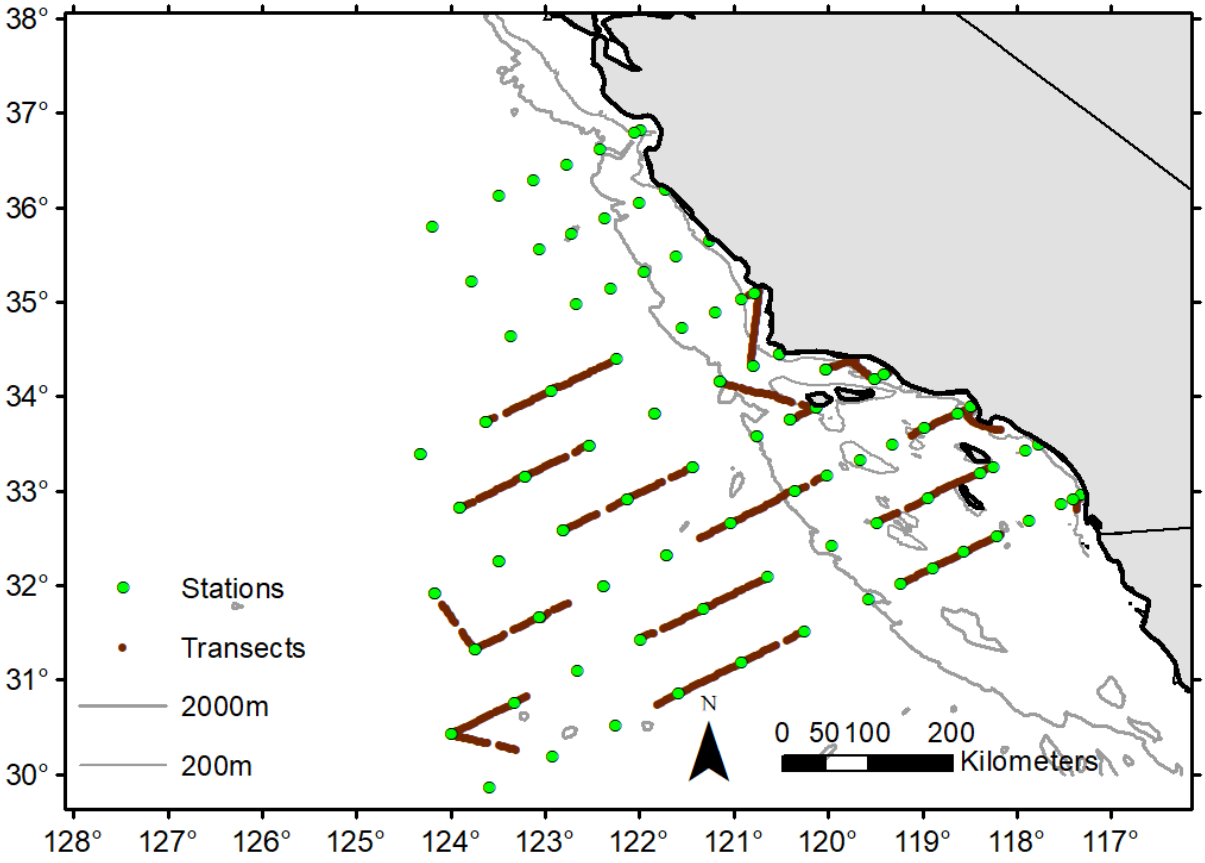


Table 3. Observations in summer 2017 by species in the core survey area. Cell values: total number of individuals (ind.) / number of observations per species (obs.) / species density (dens.) in individuals per km^2.

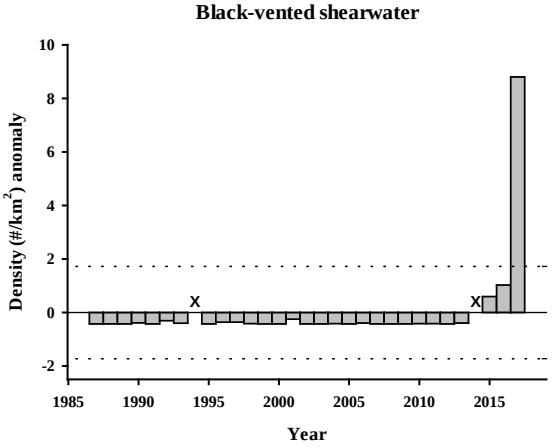
Common Name	Scientific Name	Summer 2017
American White Pelican	*Pelecanus erythrorhynchos*	
Ancient Murrelet	*Synthliboramphus antiquus*	
Arctic Loon	*Gavia arctica*	
Arctic Tern	*Sterna paradisaea*	
Ashy Storm-Petrel	*Oceanodroma homochroa*	2 / 1 / 0
Black guillemot	*Cepphus grylle*	
Black Scoter	*Melanitta nigra*	
Black Storm-Petrel	*Oceanodroma melania*	
Black-Footed Albatross	*Phoebastria nigripes*	21 / 21 / 0.04
Black-Legged Kittiwake	*Rissa tridactyla*	
Black-Vented Shearwater	*Puffinus opisthomelas*	4710 / 165 / 9.23
Bonaparte's Gull	*Larus philadelphia*	
Brandt's Cormorant	*Phalacrocorax penicillatus*	13 / 10 / 0.03
Brant	*Branta bernicla*	
Brown Booby	*Sula leucogaster*	5 / 4 / 0.01
Brown Noddy	*Anous stolidus*	
Brown Pelican	*Pelecanus occidentalis*	14 / 9 / 0.03
Buller's Shearwater	*Puffinus bulleri*	17 / 10 / 0.03
California Gull	*Larus californicus*	20 / 17 / 0.04
Caspian Tern	*Sterna caspia*	1 / 1 / 0
Cassin's Auklet	*Ptychoramphus aleuticus*	2 / 1 / 0
Clark's Grebe	*Aechmophorus clarkii*	
Common Loon	*Gavia immer*	
Common Murre	*Uria aalge*	627 / 69 / 1.23
Common Tern	*Sterna hirundo*	
Cook's Petrel	*Pterodroma cookii*	56 / 37 / 0.11
Craveri's Murrelet	*Synthliboramphus craveri*	
Dark Shearwater	(species group)	
Dark-Rumped Petrel	*Pterodroma phaeopygia sandwichensis*	
Double-Crested Cormorant	*Phalacrocorax auritus*	1 / 1 / 0
Eared Grebe	*Podiceps nigricollis*	
Elegant Tern	*Sterna elegans*	150 / 72 / 0.29
Flesh-Footed Shearwater	*Puffinus carneipes*	
Fork-Tailed Storm-Petrel	*Oceanodroma furcata*	
Forster's Tern	*Sterna forsteri*	
Franklin's Gull	*Larus pipixcan*	
Glaucous Gull	*Larus hyperboreus*	
Glaucous-Winged Gull	*Larus glaucescens*	
Guadalupe Murrelet	*Synthliboramphus hypoleucus*	1 / 1 / 0
Hawaiian Petrel	*Pterodroma sandwichensis*	
Heermann's Gull	*Larus heermanni*	23 / 12 / 0.05
Herring Gull	*Larus argentatus*	

Horned Puffin	*Fratercula corniculata*	
Hybrid Gull	(species group)	
Juan Fernandez Petrel	*Pterodroma externa*	
Kelp Gull	*Larus dominicanus*	
Kermadec Petrel	*Pterodroma neglecta*	
Laughing Gull	*Larus atricilla*	
Laysan Albatross	*Phoebastria immutabilis*	
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	91 / 78 / 0.18
Least Storm-Petrel	*Oceanodroma microsoma*	
Least Tern	*Sterna antillarum*	
Long-Tailed Jaeger	*Stercorarius longicaudus*	
Marbled Murrelet	*Brachyramphus marmoratus*	
Mew Gull	*Larus canus*	
Mottled Petrel	*Pterodroma inexpectata*	
Murphy's Petrel	*Pterodroma ultima*	
Northern Fulmar	*Fulmarus glacialis*	
Osprey	*Pandion haliaetus*	
Pacific Loon	*Gavia pacifica*	
Parakeet Auklet	*Aethia psittacula*	
Parasitic Jaeger	*Stercorarius parasiticus*	5 / 4 / 0.01
Parkinson's Petrel	*Procellaria parkinsoni*	
Pelagic Cormorant	*Phalacrocorax pelagicus*	1 / 1 / 0
Peregrine Falcon	*Falco peregrinus*	
Pigeon Guillemot	*Cepphus columba*	
Pink-Footed Shearwater	*Puffinus creatopus*	254 / 69 / 0.5
Pomarine Jaeger	*Stercorarius pomarinus*	
Red Phalarope	*Phalaropus fulicaria*	35 / 12 / 0.07
Red-Billed Tropicbird	*Phaethon aethereus*	4 / 4 / 0.01
Red-Footed Booby	*Sula sula*	
Red-Necked Grebe	*Podiceps grisegena*	
Red-Necked Phalarope	*Phalaropus lobatus*	62 / 13 / 0.12
Red-Tailed Tropicbird	*Pheathon rubricauda*	
Red-Throated Loon	*Gavia stellata*	
Rhinoceros Auklet	*Cerorhinca monocerata*	
Ring-Billed Gull	*Larus delawarensis*	
Royal Tern	*Sterna maxima*	2 / 2 / 0
Ruddy Turnstone	*Arenaria interpres*	
Sabine's Gull	*Larus sabini*	11 / 3 / 0.02
Scripps's murrelet	*Synthliboramphus scrippsi*	10 / 5 / 0.02
Short-Tailed / Slender-Billed Shearwater	*Puffinus tenuirostris*	
Short-Tailed Albatross	*Phoebastria albatrus*	
Solander's Petrel	*Pterodroma solandri*	
Sooty Shearwater	*Puffinus griseus*	12050 / 251 / 23.62
South Polar Skua	*Stercorarius maccormicki*	1 / 1 / 0
Stejneger's Petrel	*Pterodroma longirostris*	
Surf Scoter	*Melanitta perspicillata*	
Thayer's Gull	*Larus thayeri*	
Townsend's Storm-Petrel	*Oceanodroma socorroensis*	

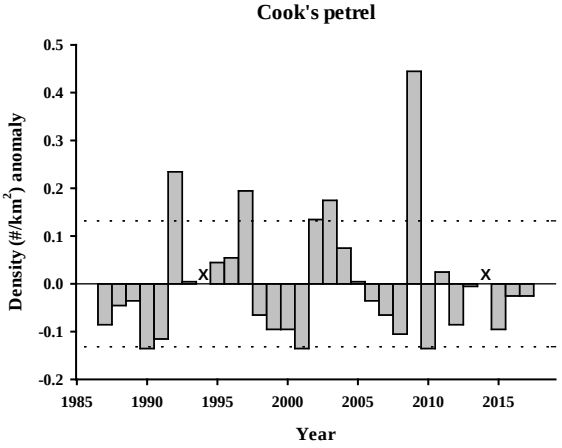
Tufted Puffin	*Fratercula cirrhata*	
Unidentified Albatross	(species group)	2 / 1 / 0
Unidentified Auklet	(species group)	
Unidentified Cormorant	(species group)	
Unidentified Duck	(species group)	
Unidentified Grebe	(species group)	
Unidentified Gull	(species group)	8 / 8 / 0.02
Unidentified Jaeger	(species group)	
Unidentified Large Alcid	(species group)	
Unidentified Leach's Storm-Petrel	(species group)	47 / 37 / 0.09
Unidentified Loon	(species group)	
Unidentified Murre	(species group)	3 / 2 / 0.01
Unidentified Petrel	(species group)	2 / 2 / 0
Unidentified Phalarope	(species group)	8 / 2 / 0.02
Unidentified Procellarid	(species group)	
Unidentified Shearwater	(species group)	1 / 1 / 0
Unidentified Skua	(species group)	
Unidentified Small Alcid	(species group)	
Unidentified Storm-Petrel	(species group)	13 / 12 / 0.03
Unidentified Tern	(species group)	1 / 1 / 0
Unidentified Tropicbird	(species group)	1 / 1 / 0
Wedge-Rumped Storm-Petrel	*Oceanodroma tethys*	
Wedge-Tailed Shearwater	*Puffinus pacificus*	
Western Grebe	*Aechmophorus occidentalis*	
Western Gull	*Larus occidentalis*	148 / 115 / 0.29
Wilson's Storm-Petrel	*Oceanites oceanicus*	
Xantus's / Craveri's Murrelet	(species group)	
Xantus's Murrelet	*Synthliboramphus hypoleucus*	

Figure 2. Density (expressed as anomalies) over time from summer surveys for species with warm water-affinity, core survey area only, 1987–2017. A) black-vented shearwater, B) Cook's petrel, and C) elegant tern. The dashed lines indicate ± 1 s.d. of the long-term mean, and 'x' indicates years when no summer survey was conducted.

A)



B)



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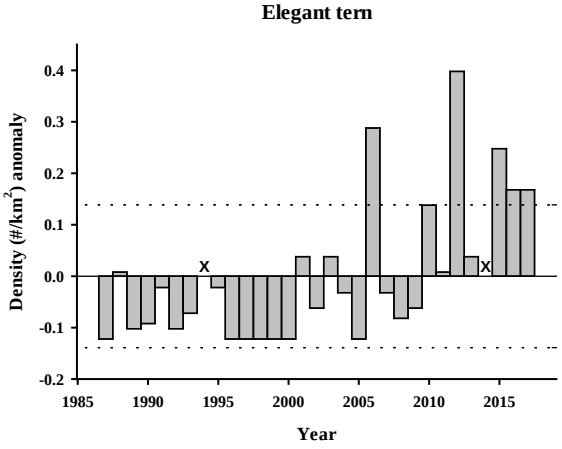
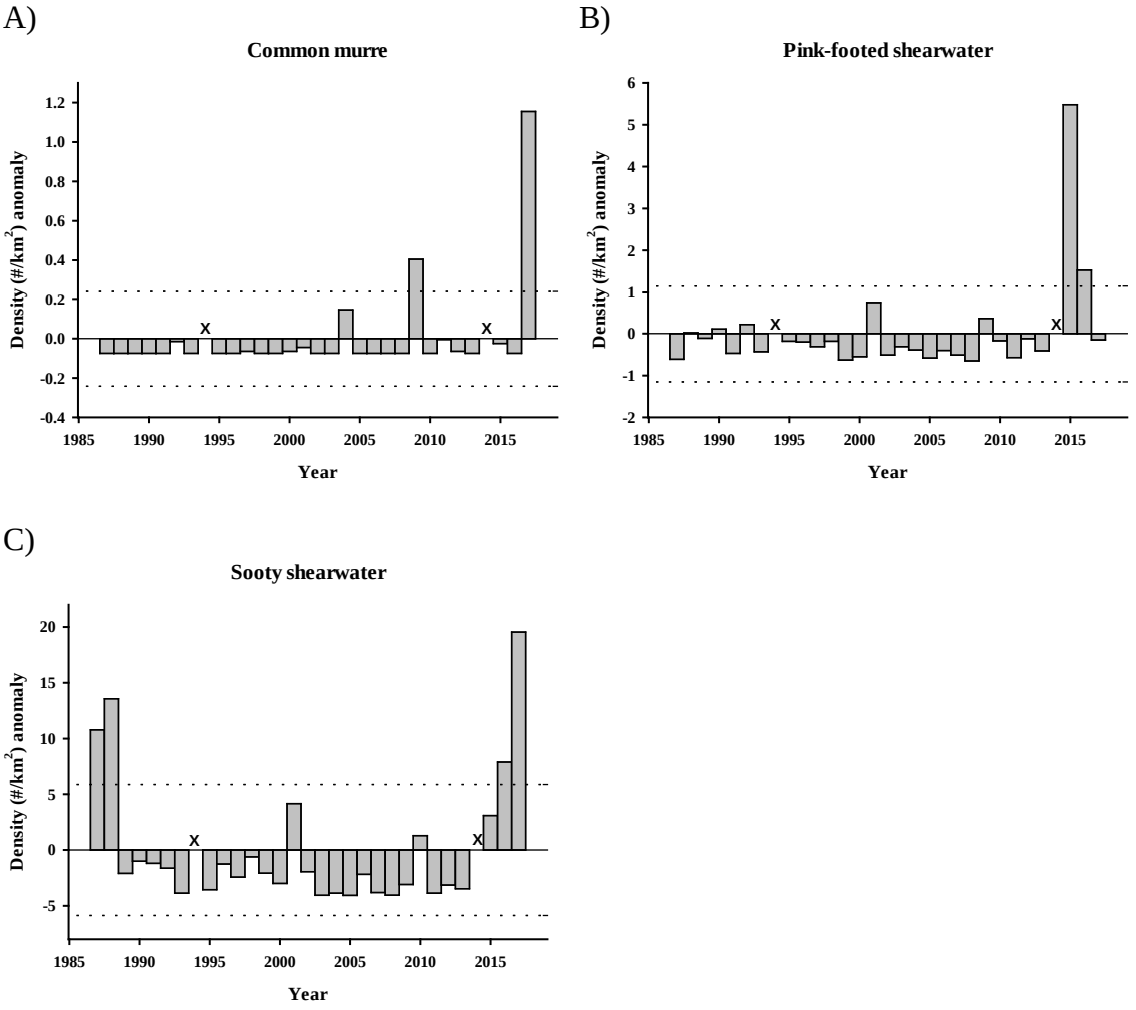


Figure 3. Density (expressed as anomalies) over time in the summer for species with cold water-affinities, core area only, 1987–2017. A) common murre, B) pink-footed shearwater, and C) sooty shearwater. The dashed lines indicate ± 1 s.d. of the long-term mean, and 'x' indicates years when no summer survey was conducted.



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Appendix 1. List of bird species excluded from this summary. These species may or may not have been observed during the survey.

Common Name	**Scientific Name**
American Coot	*Fulica americana*
Black Oystercatcher	*Haematopus bachmani*
Black Skimmer	*Rynchops niger*
Black Tern	*Chlidonias niger*
Black Turnstone	*Arenaria melanocephala*
Black-throated gray warbler	*Setophaga nigrescens*
Brewer's Sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Bufflehead	*Bucephala albeola*
Chapman's Storm-Petrel	*Oceanodroma leucorhoa chapmani*
Eurasian collared dove	*Streptopelia decaocto*
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*
Savannah sparrow	*Passerculus sandwichensis*
Snow Goose	*Chen caerulescens*
Snowy Egret	*Egretta thula*
Townsend's warbler	*Setophaga townsendi*
Unidentified Bird	(species group)
Unidentified Dowitcher	
Unidentified Goose	(species group)
Unidentified Hummingbird	(species group)
Unidentified Passerine	(species group)
Unidentified raptor	(species group)
Unidentified Shorebird	(species group)
Wandering tattler	*Tringa incana*
Western Sandpiper	*Calidris mauri*
Whimbrel	*Numenius phaeopus*
White-Winged Scoter	*Melanitta fusca*
Willet	*Catoptrophorus semipalmatus*
Wilson's warbler	*Cardellina pusilla*
Yellow-Rumped Warbler	*Dendroica coronata*