

Seabirds on the CalCOFI/CCE-LTER Survey, Summer 2022 Data Report

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Introduction

Seabird surveys 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 that 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 35 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).

This data report summarizes observations made during the 2022 summer CalCOFI/CCE-LTER cruise. We present data on survey effort as well as summary information on seabird abundance, expressed at density (birds/km²).

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 every 20 seconds. Each observation includes the species, the number of individuals observed, and their behavior (mostly “flying” or “sitting on the water”). 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 that contains data from 1987 to the present. These data are used to derive summary statistics.

Taxa excluded from this summary were all mammals, fish, terrestrial birds, and most shorebirds except phalaropes, which are largely pelagic. Species density was calculated as the total number of individuals observed per species divided by the area (km²) surveyed. Density over time was shown for select species of warm- and cold-water affinities, 1987–2022. For this summer survey, we defined species with warm-water affinity to include black-footed albatross, black storm-petrel, black-vented shearwater, brown pelican, Cook’s petrel, elegant tern, and Leach’s storm-petrel (Hyrenbach and Veit 2003). Since 2017 we have used a category for unidentified Leach’s storm-petrels that includes all newly-described species and subspecies under a single heading; in the summary, these birds are combined with Leach’s storm-petrel. Cold-water affinity species include Cassin’s auklet, common murre, pink-footed shearwater, Buller’s shearwater, and sooty shearwater (Hyrenbach and Veit 2003). All of these species were considered together in a principal component analysis.

Results

A summary of survey effort is shown in Table 2; transects surveyed are shown in Figure 1. This survey took place only within the core area. Summarized species observations for all species are shown in Table 3 (see Appendix 1 for exclusions). A total of 16 days of survey effort covering 1,565 km (469 km²) of ocean habitat was tallied over the entire survey. Density over time for the selected seabird species (listed above) was calculated and is shown as anomalies in Figures 2 (warm-water affinity), 3 (cold-water affinity), and 4 (all seabird species).

Among the warm-water species, brown pelican and elegant tern had lower than average density this year (Figure 2). On the other hand, densities of black-footed albatross and black-vented shearwater were higher than average; black-vented shearwater density was second highest in the time series (Figure 2). The other warm-water species were near average density (Figure 2). Among the cold-water species, Cassin’s auklet was lower than average density, and pink-footed shearwater were near average (Figure 3). Sooty shearwater was higher than average but within 1 standard deviation, and Buller’s shearwater was 1 standard deviation above the mean (Figure 3). Common murres were present in the highest density of the time series, continuing the trend of increasing numbers over recent years. Lastly, the principal component analysis of all species combined illustrated the general increasing trend in seabird density over the course of our time series (Figure 4).

This summer CalCOFI survey occurred later in the calendar year than previous summer cruises, and some of the seabird trends described above likely reflect this shift in timing. For example, the vast majority of common murre sightings were nearshore father-chick pairs recorded north of Point Conception. Buller’s shearwater are normally rarely seen during regular summer CalCOFI cruise periods as they are fall migrants associated with cooler water. These examples suggest that this survey captured a more transitional seabird community than is usually observed on summer CalCOFI surveys, emphasizing migration and chick-rearing dynamics.

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	2022
Month	All
Bin length	All bins > 0.1 km
Region	Lines 77-93 (core area only)
Season	Summer

Table 2. Summary of survey effort and seabird statistics for the core area and extended survey area, spring 2022.

Summer 2022	Core + extended area
Survey vessel	<i>RV Bold Horizon</i>
Start date	8/14/2022
End date	8/29/2022
Number of survey days	16
Distance surveyed (km)	1,565
Area surveyed (km ²)	469
Number of bird species	41
Overall bird density (per km ²)	15.964
Total individuals counted	7,493

Figure 1. Transects sampled during the CalCOFI summer 2022 survey. The core study area is denoted with the box, and includes CalCOFI lines 93 (south) to 77 (north).

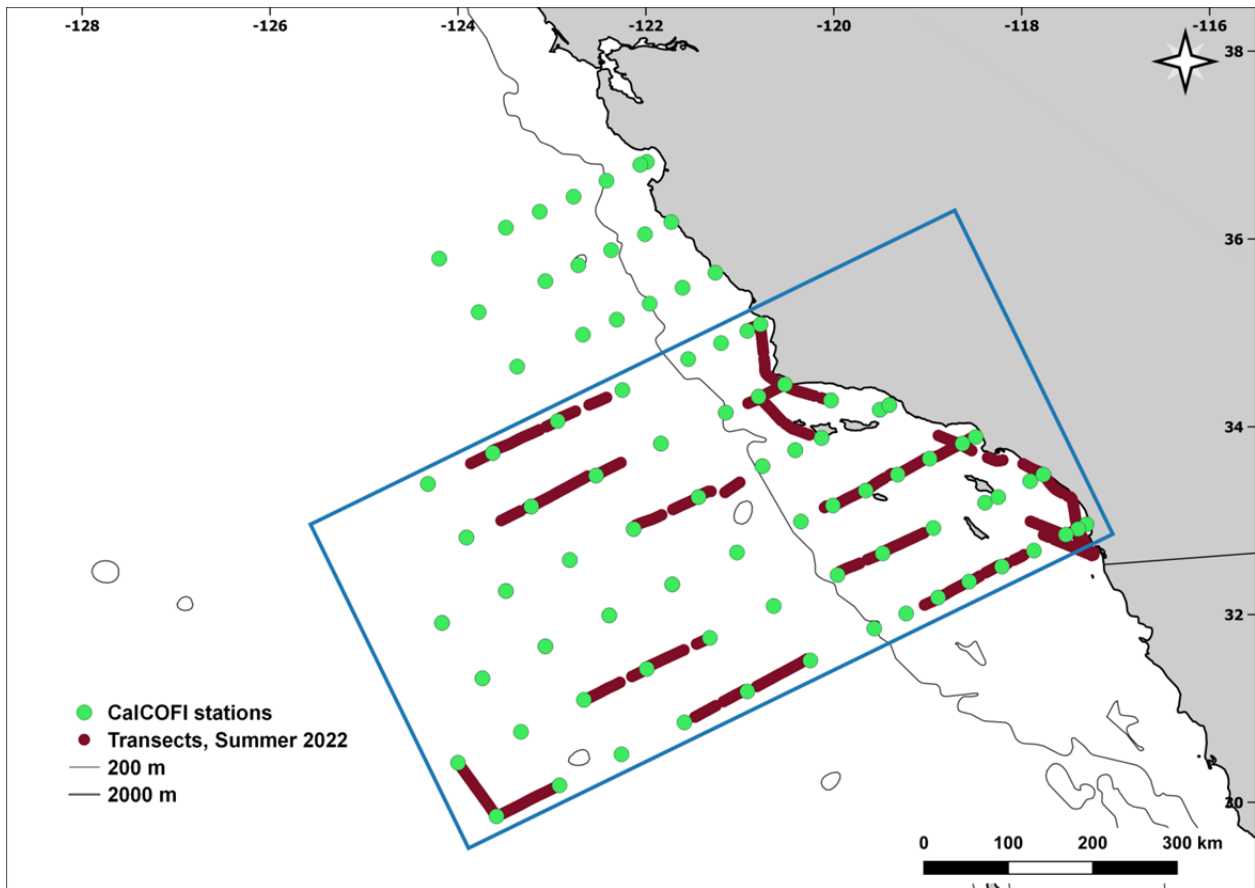


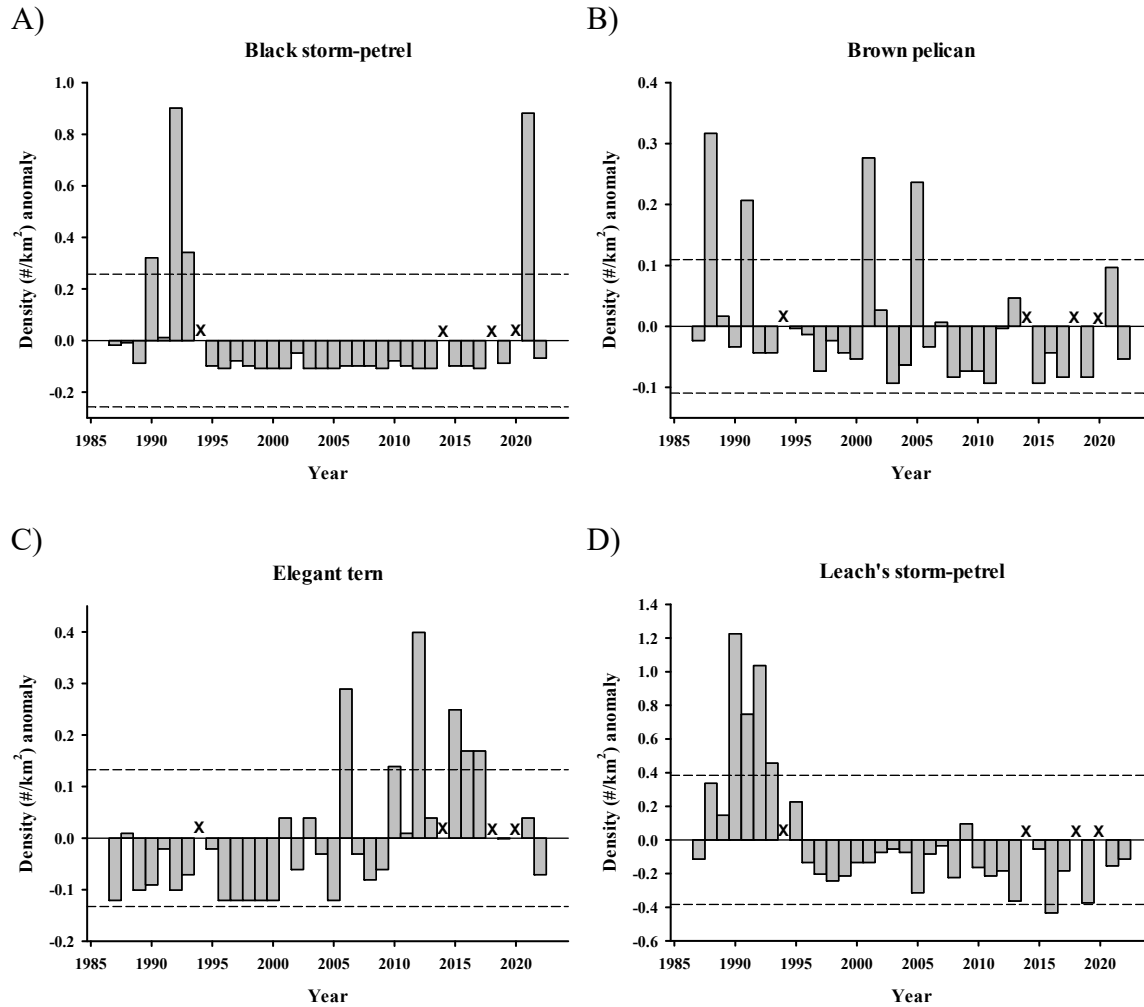
Table 3. Observations in summer 2022 by species in the core area; no surveying was done in the extended area (see Figure 1). Cell values: total number of individuals (ind.) / number of observations per species (obs.) / species density (dens.) in individuals per km².

Common Name	Scientific Name	Core only
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>	
Ashy Storm-Petrel	<i>Oceanodroma homochroa</i>	7 / 7 / 0.01
Black guillemot	<i>Cephus grylle</i>	
Black Scoter	<i>Melanitta nigra</i>	
Black Storm-Petrel	<i>Oceanodroma melania</i>	21 / 18 / 0.04
Black-Footed Albatross	<i>Phoebastria nigripes</i>	24 / 24 / 0.05
Black-Legged Kittiwake	<i>Rissa tridactyla</i>	
Black-Vented Shearwater	<i>Puffinus opisthomelas</i>	1314 / 155 / 2.8
Bonaparte's Gull	<i>Larus philadelphia</i>	2 / 2 / 0
Brandt's Cormorant	<i>Phalacrocorax penicillatus</i>	39 / 23 / 0.08
Brant	<i>Branta bernicla</i>	
Brown Booby	<i>Sula leucogaster</i>	5 / 5 / 0.01
Brown Noddy	<i>Anous stolidus</i>	
Brown Pelican	<i>Pelecanus occidentalis</i>	29 / 14 / 0.06
Buller's Shearwater	<i>Puffinus bulleri</i>	57 / 51 / 0.12
California Gull	<i>Larus californicus</i>	38 / 28 / 0.08
Caspian Tern	<i>Sterna caspia</i>	4 / 4 / 0.01
Cassin's Auklet	<i>Ptychoramphus aleuticus</i>	8 / 2 / 0.02
Clark's Grebe	<i>Aechmophorus clarkii</i>	
Common Loon	<i>Gavia immer</i>	
Common Murre	<i>Uria aalge</i>	691 / 102 / 1.47
Common Tern	<i>Sterna hirundo</i>	7 / 6 / 0.01
Cook's Petrel	<i>Pterodroma cookii</i>	58 / 48 / 0.12
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>	
Eared Grebe	<i>Podiceps nigricollis</i>	
Elegant Tern	<i>Sterna elegans</i>	25 / 12 / 0.05
Flesh-Footed Shearwater	<i>Puffinus carneipes</i>	
Fork-Tailed Storm-Petrel	<i>Oceanodroma furcata</i>	
Forster's Tern	<i>Sterna forsteri</i>	1 / 1 / 0
Franklin's Gull	<i>Larus pipixcan</i>	
Glaucous Gull	<i>Larus hyperboreus</i>	
Glaucous-Winged Gull	<i>Larus glaucescens</i>	6 / 6 / 0.01
Glaucous-winged/Western Hybrid Gull		
Guadalupe Murrelet	<i>Synthliboramphus hypoleucus</i>	2 / 2 / 0

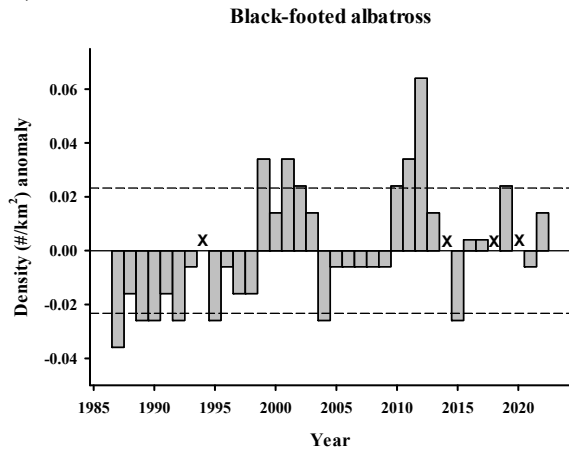
Hawaiian Petrel	<i>Pterodroma sandwichensis</i>	
Heermann's Gull	<i>Larus heermanni</i>	14 / 10 / 0.03
Herring Gull	<i>Larus argentatus</i>	
Horned Puffin	<i>Fratercula corniculata</i>	
Hybrid Gull	(species group)	
Juan Fernandez Petrel	<i>Pterodroma externa</i>	
Kelp Gull	<i>Larus dominicanus</i>	
Kermadec Petrel	<i>Pterodroma neglecta</i>	
Laughing Gull	<i>Larus atricilla</i>	
Laysan Albatross	<i>Phoebastria immutabilis</i>	
Leach's Storm-Petrel	<i>Oceanodroma leucorhoa</i>	160 / 148 / 0.34
Least Storm-Petrel	<i>Oceanodroma microsoma</i>	
Least Tern	<i>Sterna antillarum</i>	
Long-Tailed Jaeger	<i>Stercorarius longicaudus</i>	
Manx Shearwater	<i>Puffinus puffinus</i>	
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	
Masked Booby	<i>Sula dactylatra</i>	3 / 3 / 0.01
Mew Gull	<i>Larus canus</i>	
Mottled Petrel	<i>Pterodroma inexpectata</i>	
Murphy's Petrel	<i>Pterodroma ultima</i>	
Nazca Booby	<i>Sula granti</i>	1 / 1 / 0
Northern Fulmar	<i>Fulmarus glacialis</i>	2 / 2 / 0
Osprey	<i>Pandion haliaetus</i>	
Pacific Loon	<i>Gavia pacifica</i>	
Parakeet Auklet	<i>Aethia psittacula</i>	
Parasitic Jaeger	<i>Stercorarius parasiticus</i>	9 / 9 / 0.02
Parkinson's Petrel	<i>Procellaria parkinsoni</i>	
Pelagic Cormorant	<i>Phalacrocorax pelagicus</i>	
Peregrine Falcon	<i>Falco peregrinus</i>	
Pigeon Guillemot	<i>Cepphus columba</i>	
Pink-Footed Shearwater	<i>Puffinus creatopus</i>	350 / 118 / 0.75
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	3 / 2 / 0.01
Red Phalarope	<i>Phalaropus fulicaria</i>	37 / 26 / 0.08
Red-Billed Tropicbird	<i>Phaethon aethereus</i>	3 / 3 / 0.01
Red-Footed Booby	<i>Sula sula</i>	
Red-Necked Grebe	<i>Podiceps grisegena</i>	
Red-Necked Phalarope	<i>Phalaropus lobatus</i>	154 / 54 / 0.33
Red-Tailed Tropicbird	<i>Phaethon rubricauda</i>	
Red-Throated Loon	<i>Gavia stellata</i>	
Rhinoceros Auklet	<i>Cerorhinca monocerata</i>	1 / 1 / 0
Ring-Billed Gull	<i>Larus delawarensis</i>	6 / 5 / 0.01
Royal Tern	<i>Sterna maxima</i>	5 / 5 / 0.01
Ruddy Turnstone	<i>Arenaria interpres</i>	
Sabine's Gull	<i>Larus sabini</i>	2 / 2 / 0
Scripps's murrelet	<i>Synthliboramphus scrippsi</i>	2 / 1 / 0
Short-Tailed / Slender-Billed Shearwater	<i>Puffinus tenuirostris</i>	
Short-Tailed Albatross	<i>Phoebastria albatrus</i>	

Solander's Petrel	<i>Pterodroma solandri</i>	
Sooty Shearwater	<i>Puffinus griseus</i>	4211 / 262 / 8.97
South Polar Skua	<i>Stercorarius maccormicki</i>	
Stejneger's Petrel	<i>Pterodroma longirostris</i>	
Surf Scoter	<i>Melanitta perspicillata</i>	
Thayer's Gull	<i>Larus thayeri</i>	
Townsend's Storm-Petrel	<i>Oceanodroma socorroensis</i>	
Tufted Puffin	<i>Fratercula cirrhata</i>	
Unidentified Albatross	(species group)	
Unidentified Auklet	(species group)	
Unidentified Booby	(species group)	1 / 1 / 0
Unidentified Cormorant	(species group)	
Unidentified Duck	(species group)	
Unidentified Grebe	(species group)	
Unidentified Gull	(species group)	79 / 61 / 0.17
Unidentified Jaeger	(species group)	2 / 2 / 0
Unidentified Large Alcid	(species group)	
Unidentified Leach's Storm-Petrel	(species group)	
Unidentified Loon	(species group)	
Unidentified Murre	(species group)	
Unidentified Petrel	(species group)	
Unidentified Phalarope	(species group)	31 / 4 / 0.07
Unidentified Procellarid	(species group)	
Unidentified Shearwater	(species group)	
Unidentified Skua	(species group)	
Unidentified Small Alcid	(species group)	
Unidentified Storm-Petrel	(species group)	
Unidentified Tern	(species group)	2 / 2 / 0
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>	78 / 66 / 0.17
Wilson's Storm-Petrel	<i>Oceanites oceanicus</i>	
Xantus's / Craveri's Murrelet	(species group)	
Xantus's Murrelet	<i>Synthliboramphus hypoleucus</i>	

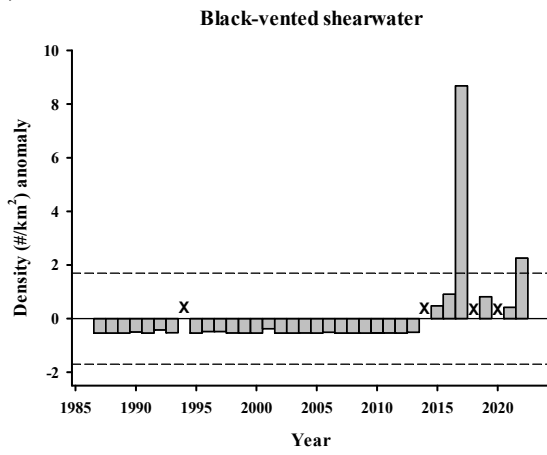
Figure 2. Density (expressed as anomalies) over time from summer surveys for species with warm-water affinity, core survey area, 1987–2022. A) black storm-petrel, B) brown pelican, C) elegant tern, D) Leach’s storm-petrel (includes unidentified Leach’s storm-petrels since 2017), E) black-footed albatross, F) black-vented shearwater, and G) Cook’s petrel. A–D are locally-breeding species. The dashed lines indicate ± 1 s.d. of the long-term mean, and ‘X’ indicates years when no summer survey was conducted.



E)



F)



G)

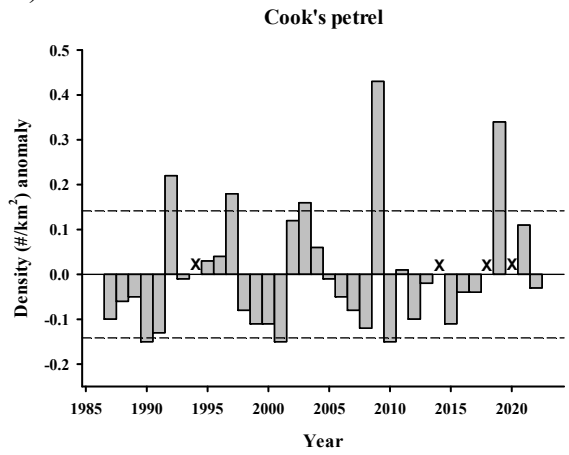


Figure 3. Density (expressed as anomalies) over time in the summer for species with cold-water affinities, core area only, 1987–2022. A) Cassin’s auklet, B) common murre, C) Buller’s shearwater, D) pink-footed shearwater, and E) sooty shearwater. Cassin’s auklet and common murre are locally-breeding species. The dashed lines indicate ± 1 s.d. of the long-term mean, and ‘X’ indicates years when no summer survey was conducted.

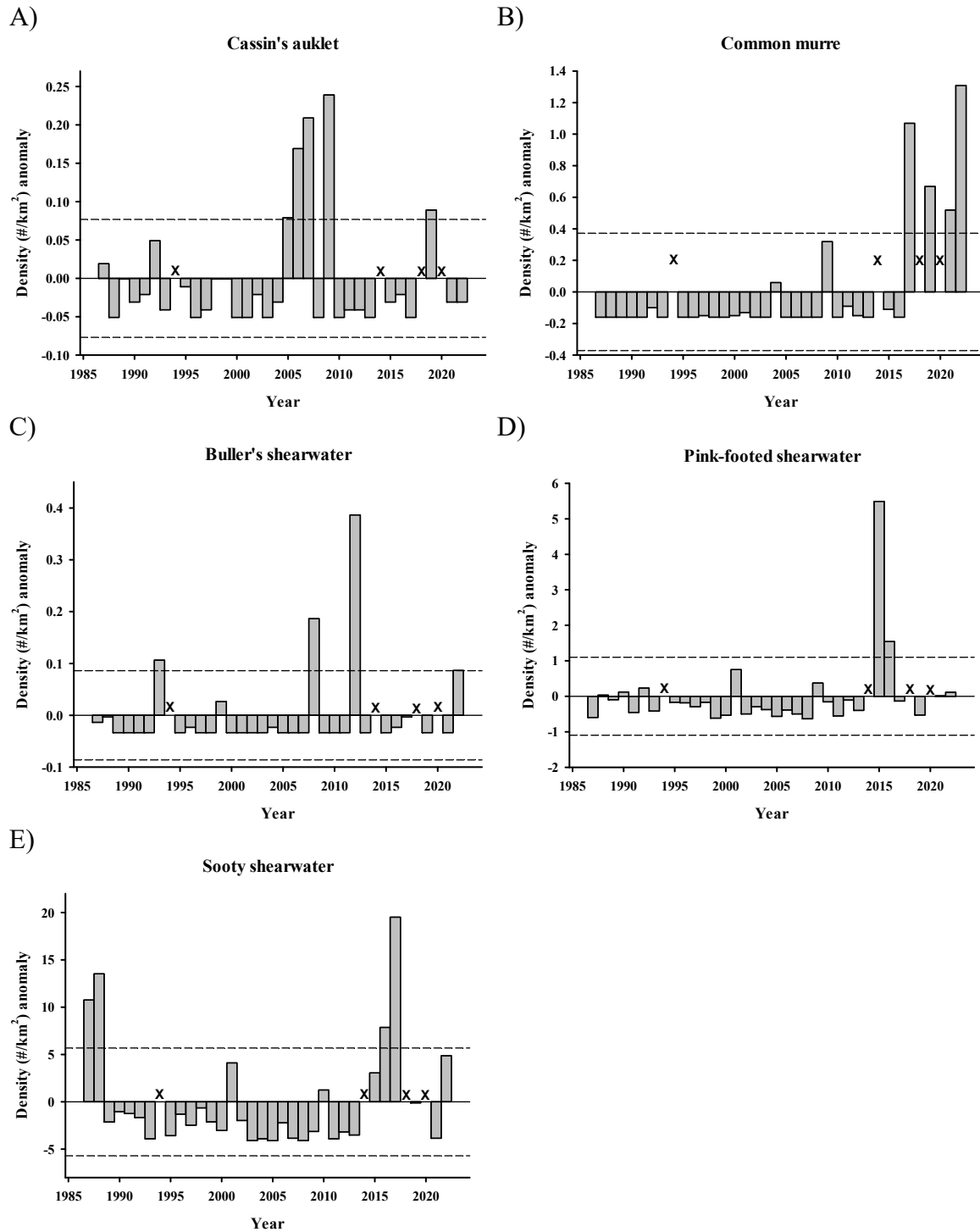
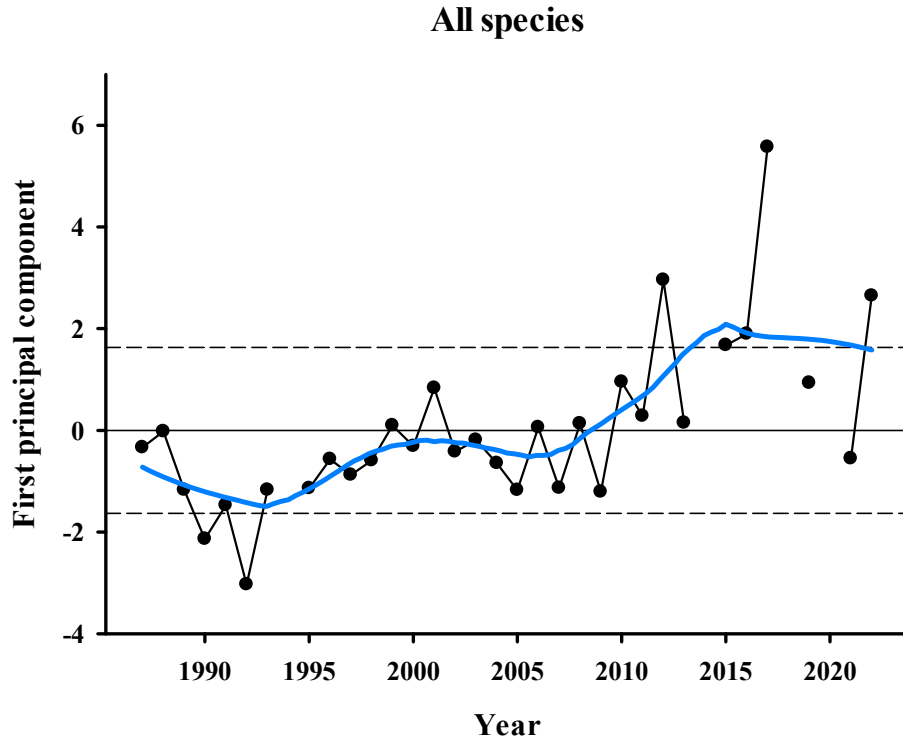


Figure 4. First principal component from principal component analysis of the species summarized in this report (core area) over time, 1987–2022. The dashed lines indicate ± 1 standard deviation. The blue line is a Loess smoothing function.



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Cover photo: Nazca booby aboard the survey vessel; photo by Brian Hoover.

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	<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>
Black-throated gray warbler	<i>Setophaga nigrescens</i>
Brewer's Sparrow	<i>Spizella breweri</i>
Brown-headed cowbird	<i>Molothrus ater</i>
Bufflehead	<i>Bucephala albeola</i>
Chapman's Storm-Petrel	<i>Oceanodroma leucorhoa chapmani</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>
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>
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 Dowitcher	
Unidentified Goose	(species group)
Unidentified Hummingbird	(species group)
Unidentified Passerine	(species group)
Unidentified raptor	(species group)
Unidentified Shorebird	(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>