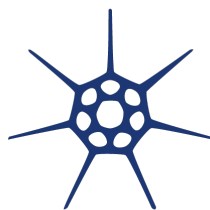


Seabirds and ocean conditions from the CalCOFI/CCE-LTER Survey: Summer 2026 data report

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Introduction

Surveys of seabirds at sea in the greater Southern California Bight 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, biodiversity, and distribution contribute to understanding the spatial ecology of the Southern California Bight and adjacent marine habitats (e.g., Santora et al. 2017), with application to marine spatial planning. This is a region characterized by substantial temporal environmental heterogeneity and a major biogeographic boundary at Point Conception. Third, by extending our existing records (currently 40 years and building; 1987–present) and coupling this information with long-term hydrographic and plankton data, the seabird data contribute to understanding the effects of climate variability and change on the southern sector of the California Current Ecosystem (CCE) (e.g., Veit et al. 1996, Hyrenbach and Veit 2003, Santora and Sydeman 2015, Sydeman et al. 2015).

This data report summarizes observations of seabirds at sea made within the CalCOFI core and full regions during the 2026 summer CalCOFI/CCE-LTER cruise. We include metadata on survey effort as well as summary information on seabird relative abundance, expressed as density (birds/km²), and ocean conditions during the survey period.

Methods

Ocean conditions. We present sea surface temperature (SST; C°) and wind averages for the period 29 June 2026 to 13 July 2026 for the full CalCOFI survey area. SST data and their anomalies (SSTa; baseline period 1991–2020) were downloaded from the Optimal Interpolation SST V.2.1 (OISST) dataset (<https://psl.noaa.gov/data/gridded/data.noaa.oisst.v2.highres.html>) and wind (speed and direction) data were downloaded for NOAA/NDBC buoys (<https://www.ndbc.noaa.gov>). Additionally, daily SST and wind averages for the study period are shown specifically for NOAA/NDBC buoy 46054 (https://www.ndbc.noaa.gov/station_page.php?station=46054).

Seabird observations. Observations of seabirds are made continuously during daylight ship transits between oceanographic/plankton sampling stations. The seabird observer, located on the flying bridge approximately 15 meters above sea level, uses hand-held binoculars and occasionally a digital camera 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 computer using the dedicated application “DLog”; the ship’s position is automatically recorded every 20 seconds from an externally connected GPS. 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, and these data are used to

derive summary statistics. The raw data are made publicly available in the fall each year on a [NOAA ERDDAP server](#).

Calculation of seabird densities. Taxa excluded from this summary are all mammals, fish, turtles, terrestrial birds, and most shorebirds except phalaropes, which are found in the pelagic realm. Species densities were calculated as the total number of individuals observed divided by the total area (km²) surveyed during the cruise. Density is expressed by log₁₀ function; a constant of 0.01 was added to each species' density prior to transformation. Trends in anomalies of log₁₀-transformed density are shown for selected species for the period 1987 through 2026. In phylogenetic order, species included were sooty shearwater *Ardenna grisea*, pink-footed shearwater *A. creatopus*, black-footed albatross *Phoebastria nigripes*, Cook's petrel *Pterodroma cookii*, a Leach's storm-petrel complex (Leach's storm-petrel *Hydrobates leucorhous*, Townsend's storm-petrel *H. socorroensis*, and unidentified Leach's storm-petrels), small alcids (grouped Scripps' murrelet *Synthliboramphus scrippsi*, Craveri's murrelet *S. craveri*, and Guadalupe murrelet *S. hypoleucus*), Cassin's auklet *Ptychoramphus aleuticus*, common murre *Uria aalge*, Brandt's cormorant *Urile penicillatus*, brown pelican *Pelecanus occidentalis*, western gull *Larus occidentalis*, Heermann's gull *Larus heermanni*, elegant tern *Thalasseus elegans*, grouped red and red-necked phalaropes *Phalaropus fulicarius* and *P. lobatus*, and grouped boobies: blue-footed booby *Sula nebouxii*, brown booby *S. leucogaster*, Nazca booby *S. granti*, and red-footed booby *S. sula*. Trends in seabird density were examined using Spearman rank correlation.

Results

Ocean conditions. The summer CalCOFI survey transited through a short upwelling event around Point Conception with cool water while the Southern California Bight experienced warmer ocean temperatures (Figure 1A). These conditions (upwelling in the northern part of the survey and warm water in the bight) are illustrated in the sea surface temperature anomaly map (Figure 1B). Buoy data showed a consistent wind blowing toward the southeast for the first 12 days (with varying speeds) and then the wind blew from the west during the last three days (Figure 2).

Surveying effort. A summary of survey effort is shown in Table 1; transects surveyed are shown in Figure 3. Survey effort occurred over 15 days and covered 1,285 km (386 km²) of ocean habitat; 1,200 km (360 km²) were surveyed over 15 days in the core survey area (Figure 3; the core area was surveyed on all days).

Seabirds. Summarized species observations for all species are shown in Table 2 (see Appendix 1 for exclusions). Density over time for the selected seabird species (listed above) was calculated for the core survey area and are shown as anomalies within the long-term survey record in Figures 4–7. Sooty shearwaters and Cook's petrels were present at higher densities: both had densities greater than 1 s.d. of the mean and the density for Cook's petrel was the highest in the time series (Figure 4). Black-footed albatrosses, pink-footed shearwaters, and birds belonging to the Leach's storm-petrel complex were present at above average densities but within 1 s.d. of the mean (Figure 4). Small *Synthliboramphus* alcids had above average density, greater than 1 s.d. of the long-term mean (Figure 5). Common murre density was higher than average but within 1 s.d.

(Figure 5). Cassin's auklets were present at lower than average density but also within 1 s.d. of the mean (Figure 5). Brandt's cormorants had very high density, logging the third highest value in their time series and continuing an increasing trend since 2012 (Figure 6). Elegant terns also had high density and the third largest value in their time series, continuing an increasing trend since ~2000 (Figure 6). Heermann's gulls were present at higher than average density but within 1 s.d. of the mean, while western gulls were near average (Figure 6). Brown pelicans had density slightly lower than the mean (Figure 6). Phalaropes were present at very low density this summer, below 1 s.d. of the mean, while boobies had the highest value in the time series, continuing an increasing trend since 2015 (Figure 7).

Rank correlation analysis showed significant increasing trends for black-footed albatross, common murre, Brandt's cormorant, Heermann's gull, elegant tern, and grouped boobies, and decreasing trends for Leach's storm-petrel complex, western gull, and phalaropes ($p < 0.1$; Table 3).

Figure 1. Ocean conditions in the greater CalCOFI area for the period 29 June to 13 July 2026. White dots indicate CalCOFI sampling stations and NOAA/NDBC buoys are indicated with purple dots and orange star. A) Sea surface temperature (SST; $^{\circ}\text{C}$) and wind averages (speed and direction the wind is blowing). B) Sea surface temperature anomalies (SSTa; $^{\circ}\text{C}$) averages. Baseline period: 1991–2020.

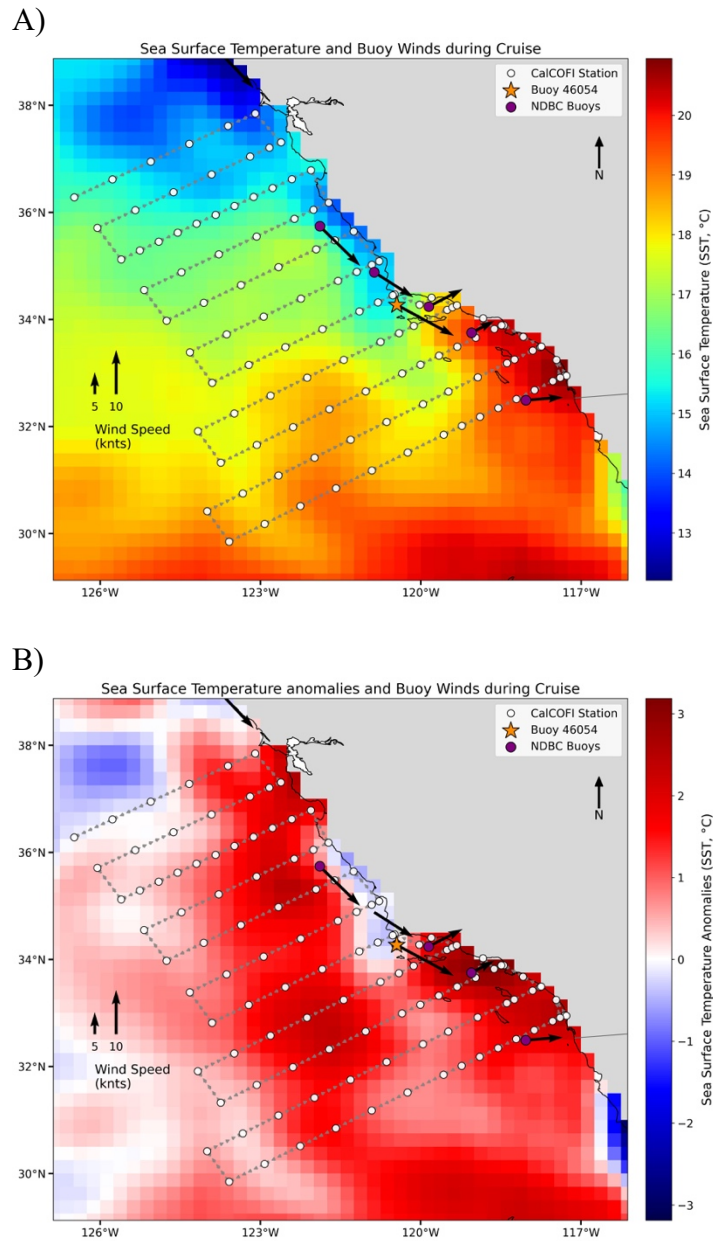


Figure 2. Daily SST (C°) and wind averages for the period 29 June to 13 July 2026 at NOAA/NDBC buoy 46054; location is marked in Figure 1 with an orange star. Bottom panel: arrow direction indicates the direction the wind is blowing (up = north) and the y-axis indicates wind speed scale in knots. Upwelling-favorable winds are strong winds to the southeast.

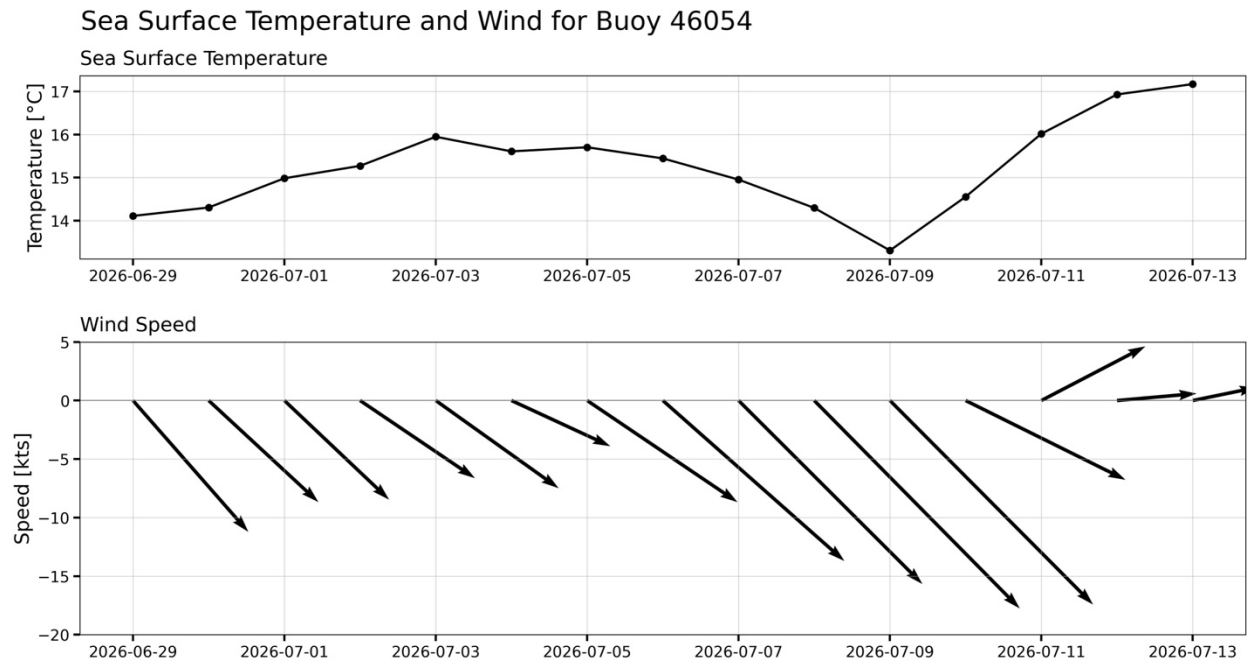


Table 1. Summary of survey effort and seabird statistics for the full and core survey areas, summer 2026.

Summer 2026	Full survey area	Core survey area
Survey vessel	<i>RV Bell M. Shimada</i>	
Start date	6/29/26	
End date	7/13/26	
Number of survey days	15	15
Distance surveyed (km)	1,285	1,200
Area surveyed (km ²)	386	360
Number of bird species	35	35
Overall bird density (per km ²)	16.833	16.532
Total individuals counted	6,490	5,952

Figure 3. Transects sampled during the CalCOFI summer 2026 survey. The core study area is denoted with the blue box and includes CalCOFI lines 93 (south) to 77 (north).

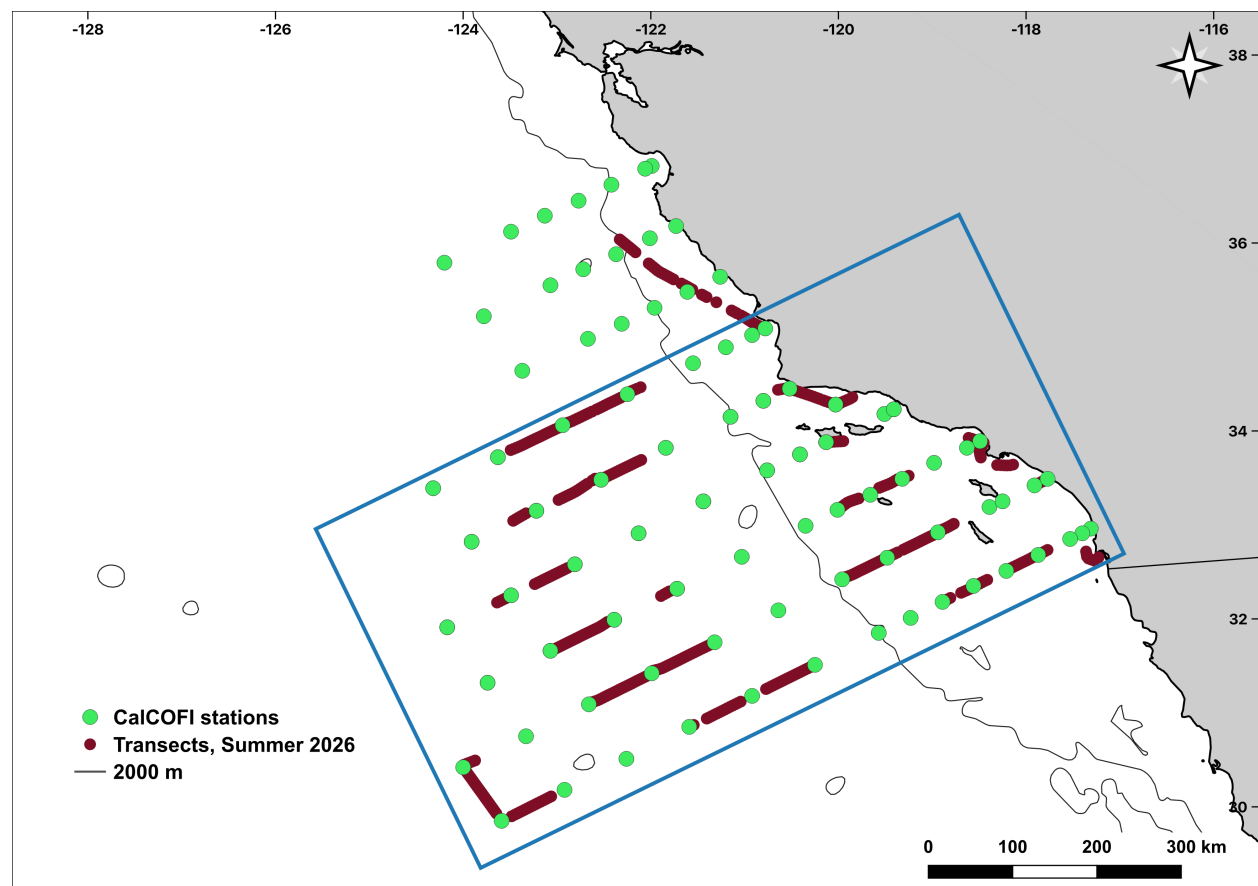


Table 2. Observations in summer 2026 of species in the full and core survey areas (see Figure 3). Cell values: total number of individuals (ind.) / number of observations per species (obs.) / species density (dens.) in individuals per km².

Common Name	Scientific Name	Full area	Core area
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>Hydrobates homochroa</i>	8 / 3 / 0.02	8 / 3 / 0.02
Black guillemot	<i>Cepphus grylle</i>		
Black storm-petrel	<i>Hydrobates melania</i>	30 / 20 / 0.08	30 / 20 / 0.08
Black-footed albatross	<i>Phoebastria nigripes</i>	18 / 16 / 0.05	18 / 16 / 0.05
Black-legged kittiwake	<i>Rissa tridactyla</i>		
Black-vented shearwater	<i>Puffinus opisthomelas</i>	30 / 11 / 0.08	30 / 11 / 0.08
Blue-footed booby	<i>Sula nebouxii</i>		
Bonaparte's gull	<i>Chroicocephalus philadelphia</i>		
Brandt's cormorant	<i>Urile penicillatus</i>	37 / 15 / 0.1	37 / 15 / 0.1
Brant	<i>Branta bernicla</i>		
Brown booby	<i>Sula leucogaster</i>	11 / 3 / 0.03	11 / 3 / 0.03
Brown pelican	<i>Pelecanus occidentalis</i>	27 / 9 / 0.07	27 / 9 / 0.07
Buller's shearwater	<i>Ardenna bulleri</i>		
California gull	<i>Larus californicus</i>		
Caspian tern	<i>Hydroprogne caspia</i>	2 / 1 / 0.01	2 / 1 / 0.01
Cassin's auklet	<i>Ptychoramphus aleuticus</i>	5 / 4 / 0.01	3 / 3 / 0.01
Clark's grebe	<i>Aechmophorus clarkii</i>		
Common loon	<i>Gavia immer</i>		
Common murre	<i>Uria aalge</i>	55 / 28 / 0.14	39 / 20 / 0.11
Common tern	<i>Sterna hirundo</i>		
Cook's petrel	<i>Pterodroma cookii</i>	330 / 146 / 0.86	329 / 145 / 0.91
Craveri's murrelet	<i>Synthliboramphus craveri</i>		
Dark shearwater	(species group)		
Dark-rumped petrel	<i>Pterodroma phaeopygia sandwichensis</i>		
Double-crested cormorant	<i>Nannopterum auritum</i>		
Eared grebe	<i>Podiceps nigricollis</i>		
Elegant tern	<i>Thalasseus elegans</i>	167 / 76 / 0.43	167 / 76 / 0.46
Flesh-footed shearwater	<i>Ardenna carneipes</i>	1 / 1 / 0.0	1 / 1 / 0.0
Fork-tailed storm-petrel	<i>Hydrobates furcata</i>		
Forster's tern	<i>Sterna forsteri</i>		
Franklin's gull	<i>Leucophaeus pipixcan</i>		
Glaucous gull	<i>Larus hyperboreus</i>		
Glaucous-winged gull	<i>Larus glaucescens</i>	2 / 2 / 0.01	2 / 2 / 0.01
Glaucous-winged/Western hybrid gull			
Guadalupe murrelet	<i>Synthliboramphus hypoleucus</i>	3 / 2 / 0.01	3 / 2 / 0.01
Hawaiian petrel	<i>Pterodroma sandwichensis</i>		
Heermann's gull	<i>Larus heermanni</i>	12 / 8 / 0.03	12 / 8 / 0.03
Herring gull	<i>Larus argentatus</i>		
Horned puffin	<i>Fratercula corniculata</i>		

Hybrid gull	(species group)		
Kelp gull	<i>Larus dominicanus</i>		
Laughing gull	<i>Leucophaeus atricilla</i>		
Laysan albatross	<i>Phoebastria immutabilis</i>	2 / 2 / 0.01	2 / 2 / 0.01
Leach's storm-petrel complex	(species group)	253 / 231 / 0.66	244 / 222 / 0.68
Least storm-petrel	<i>Hydrobates 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>	4 / 4 / 0.01	4 / 4 / 0.01
Mottled petrel	<i>Pterodroma inexpectata</i>		
Murphy's petrel	<i>Pterodroma ultima</i>		
Nazca booby	<i>Sula granti</i>	1 / 1 / 0.0	1 / 1 / 0.0
Northern fulmar	<i>Fulmarus glacialis</i>	1 / 1 / 0.0	1 / 1 / 0.0
Pacific loon	<i>Gavia pacifica</i>		
Parakeet auklet	<i>Aethia psittacula</i>		
Parasitic jaeger	<i>Stercorarius parasiticus</i>		
Pelagic cormorant	<i>Urile pelagicus</i>		
Pigeon guillemot	<i>Cephus columba</i>		
Pink-footed shearwater	<i>Ardenna creatopus</i>	191 / 66 / 0.5	183 / 58 / 0.51
Pomarine jaeger	<i>Stercorarius pomarinus</i>	1 / 1 / 0.0	1 / 1 / 0.0
Red phalarope	<i>Phalaropus fulicaria</i>		
Red-billed tropicbird	<i>Phaethon aethereus</i>	1 / 1 / 0.0	1 / 1 / 0.0
Red-footed booby	<i>Sula sula</i>		
Red-necked grebe	<i>Podiceps grisegena</i>		
Red-necked phalarope	<i>Phalaropus lobatus</i>	52 / 14 / 0.13	41 / 8 / 0.11
Red-tailed tropicbird	<i>Pheathon rubricauda</i>		
Red-throated loon	<i>Gavia stellata</i>		
Rhinoceros auklet	<i>Cerorhinca monocerata</i>	1 / 1 / 0.0	1 / 1 / 0.0
Ring-billed gull	<i>Larus delawarensis</i>		
Royal tern	<i>Thalasseus maximus</i>	9 / 7 / 0.02	9 / 7 / 0.02
Sabine's gull	<i>Xema sabini</i>		
Scripps's murrelet	<i>Synthliboramphus scrippsi</i>	10 / 4 / 0.03	10 / 4 / 0.03
Short-billed gull	<i>Larus brachyrhynchus</i>		
Short-tailed / Slender-billed shearwater	<i>Ardenna tenuirostris</i>		
Short-tailed albatross	<i>Phoebastria albatrus</i>		
Sooty shearwater	<i>Ardenna grisea</i>	5066 / 483 / 13.14	4580 / 366 / 12.72
South polar skua	<i>Stercorarius maccormicki</i>	1 / 1 / 0.0	1 / 1 / 0.0
Surf scoter	<i>Melanitta perspicillata</i>		
Thayer's gull	<i>Larus glaucooides thayeri</i>		
Tufted puffin	<i>Fratercula cirrhata</i>		
Unidentified albatross	(species group)		
Unidentified auklet	(species group)		
Unidentified booby	(species group)		
Unidentified cormorant	(species group)		
Unidentified gull	(species group)	2 / 2 / 0.01	2 / 2 / 0.01
Unidentified jaeger	(species group)		
Unidentified large alcid	(species group)		
Unidentified loon	(species group)		

Unidentified murre	(species group)		
Unidentified murrelet	(species group)		
Unidentified petrel	(species group)		
Unidentified phalarope	(species group)		
Unidentified procellarid	(species group)		
Unidentified shearwater	(species group)		
Unidentified small alcid	(species group)		
Unidentified storm-petrel	(species group)		
Unidentified tern	(species group)	1 / 1 / 0.0	1 / 1 / 0.0
Wedge-rumped storm-petrel	<i>Hydrobates tethys</i>		
Wedge-tailed shearwater	<i>Puffinus pacificus</i>		
Western grebe	<i>Aechmophorus occidentalis</i>		
Western gull	<i>Larus occidentalis</i>	155 / 116 / 0.4	150 / 111 / 0.42
Wilson's storm-petrel	<i>Oceanites oceanicus</i>		
Xantus's murrelet	<i>Synthliboramphus hypoleucus</i>		

Figure 4. Log₁₀ density anomalies for select procellariiform seabird species, core survey area, summer 1987–2026. A) sooty shearwater, B) pink-footed shearwater, C) black-footed albatross, D) Cook’s petrel, and F) Leach’s storm-petrel complex (includes unidentified and subspecies identified since 2017). The shearwaters, albatrosses, and petrels are migrant species to the Southern California Bight region. Dashed lines indicate ± 1 s.d. of the long-term mean, and ‘X’ indicates years when no survey was conducted. A constant of 0.01 was added to each density prior to log₁₀ transformation and the anomaly calculation.

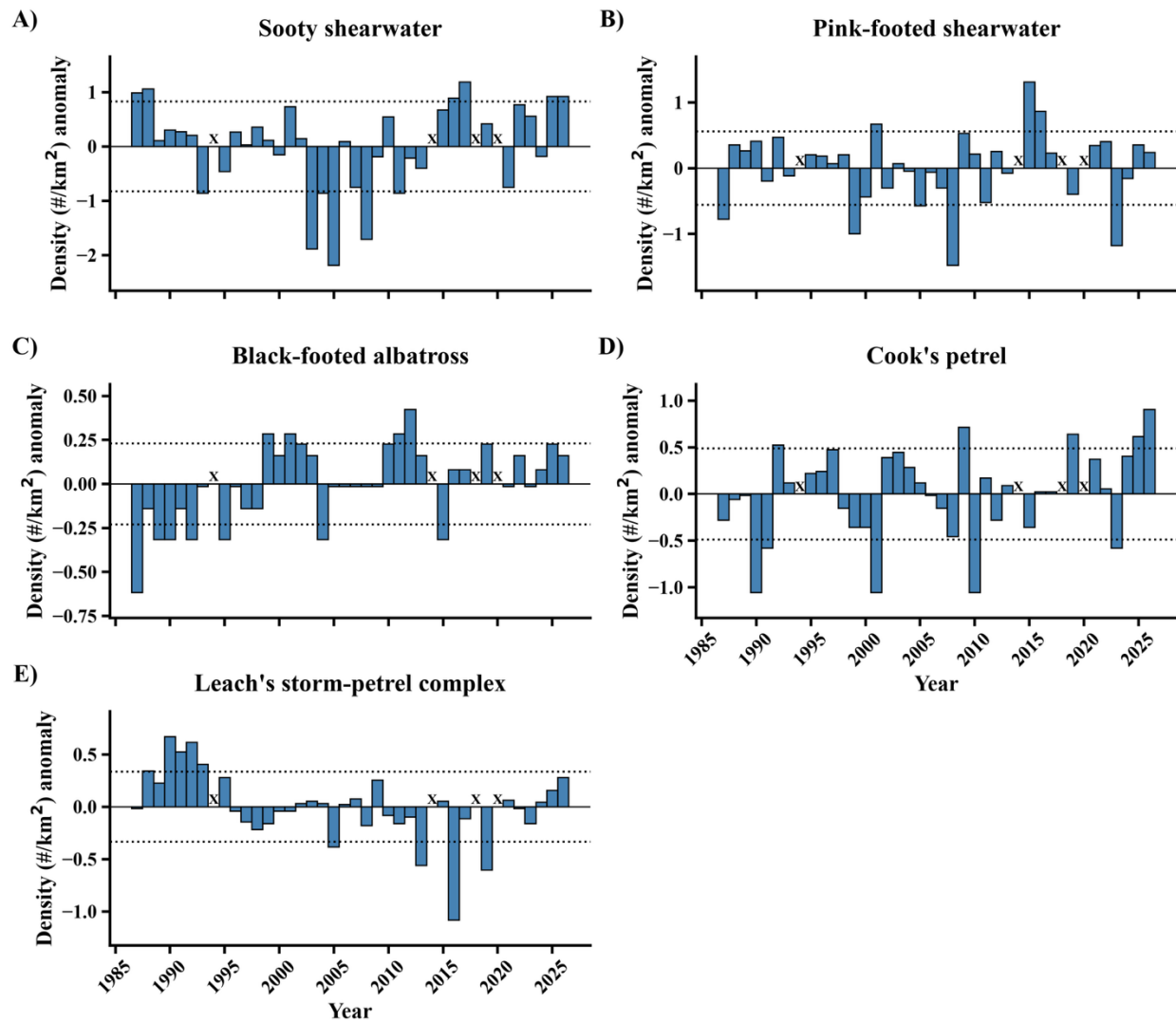


Figure 5. Log₁₀ density anomalies for select alcid species, core survey area, summer 1987–2026. A) Small *Synthliboramphus* alcids (Scripps', Xantus', Craveri's, and Guadalupe murrelets grouped), B) Cassin's auklet, and C) common murre. All of these species are locally breeding species in the California Current Ecosystem. The dashed lines indicate ± 1 s.d. of the long-term mean, and 'X' indicates years when no survey was conducted. A constant of 0.01 was added to each density prior to log₁₀ transformation and the anomaly calculation.

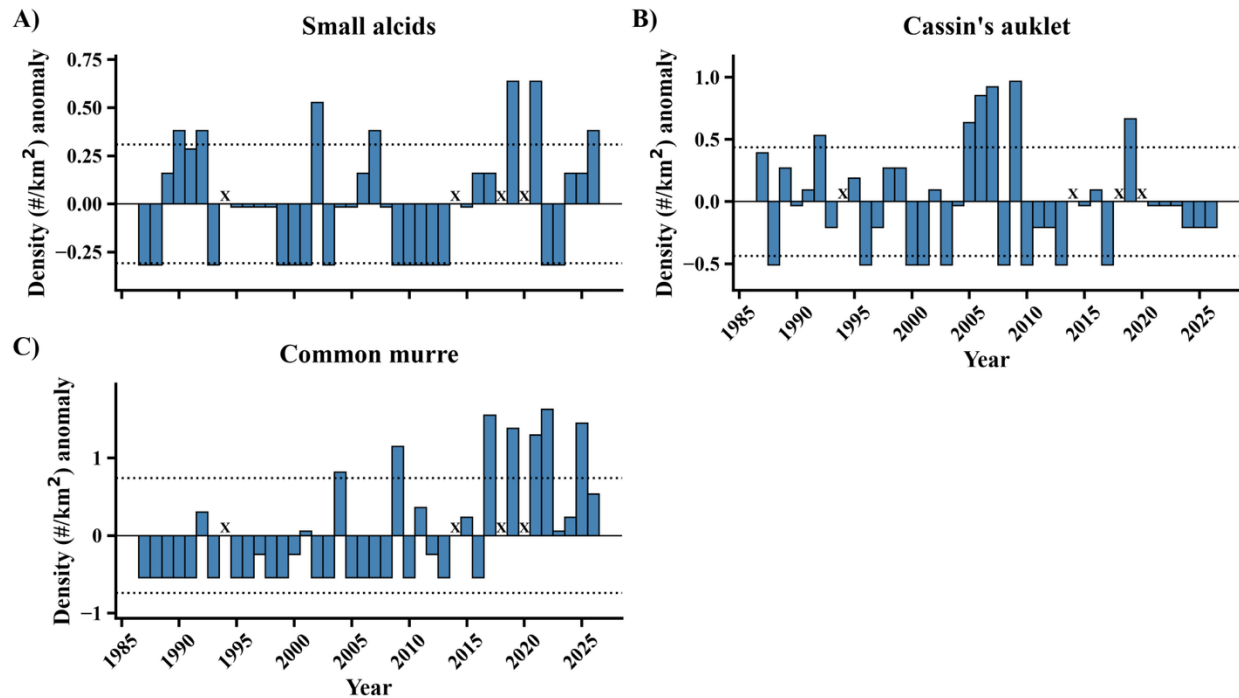


Figure 6. Log₁₀ density anomalies for select seabird species, core survey area, summer 1987–2026. A) Brandt’s cormorant, B) brown pelican, C) western gull, D) Heermann’s gull, and E) elegant tern. Brandt’s cormorant, brown pelican, western gull, and elegant tern are locally breeding species. The dashed lines indicate ± 1 s.d. of the long-term mean, and ‘X’ indicates years when no survey was conducted. A constant of 0.01 was added to each density prior to log₁₀ transformation and the anomaly calculation.

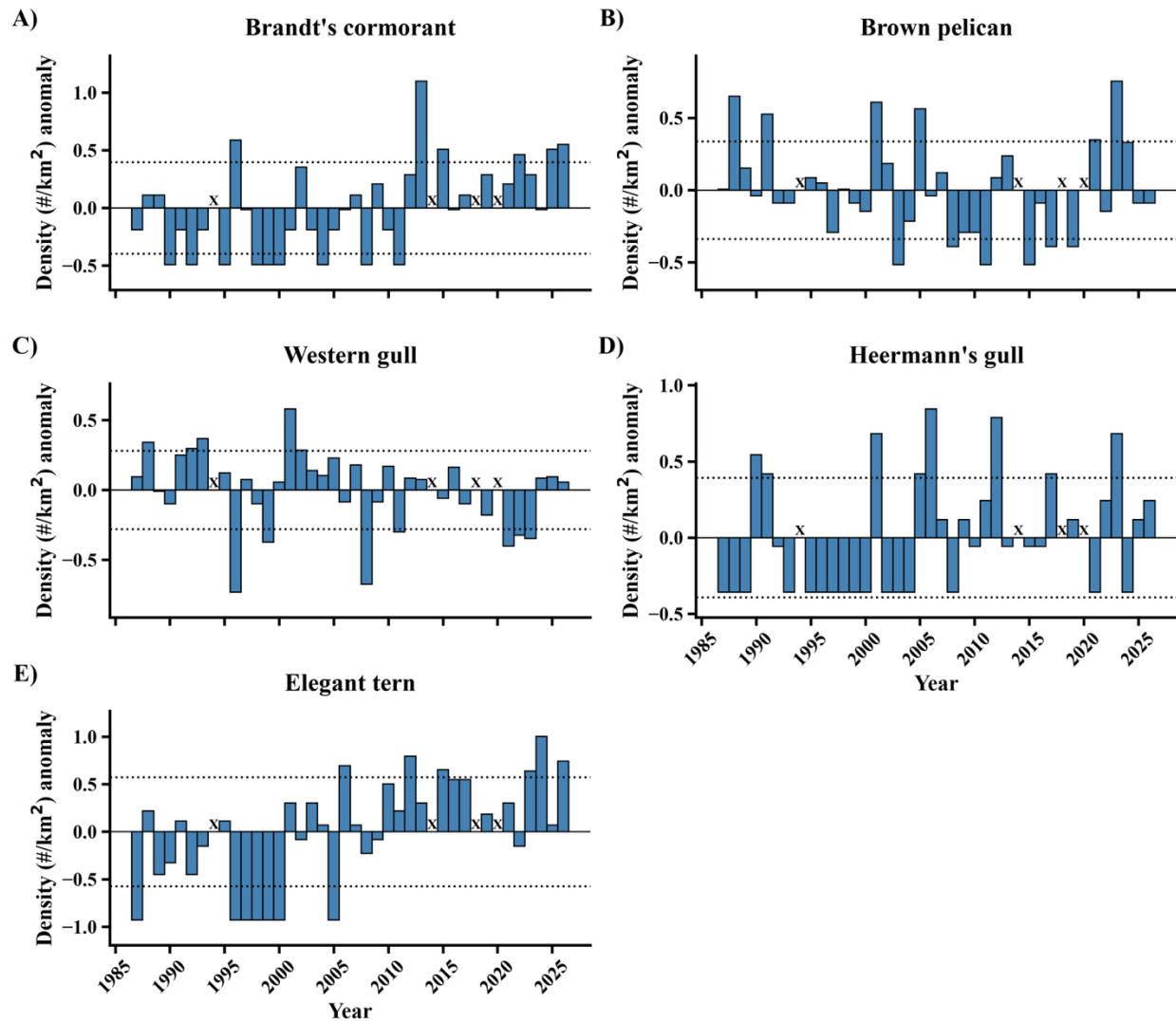


Figure 7. Log₁₀ density anomalies for select migrant seabird species, core survey area, summer 1987–2026. A) Phalaropes (grouped red and red-necked phalaropes) and B) boobies (grouped brown, Nazca, masked, blue-footed, and red-footed). The dashed lines indicate ± 1 s.d. of the long-term mean, and ‘X’ indicates years when no survey was conducted. A constant of 0.01 was added to each density prior to log₁₀ transformation and the anomaly calculation.

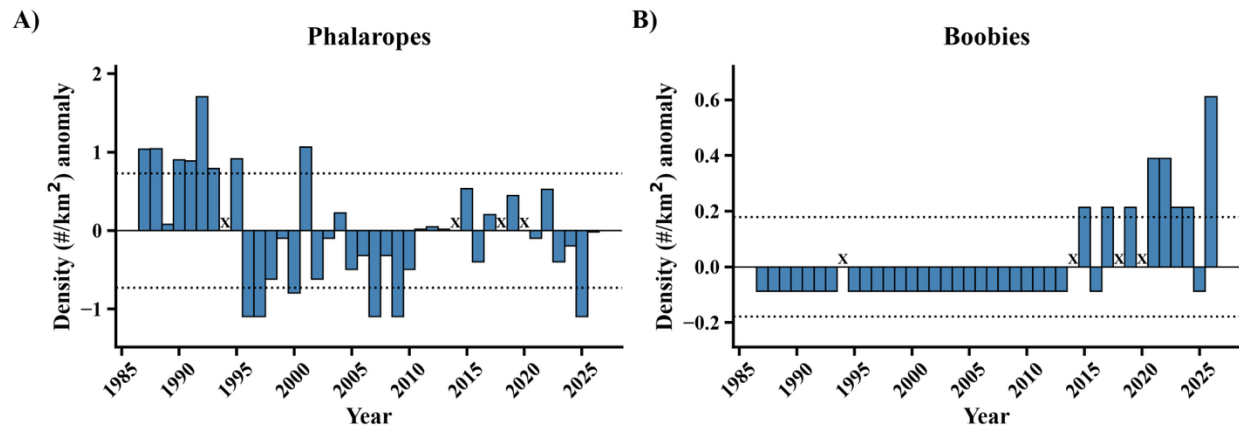


Table 3. Results of Spearman rank correlation of seabird density over time to indicate trends.
Bold: nominal significance $p < 0.1$. N = 36 years of data.

Species/Group	rho	p-value
Sooty shearwater	0.10	0.575
Pink-footed shearwater	0.07	0.703
Black-footed albatross	0.54	0.001
Cook's petrel	0.27	0.113
Leach's storm-petrel complex	-0.34	0.043
Small alcids	0.12	0.469
Cassin's auklet	-0.13	0.432
Common murre	0.62	<0.001
Brandt's cormorant	0.52	0.001
Brown pelican	-0.20	0.244
Western gull	-0.33	0.046
Heermann's gull	0.37	0.026
Elegant tern	0.63	<0.001
Phalaropes	-0.32	0.060
Boobies	0.67	<0.001

References

- Hyrenbach, D.K., and R.R. Veit. 2003. Ocean warming and seabird communities of the Southern California Current System (1987–98): response at multiple temporal scales. *Deep-Sea Research Part II* 50:2537–2565.
- Santora, J.A. and W.J. Sydeman. 2015. Persistence of hotspots and variability of seabird species richness and abundance in the southern California Current. *Ecosphere* 6:214.
- Santora, J.A., W.J. Sydeman, I.D. Schroeder, J.C. Field, R.R. Miller, and B.K. Wells. 2017. Persistence of trophic hotspots and relation to human impacts within an upwelling marine ecosystem. *Ecological Applications* 27:560–574.
- Sydeman, W.J., S.A. Thompson, J.A. Santora, J.A. Koslow, R. Goericke, and M.D. Ohman. 2015. Climate-ecosystem change off southern California: Time-dependent seabird predator-prey numerical responses. *Deep-Sea Research Part II* 112:158–170.
- Veit, R.R., P. Pyle, and J.A. McGowan. 1996. Ocean warming and long-term change in pelagic bird abundance within the California Current System. *Marine Ecology Progress Series* 139:11–18.
- Velarde, E., E. Ezcurra, M.H. Horn, and R.T. Patton. 2015. Warm oceanographic anomalies and fishing pressure drive seabird nesting north. *Science Advances* 1:e1400210.

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>
Blue-footed booby	<i>Sula nebouxii</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>
Waved albatross	<i>Phoebastria irrorata</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>