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

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Cover Photo: Waved albatross, 23 January 2026. Photo by Melody Baran.

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), a region characterized by substantial temporal environmental heterogeneity and a major biogeographic boundary at Point Conception, with application to marine spatial planning. 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 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 winter CalCOFI/CCE-LTER cruise. We include metadata on survey effort as well as summary information on seabird relative abundance, expressed as density (birds/km^2), and ocean conditions during the survey period.

Methods

Ocean conditions. We present sea surface temperature (SST; C°) and wind averages for the period 8 to 31 January 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). 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 per species divided by the total area (km^2) surveyed during the cruise. Density is expressed by log_{10} function; a constant of 0.01 was added to each species' density prior to transformation. Trends in anomalies of log_{10}-transformed density are shown for selected species for the period 1988 through 2025, as winter surveys began in 1988. In phylogenetic order, species included were black-vented shearwater *Puffinus opisthomelas*, pink-footed shearwater *Ardenna creatopus*, black-footed albatross *Phoebastria nigripes*, Laysan albatross *P. immutabilis*, a Leach's storm-petrel complex (Leach's storm-petrel *Hydrobates leucorhous*, Townsend's storm-petrel *H. socorroensis*, Ainley's storm-petrel *H. cheimomnestes*, and unidentified Leach's storm-petrels), small alcids (grouped Scripps' murrelet *Synthliboramphus scrippsi*, Xantus'/Craveri's murrelet *S. craveri*, and Guadalupe murrelet *S. hypoleucus*), Cassin's auklet *Ptychoramphus aleuticus*, common murre *Uria aalge*, rhinoceros auklet *Cerorhinca monocerata*, Brandt's cormorant *Urile penicillatus*, brown pelican *Pelecanus occidentalis*, and western gull *Larus occidentalis*. Trends in seabird density were examined using Spearman rank correlation.

Results

Ocean conditions. The survey transited through a latitudinal range of water temperatures (Figure 1A). The sea surface temperature (SST) anomalies map indicates warmer than normal water temperatures observed over the coastal domain, with areas of normal SST offshore and warmer patches in the southern part of the domain (Figure 1B). During this survey, winds blew from the east and northeast, with water temperatures starting cooler and increasing in the first days of the cruise, then remaining warm for the duration of the survey (Figure 2).

Surveying effort. A summary of survey effort is shown in Table 1; transects surveyed are shown in Figure 3. Summarized species observations for all species are shown in Table 2 (see Appendix 1 for exclusions). Survey effort occurred over 24 days and covered 2,139 km (642 km^2) of ocean habitat; 1,423 km (427 km^2) were surveyed over 16 days in the core survey area (Figure 3).

Seabirds. 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 4–6. Black-vented and pink-footed shearwaters both had high densities (greater than 1 s.d. of the mean), continuing a trend of higher densities over the past ten years (Figure 4). Black-footed albatross were seen at very low density (below 1 s.d. of the mean), and Laysan albatross had near-average density (Figure 4). Birds belonging to the Leach's storm-petrel complex were also present at near-average density (Figure 4). Small *Synthliboramphus* alcids were present at near-average density while Cassin's auklets were seen at lower than average density (Figure 5). Common murres, on the other hand, had high density (above 1 s.d.), marking three consecutive years of high numbers (Figure 5). Brandt's cormorants were present at higher than average density (right at 1 s.d. of the mean) and have had higher than average densities since 2020

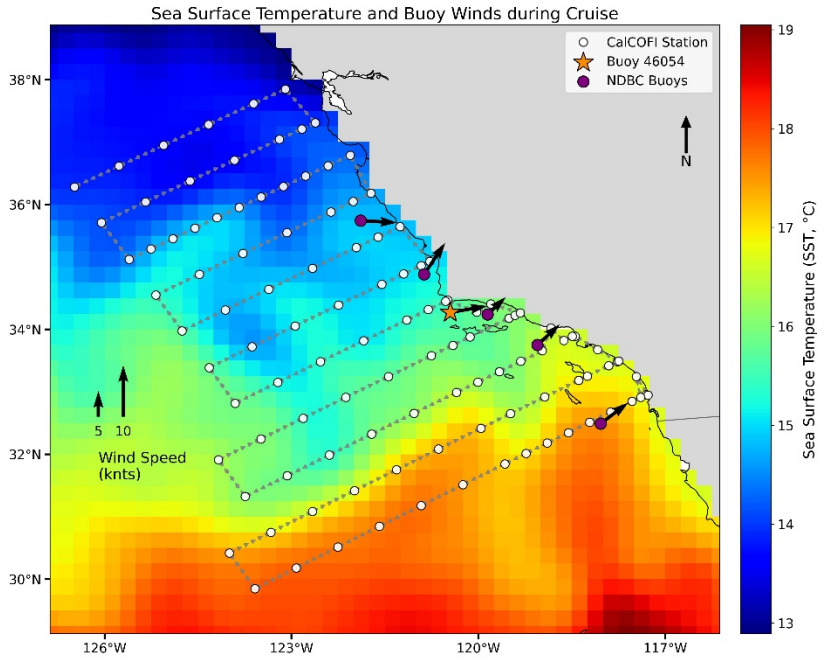
(Figure 6). Brown pelicans were observed at a high density in their time series, continuing an increasing trend since 2017 (Figure 6). Western gulls had near-average density (Figure 6).

Rank correlation analysis showed increasing trends for black-vented and pink-footed shearwaters, Brandt's cormorant, and brown pelican, as well as significant decreasing trends for black-footed albatross, Leach's storm-petrel complex, and Cassin's auklet ($p < 0.1$; Table 3).

Unusual observation. On 23 January 2026, an exceptional observation was made of a waved albatross (*Phoebastria irrorata*) near station 55 on line 73. Waved albatross are native to South America and commonly found offshore of Ecuador and Peru. The bird seen on this survey was identified at the time of observation and photographed (see cover photo). A waved albatross was also seen on 5 October 2025 near Cordell Bank off central-northern California, and examination of the bird's molt pattern in photos taken in both encounters confirmed that the bird was the same individual. For this observation, viewing conditions were excellent, with overcast skies and low winds (11 kts), but some swell. There were multitudes of other seabirds in the vicinity at that time, along with humpback whales and dolphins. This and the observation in October 2025 are the only known recorded instances of waved albatross north of Costa Rica.

Figure 1. Ocean conditions in the greater CalCOFI area for the period 8 to 31 January 2026. White dots indicate CalCOFI sampling stations and NOAA/NDBC buoys are indicated with purple dots and orange star. A) Sea surface temperature (SST; C°) and wind averages (speed and direction the wind is blowing). B) Sea surface temperature anomalies (SSTa; C°) averages derived from a MUR climatology.

A)



B)

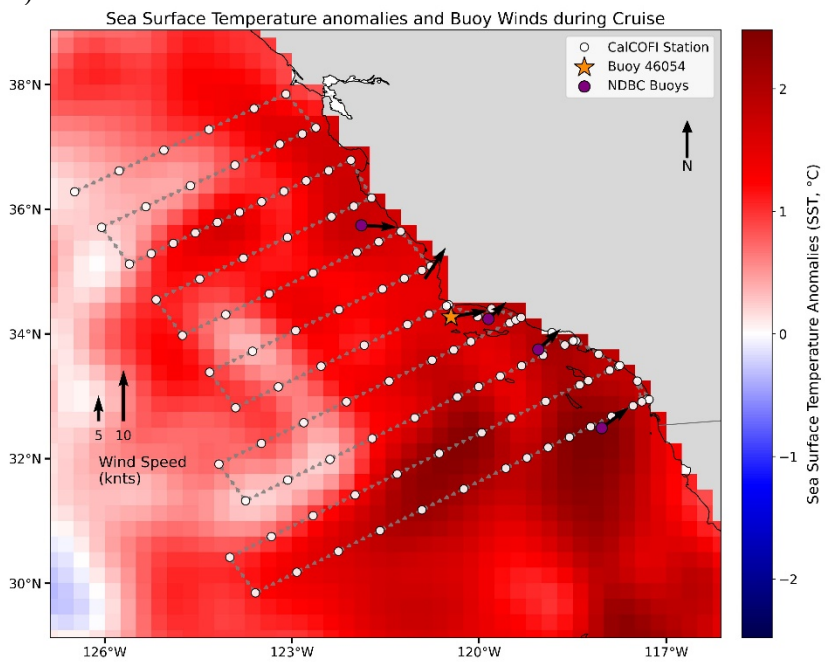


Figure 2. Daily SST (C°) and wind averages for the period 8 to 31 January 2026 at NOAA/NDBC buoy 46054; location is marked in Figure 1 with an orange star. Bottom panel: arrow direction indicates the direction the wind is blowing (up = north) and the y-axis indicates wind speed scale in knots. Upwelling-favorable winds are strong winds to the southeast.

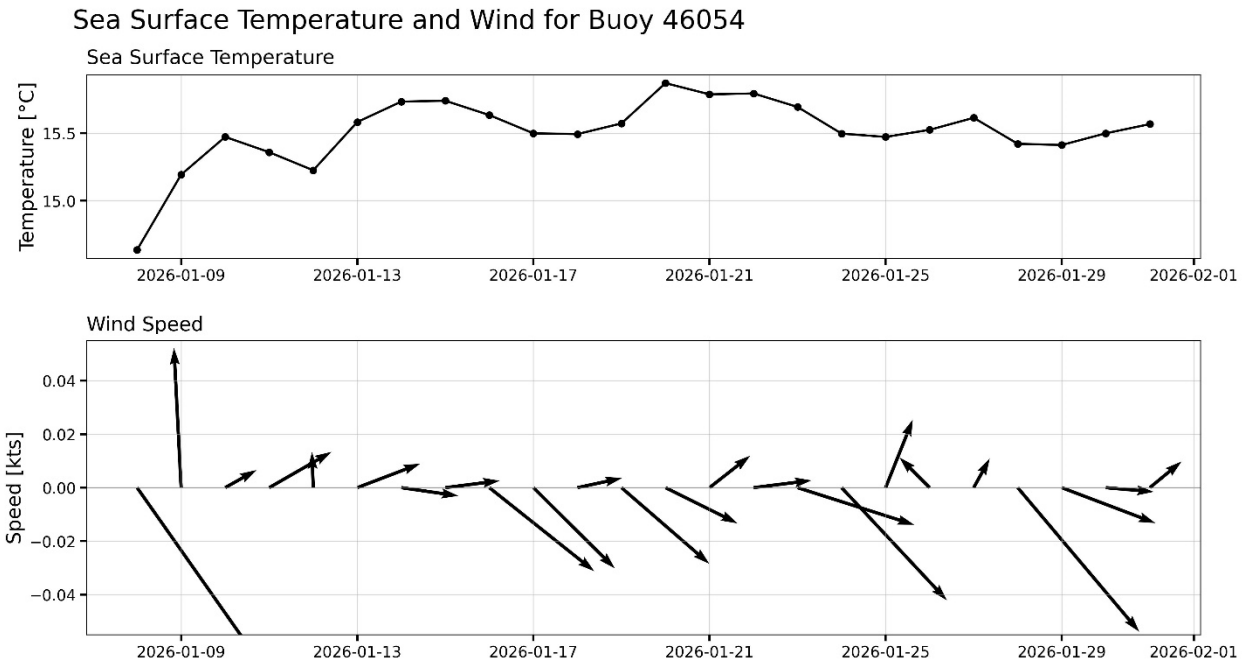


Table 1. Summary of survey effort and seabird statistics for the full and core survey areas, winter 2026.

Winter 2026	Full survey area	Core survey area
Survey vessel	RV *Reuben Lasker*	
Start date	1/8/2026	
End date	1/31/2026	
Number of survey days	24	16
Distance surveyed (km)	2,139	1,423
Area surveyed (km^2)	642	427
Number of bird species	42	36
Overall bird density (per km^2)	5.818	6.465
Total individuals counted	3,733	2,760

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

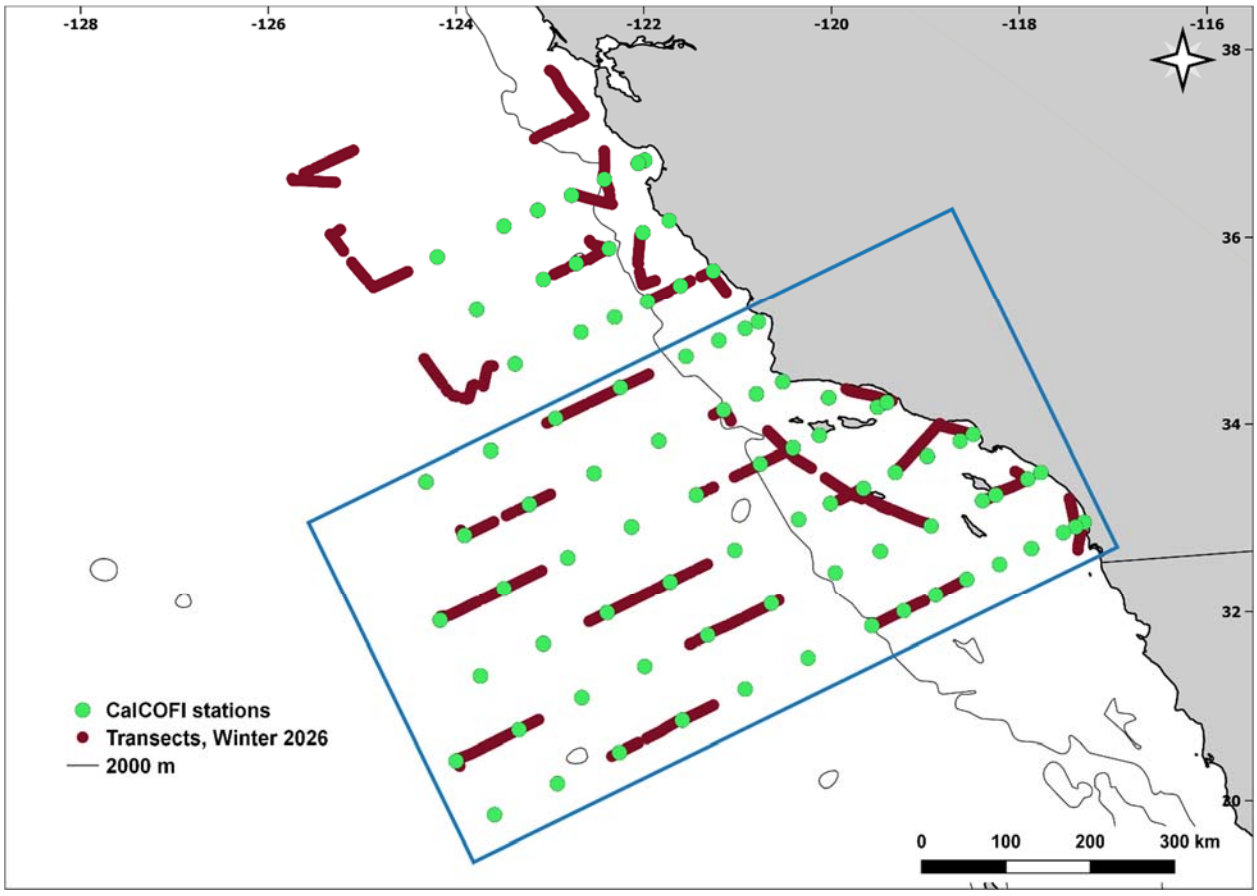


Table 2. Observations in winter 2026 by species in the core survey area (see Figure 3). Cell values: total number of individuals (ind.) / number of observations per species (obs.) / species density (dens.) in individuals per km^2.

Common Name	Scientific Name	Full area	Core area
American white pelican	*Pelecanus erythrorhynchos*		
Ancient murrelet	*Synthliboramphus antiquus*		
Arctic loon	*Gavia arctica*		
Arctic tern	*Sterna paradisaea*		
Ashy storm-petrel	*Hydrobates homochroa*		
Black guillemot	*Cepphus grylle*		
Black scoter	*Melanitta americana*		
Black storm-petrel	*Hydrobates melania*		
Black-footed albatross	*Phoebastria nigripes*	8 / 8 / 0.01	2 / 2 / 0
Black-legged kittiwake	*Rissa tridactyla*	1 / 1 / 0	
Black-vented shearwater	*Puffinus opisthomelas*	537 / 139 / 0.84	517 / 124 / 1.21
Blue-footed booby	*Sula nebouxii*		
Bonaparte's gull	*Chroicocephalus philadelphia*	289 / 50 / 0.45	289 / 50 / 0.68
Brandt's cormorant	*Urile penicillatus*	213 / 87 / 0.33	141 / 69 / 0.33
Brant	*Branta bernicla*		
Brown booby	*Sula leucogaster*		
Brown noddy	*Anous stolidus*		
Brown pelican	*Pelecanus occidentalis*	511 / 164 / 0.8	481 / 142 / 1.13
Buller's shearwater	*Ardenna bulleri*		
California gull	*Larus californicus*	671 / 397 / 1.05	460 / 247 / 1.08
Caspian tern	*Hydroprogne caspia*		
Cassin's auklet	*Ptychoramphus aleuticus*	63 / 50 / 0.1	41 / 32 / 0.1
Clark's grebe	*Aechmophorus clarkii*		
Common loon	*Gavia immer*	12 / 1 / 0.02	
Common murre	*Uria aalge*	253 / 90 / 0.39	82 / 44 / 0.19
Common tern	*Sterna hirundo*		
Cook's petrel	*Pterodroma cookii*	3 / 3 / 0	1 / 1 / 0
Craveri's murrelet	*Synthliboramphus craveri*		
Dark shearwater	(species group)		
Dark-rumped petrel	*Pterodroma phaeopygia sandwichensis*		
Double-crested cormorant	*Nannopterum auritum*	2 / 2 / 0	2 / 2 / 0
Eared grebe	*Podiceps nigricollis*		
Elegant tern	*Thalasseus elegans*		
Flesh-footed shearwater	*Ardenna carneipes*		
Fork-tailed storm-petrel	*Hydrobates furcata*		
Forster's tern	*Sterna forsteri*	2 / 2 / 0	2 / 2 / 0
Franklin's gull	*Leucophaeus pipixcan*		
Glaucous gull	*Larus hyperboreus*		
Glaucous-winged gull	*Larus glaucescens*	15 / 15 / 0.02	3 / 3 / 0.01
Glaucous-winged/Western hybrid gull			
Guadalupe murrelet	*Synthliboramphus hypoleucus*		
Hawaiian petrel	*Pterodroma sandwichensis*		
Heermann's gull	*Larus heermanni*	116 / 70 / 0.18	106 / 62 / 0.25
Herring gull	*Larus argentatus*	12 / 12 / 0.02	6 / 6 / 0.01
Horned puffin	*Fratercula corniculata*		

Hybrid gull	(species group)		
Juan Fernandez petrel	*Pterodroma externa*		
Kelp gull	*Larus dominicanus*		
Kermadec petrel	*Pterodroma neglecta*		
Laughing gull	*Leucophaeus atricilla*		
Laysan albatross	*Phoebastria immutabilis*	9 / 9 / 0.01	6 / 6 / 0.01
Leach's storm-petrel complex	(species group)	99 / 31 / 0.15	79 / 20 / 0.18
Least storm-petrel	*Hydrobates microsoma*		
Least tern	*Sterna antillarum*		
Long-tailed jaeger	*Stercorarius longicaudus*		
Manx shearwater	*Puffinus puffinus*		
Marbled murrelet	*Brachyramphus marmoratus*	1 / 1 / 0	
Masked booby	*Sula dactylatra*	2 / 2 / 0	1 / 1 / 0
Mottled petrel	*Pterodroma inexpectata*		
Murphy's petrel	*Pterodroma ultima*		
Nazca booby	*Sula granti*		
Northern fulmar	*Fulmarus glacialis*	117 / 66 / 0.18	105 / 55 / 0.25
Osprey	*Pandion haliaetus*		
Pacific loon	*Gavia pacifica*	23 / 17 / 0.04	7 / 7 / 0.02
Parakeet auklet	*Aethia psittacula*		
Parasitic jaeger	*Stercorarius parasiticus*	6 / 6 / 0.01	4 / 4 / 0.01
Pelagic cormorant	*Urile pelagicus*	47 / 22 / 0.07	1 / 1 / 0
Peregrine falcon	*Falco peregrinus*	1 / 1 / 0	
Pigeon guillemot	*Cepphus columba*		
Pink-footed shearwater	*Ardenna creatopus*	23 / 20 / 0.04	8 / 7 / 0.02
Pomarine jaeger	*Stercorarius pomarinus*	9 / 8 / 0.01	5 / 4 / 0.01
Providence/Solander's petrel	*Pterodroma solandri*		
Red phalarope	*Phalaropus fulicaria*	30 / 18 / 0.05	19 / 13 / 0.04
Red-billed tropicbird	*Phaethon aethereus*		
Red-footed booby	*Sula sula*		
Red-necked grebe	*Podiceps grisegena*		
Red-necked phalarope	*Phalaropus lobatus*	9 / 5 / 0.01	1 / 1 / 0
Red-tailed tropicbird	*Pheathon rubricauda*		
Red-throated loon	*Gavia stellata*	3 / 1 / 0	3 / 1 / 0.01
Rhinoceros auklet	*Cerorhinca monocerata*	191 / 85 / 0.3	19 / 14 / 0.04
Ring-billed gull	*Larus delawarensis*		
Royal tern	*Thalasseus maximus*	7 / 7 / 0.01	7 / 7 / 0.02
Ruddy turnstone	*Arenaria interpres*		
Sabine's gull	*Xema sabini*		
Scripps's murrelet	*Synthliboramphus scrippsi*	4 / 3 / 0.01	4 / 3 / 0.01
Short-billed gull	*Larus brachyrhynchus*	5 / 5 / 0.01	
Short-tailed / Slender-billed shearwater	*Ardenna tenuirostris*		
Short-tailed albatross	*Phoebastria albatrus*		
Sooty shearwater	*Ardenna grisea*	3 / 3 / 0	2 / 2 / 0
South polar skua	*Stercorarius maccormicki*		
Stejneger's petrel	*Pterodroma longirostris*		
Surf scoter	*Melanitta perspicillata*		
Thayer's gull	*Larus glaucoides thayeri*		
Tufted puffin	*Fratercula cirrhata*		
Unidentified albatross	(species group)		
Unidentified auklet	(species group)		

Unidentified booby	(species group)		
Unidentified cormorant	(species group)		
Unidentified gull	(species group)	46 / 34 / 0.07	38 / 26 / 0.09
Unidentified jaeger	(species group)	3 / 3 / 0	2 / 2 / 0
Unidentified large alcid	(species group)		
Unidentified loon	(species group)	3 / 1 / 0	3 / 1 / 0.01
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)		
Wedge-rumped storm-petrel	*Hydrobates tethys*		
Wedge-tailed shearwater	*Puffinus pacificus*		
Western grebe	*Aechmophorus occidentalis*	65 / 15 / 0.1	65 / 15 / 0.15
Western gull	*Larus occidentalis*	319 / 263 / 0.5	248 / 199 / 0.58
Wilson's storm-petrel	*Oceanites oceanicus*		
Xantus's / Craveri's murrelet	(species group)		
Xantus's murrelet	*Synthliboramphus hypoleucus*		

Figure 4. Log_{10} density anomalies for select procellariform seabird species, core survey area, winter 1988–2026. A) black-vented shearwater, B) pink-footed shearwater, C) black-footed albatross, D) Laysan albatross, and E) 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 winter survey was conducted. A constant of 0.01 was added to each density prior to log_{10} transformation and the anomaly calculation.

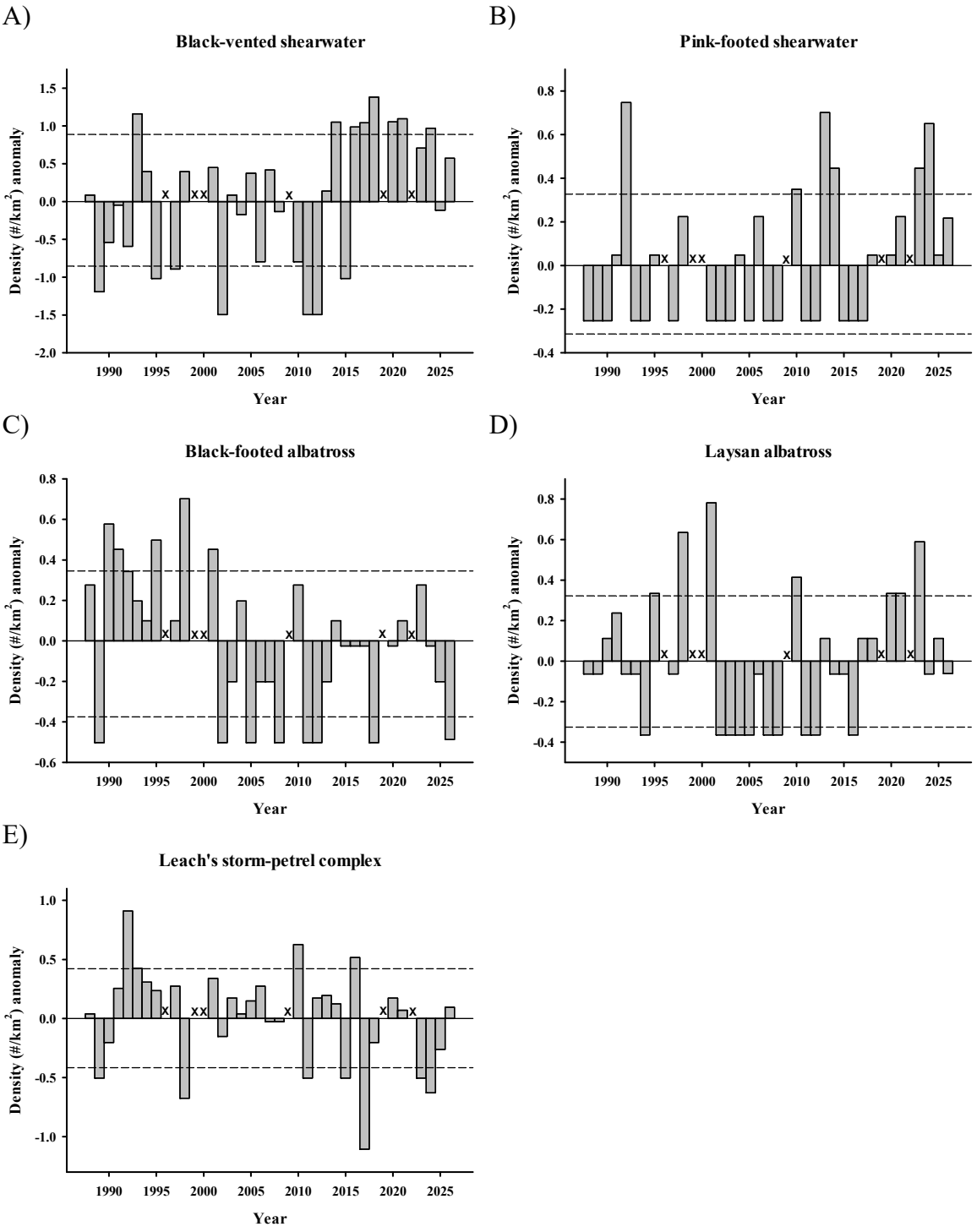


Figure 5. Log_{10} density anomalies for select alcid species, core survey area, winter 1988–2026. A) Small *Synthliboramphus* alcids (Scripps' murrelet, Xantus'/Craveri's murrelet, and Guadalupe murrelet grouped), B) Cassin's auklet, C) common murre, and D) rhinoceros auklet. All of these species are 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 winter survey was conducted. A constant of 0.01 was added to each density prior to log_{10} transformation and the anomaly calculation.

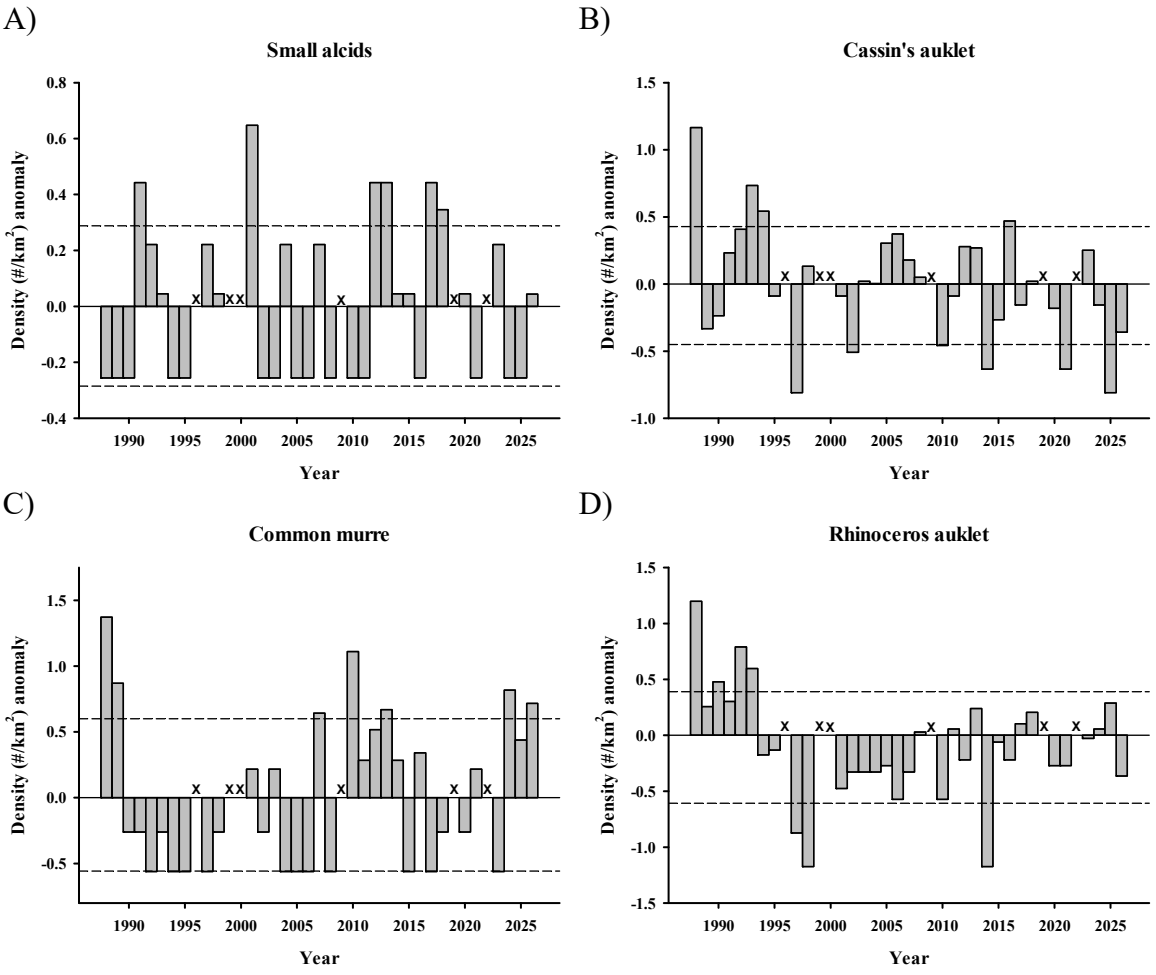


Figure 6. Log_{10} density anomalies for select locally breeding seabird species, core survey area, winter 1988–2026. A) Brandt's cormorant, B) brown pelican, and C) western gull. The dashed lines indicate ± 1 s.d. of the long-term mean, and 'X' indicates years when no winter survey was conducted. A constant of 0.01 was added to each density prior to log_{10} transformation and the anomaly calculation.

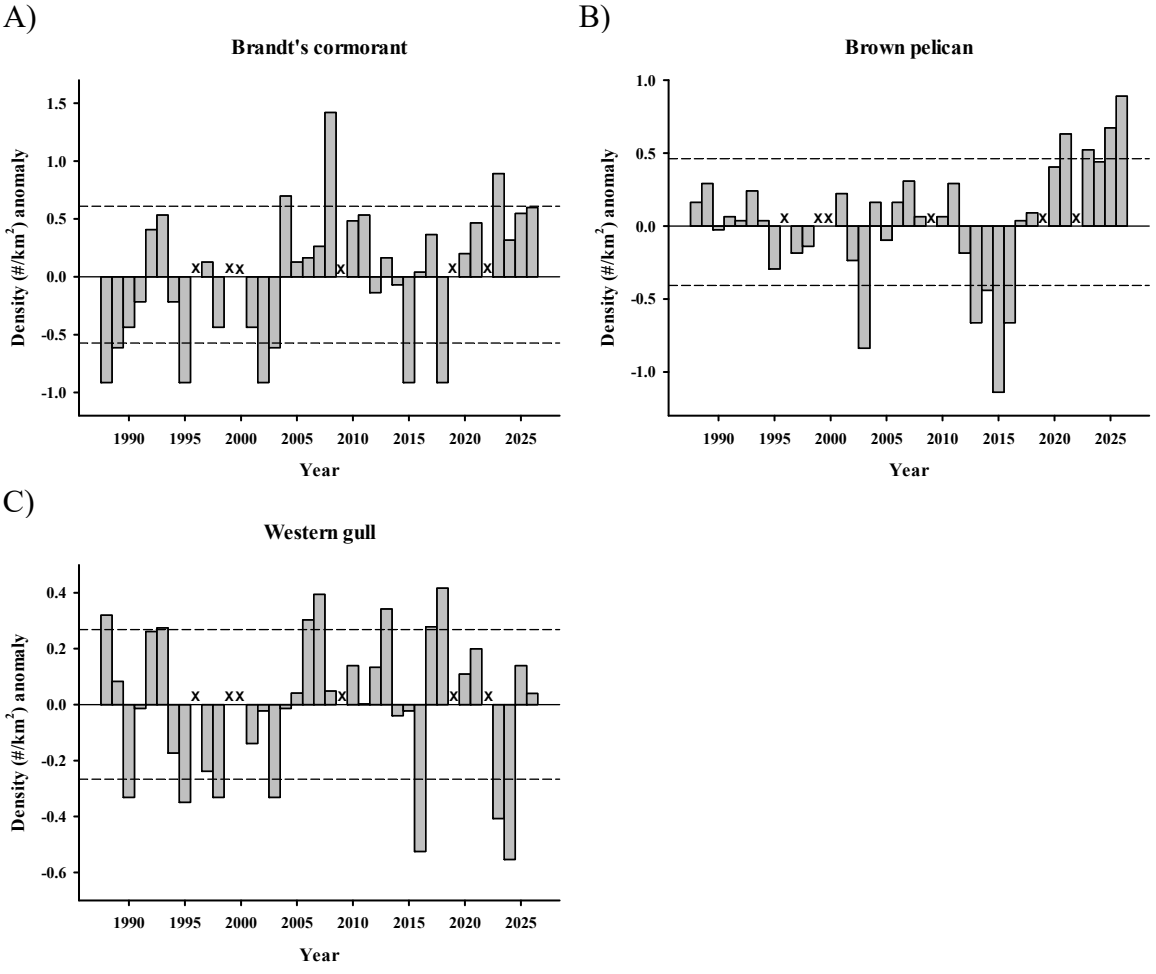


Table 3. Results of Spearman rank correlation of seabird density over time indicating trends. Bold: nominal significance $p < 0.1$. N = 33 years of data.

Species/Group	rho	p-value
Black-vented shearwater	**0.41**	**0.017**
Pink-footed shearwater	**0.37**	**0.035**
Black-footed albatross	**-0.41**	**0.018**
Laysan albatross	0.11	0.546
Leach's storm-petrel complex	**-0.31**	**0.080**
Small alcids	0.08	0.642
Cassin's auklet	**-0.33**	**0.057**
Common murre	0.17	0.357
Rhinoceros auklet	-0.20	0.274
Brandt's cormorant	**0.45**	**0.009**
Brown pelican	**0.30**	**0.094**
Western gull	0.06	0.743
Overall density	0.22	0.209

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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*
Blue-footed booby	*Sula nebouxii*
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*
Waved albatross	*Phoebastria irrorata*
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*