

**Seabirds and ocean conditions from the CalCOFI/CCE-LTER Survey:  
Summer 2025 data report**

William J. Sydeman, Principal Investigator  
Brian Hoover, Lead Scientist & Observer  
Erendira Ceballos, Observer-in-Training  
Sarah Ann Thompson, Analyst  
Marisol García-Reyes, Oceanographer



FARALLON INSTITUTE

101 H Street, Suite Q  
Petaluma, CA 94952  
[www.faralloninstitute.org](http://www.faralloninstitute.org)

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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 at Point Conception. Third, by extending our existing records (currently 39 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 within the CalCOFI core region during the 2025 summer CalCOFI/CCE-LTER cruise. We include data on survey effort as well as summary information on seabird abundance, expressed at density (birds/km<sup>2</sup>), and oceanographic conditions during the survey period.

## Methods

*Oceanographic conditions.* We present sea surface temperature (SST; C°) and wind averages for the period 18 to 29 July 2025 in the southern CalCOFI survey area. SST data and anomalies (SSTa; baseline period 1991–2020) were downloaded from the high-resolution 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 (speed and direction) data along the California coast were downloaded from NOAA/NDBC buoys (<https://www.ndbc.noaa.gov/>).

*Seabird observations.* Observations of seabirds are made continuously during daylight ship transits between oceanographic/plankton sampling stations. The observer, located on the flying bridge approximately 15 meters above sea level, uses hand-held binoculars and occasionally also 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 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, and these data are used to derive summary statistics. Observations on the 2025 summer survey were made by lead observer Brian Hoover and observer-in-training Erendira Ceballos. Hoover and Ceballos shared survey duties, and the

primary observer during each transect was identified by entering their initials in the survey software.

*Calculation of seabird densities.* Taxa excluded from this summary were all mammals, fish, terrestrial birds, and most shorebirds except phalaropes, which can be found in the pelagic realm. Species densities were calculated as the total number of individuals observed per species divided by the area (km<sup>2</sup>) surveyed. Density is expressed by log<sub>10</sub> function; a constant of 0.01 was added to each species' density prior to transformation. Anomalies of log<sub>10</sub>-transformed density over time are shown for selected species for the period 1987 through 2025, summer only. 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*, 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*, Brandt's cormorant *Urile penicillatus*, brown pelican *Pelecanus occidentalis*, western gull *Larus occidentalis*, Heermann's gull *Larus heermanni*, elegant tern *Thalasseus elegans*, phalaropes (grouped red phalarope *Phalaropus fulicaria* and red-necked phalarope *P. lobatus*), and boobies (grouped brown booby *Sula leucogaster*, Nazca booby *S. granti*, masked booby *S. dactylatra*, blue-footed booby *S. nebouxii*, and red-footed booby *S. sula*). Trends in seabird density were examined using Spearman rank correlation.

## Results

*Oceanographic conditions.* The summer CalCOFI survey transited through an upwelling event with cool water north of Point Conception, meanwhile, the Southern California Bight experienced warmer ocean temperatures (Figure 1A). Both of these trends (upwelling in the northern part of the survey and warm water in the bight) are confirmed in the sea surface temperature anomaly map (Figure 1B). There was a consistent decline in water temperature after the start of the cruise indicated by the buoy data, and the wind was consistently blowing strongly towards the southeast, creating upwelling-favorable conditions (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 over 12 days covered 1,217 km (365 km<sup>2</sup>) of ocean habitat within the core survey area; no surveying was done outside the core area (Figure 3).

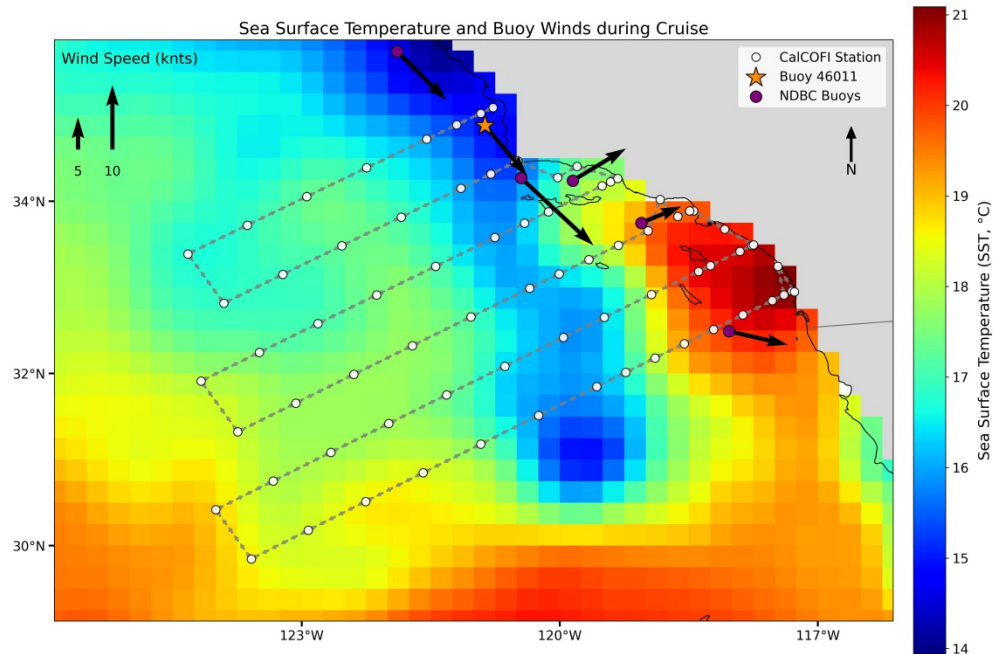
*Seabirds.* Density over time for the selected seabird species (listed above) was calculated for the core survey area and is shown as anomalies in Figures 4–7. Sooty shearwater had high density (greater than 1 s.d. of the mean) while pink-footed shearwaters were present at an above-average density but within 1 s.d. of the mean (Figure 4). Black-footed albatross were seen at above-average density (~1 s.d.) and Cook's petrel had above-average density, logging the third-highest value in the time series (Figure 4). Birds in the Leach's storm-petrel complex were present at an above-average density within 1 s.d. of the mean (Figure 4). Birds in the small alcid group were present at an above-average density (within 1 s.d.) while Cassin's auklets were seen at lower

than average density, also within 1 s.d. of the mean (Figure 5). Common murre, on the other hand, had high density with the third highest value in the time series, following two years of near-average numbers (Figure 5). Brandt's cormorants were present at higher than 1 s.d. of average density, and brown pelicans were present at slightly below average density (Figure 6). Western gull had slightly higher than average density, and Heermann's gulls had higher than average density (within 1 s.d.; Figure 6). Elegant terns were near average and down from the high densities seen over the last two years (Figure 6). One red phalarope was seen this year (rounding to 0 density), which is very low abundance for the last 15 years (Table 2, Figure 7). Finally, there was one masked booby and one red-footed booby observed on this year's survey (also rounding to 0 density); occasional observations of these birds had been made on the summer survey since 2015 (Table 2, Figure 7). An additional observation to note was the three red-tailed tropicbirds *Pheathon rubricauda* seen on the survey (Table 2; density not plotted). A few individuals of this species are regularly observed on the summer CalCOFI survey and their presence is interesting since the survey area is at the northern edge of their tropic/sub-tropic distributional range.

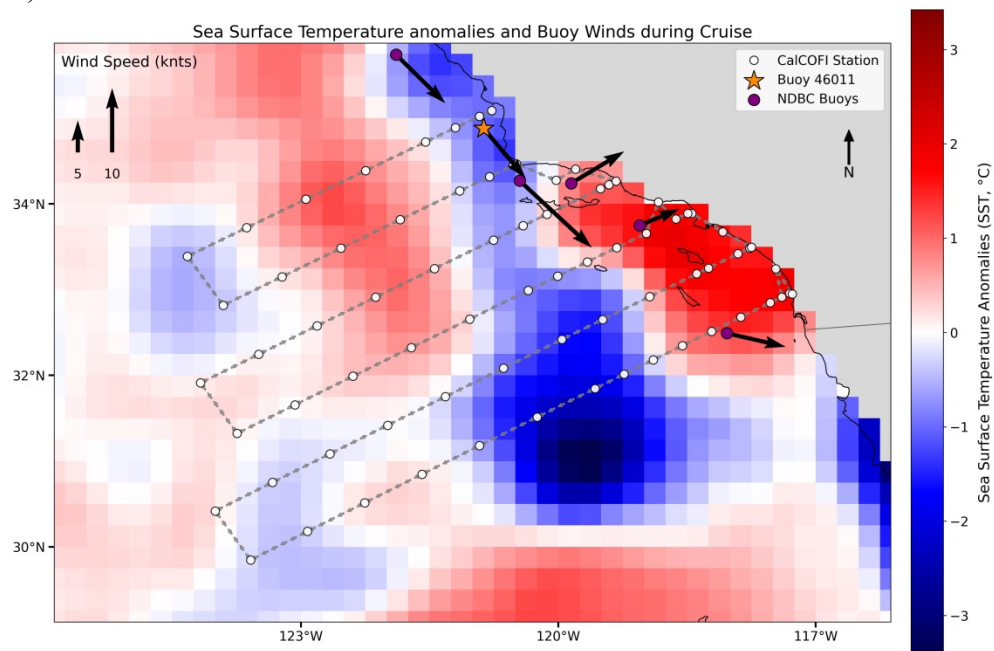
Rank correlation analysis showed increasing at-sea abundance for migrant black-footed albatross, and locally breeding common murre, Brandt's cormorant, Heermann's gull, and elegant tern. Despite no observations made on this survey, there is also an increasing trend over time for the boobies group. Decreasing abundance was found for the Leach's storm-petrel complex, western gull, and the phalaropes group ( $p < 0.1$ ; Table 3).

**Figure 1.** Ocean conditions in the greater CalCOFI area for the period 18 to 29 July 2025. 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.

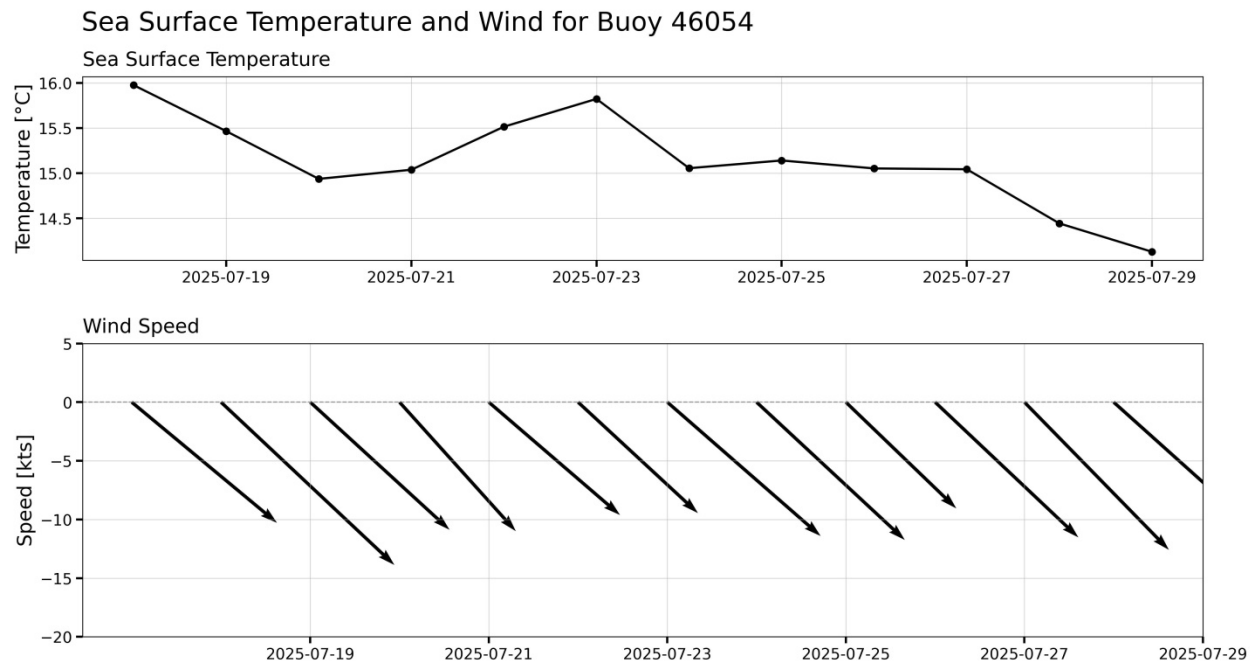
A)



B)



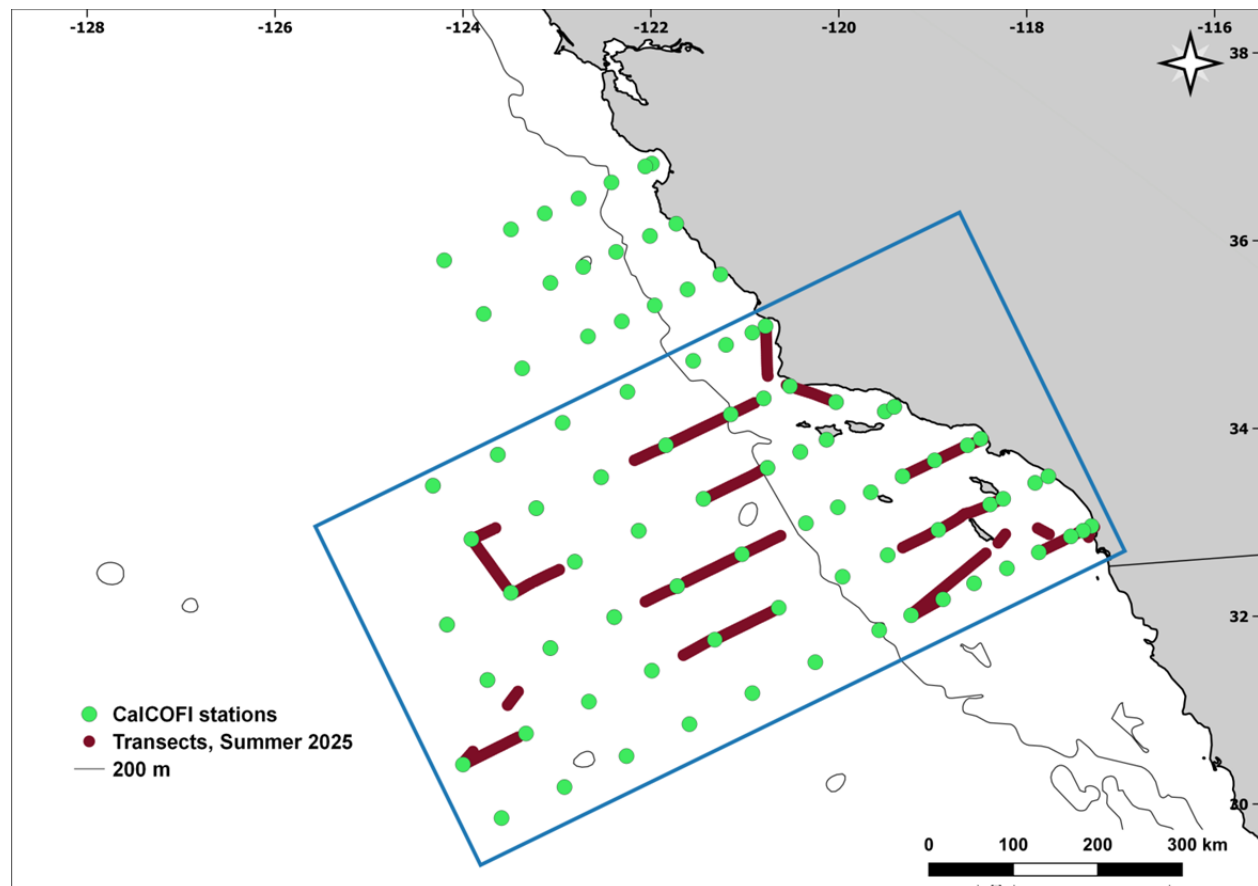
**Figure 2.** Daily SST (C°) and wind averages for the period 18 to 29 July 2025 at NOAA/NDBC buoy 46054; location is marked in Figure 1 with an orange star. Bottom panel: arrow direction indicates the direction the wind is blowing (up = north) and the y-axis indicates wind speed scale in knots. Upwelling-favorable winds are strong winds to the southeast.



**Table 1.** Summary of survey effort and seabird statistics for the core survey area, summer 2025.  
Note: there was no surveying outside of the core survey area.

| Summer 2025                                 | Core survey area     |
|---------------------------------------------|----------------------|
| Survey vessel                               | RV <i>Sally Ride</i> |
| Start date                                  | 7/18/2025            |
| End date                                    | 7/29/2025            |
| Number of survey days                       | 12                   |
| Distance surveyed (km)                      | 1,217                |
| Area surveyed (km <sup>2</sup> )            | 365                  |
| Number of bird species                      | 33                   |
| Overall bird density (per km <sup>2</sup> ) | 16.63                |
| Total individuals counted                   | 6,070                |

**Figure 3.** Transects sampled during the CalCOFI summer 2025 survey. The core study area is denoted with the box, and includes CalCOFI lines 93 (south) to 77 (north).



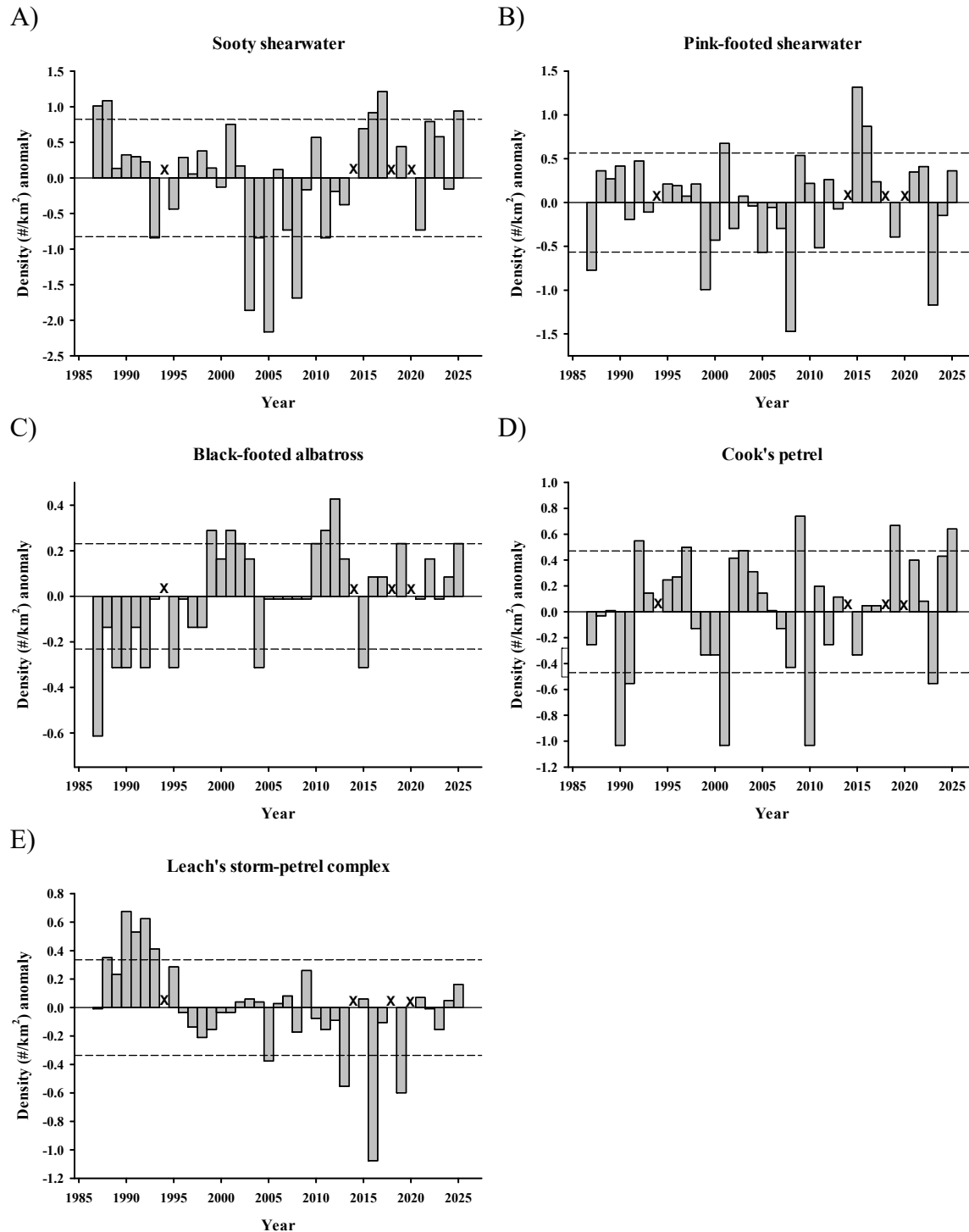
**Table 2.** Observations in summer 2025 by species in the core survey area (see Figure 3). Cell values: total number of individuals (ind.) / number of observations per species (obs.) / species density (dens.) in individuals per km<sup>2</sup>.

| Common Name                         | Scientific Name                            | 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>                | 1 / 1 / 0        |
| Black guillemot                     | <i>Cephus grylle</i>                       |                  |
| Black scoter                        | <i>Melanitta americana</i>                 |                  |
| Black storm-petrel                  | <i>Hydrobates melania</i>                  | 27 / 12 / 0.07   |
| Black-footed albatross              | <i>Phoebastria nigripes</i>                | 22 / 18 / 0.06   |
| Black-legged kittiwake              | <i>Rissa tridactyla</i>                    |                  |
| Black-vented shearwater             | <i>Puffinus opisthomelas</i>               | 95 / 20 / 0.26   |
| Blue-footed booby                   | <i>Sula nebouxii</i>                       |                  |
| Bonaparte's gull                    | <i>Chroicocephalus philadelphia</i>        |                  |
| Brandt's cormorant                  | <i>Urile penicillatus</i>                  | 34 / 20 / 0.09   |
| Brant                               | <i>Branta bernicla</i>                     |                  |
| Brown booby                         | <i>Sula leucogaster</i>                    |                  |
| Brown noddy                         | <i>Anous stolidus</i>                      |                  |
| Brown pelican                       | <i>Pelecanus occidentalis</i>              | 26 / 11 / 0.07   |
| Buller's shearwater                 | <i>Ardenna bulleri</i>                     | 1 / 1 / 0        |
| California gull                     | <i>Larus californicus</i>                  | 4 / 4 / 0.01     |
| Caspian tern                        | <i>Hydroprogne caspia</i>                  |                  |
| Cassin's auklet                     | <i>Ptychoramphus aleuticus</i>             | 2 / 2 / 0.01     |
| Clark's grebe                       | <i>Aechmophorus clarkii</i>                |                  |
| Common loon                         | <i>Gavia immer</i>                         |                  |
| Common murre                        | <i>Uria aalge</i>                          | 354 / 107 / 0.97 |
| Common tern                         | <i>Sterna hirundo</i>                      | 1 / 1 / 0        |
| Cook's petrel                       | <i>Pterodroma cookii</i>                   | 168 / 82 / 0.46  |
| 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>                  | 34 / 18 / 0.09   |
| Flesh-footed shearwater             | <i>Ardenna carneipes</i>                   | 2 / 2 / 0.01     |
| 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>                   |                  |
| Glaucous-winged/Western hybrid gull |                                            |                  |
| Guadalupe murrelet                  | <i>Synthliboramphus hypoleucus</i>         |                  |
| Hawaiian petrel                     | <i>Pterodroma sandwichensis</i>            |                  |
| Heermann's gull                     | <i>Larus heermanni</i>                     | 9 / 9 / 0.02     |
| Herring gull                        | <i>Larus argentatus</i>                    |                  |
| Horned puffin                       | <i>Fratercula corniculata</i>              |                  |

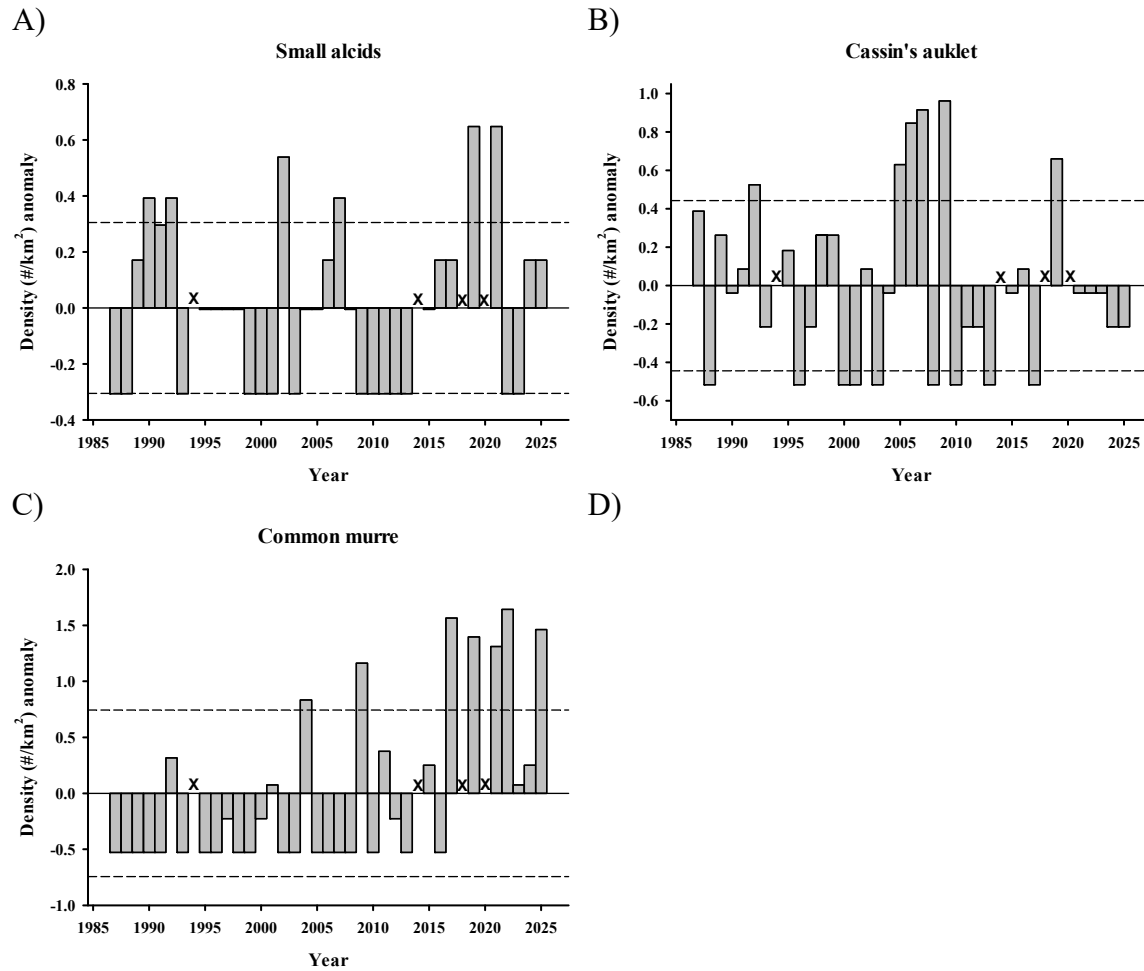
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|------------------------------------------|----------------------------------|--------------------|
| Hybrid gull                              | (species group)                  |                    |
| Juan Fernandez petrel                    | <i>Pterodroma externa</i>        |                    |
| Kelp gull                                | <i>Larus dominicanus</i>         |                    |
| Kermadec petrel                          | <i>Pterodroma neglecta</i>       |                    |
| Laughing gull                            | <i>Leucophaeus atricilla</i>     |                    |
| Laysan albatross                         | <i>Phoebastria immutabilis</i>   | 1 / 1 / 0          |
| Leach's storm-petrel complex             | (species group)                  | 187 / 171 / 0.51   |
| Least storm-petrel                       | <i>Hydrobates microsoma</i>      |                    |
| Least tern                               | <i>Sterna antillarum</i>         | 2 / 2 / 0.01       |
| 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>           | 1 / 1 / 0          |
| 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>               |                    |
| Northern fulmar                          | <i>Fulmarus glacialis</i>        |                    |
| Osprey                                   | <i>Pandion haliaetus</i>         |                    |
| Pacific loon                             | <i>Gavia pacifica</i>            |                    |
| Parakeet auklet                          | <i>Aethia psittacula</i>         |                    |
| Parasitic jaeger                         | <i>Stercorarius parasiticus</i>  | 1 / 1 / 0          |
| Pelagic cormorant                        | <i>Urile pelagicus</i>           | 1 / 1 / 0          |
| Peregrine falcon                         | <i>Falco peregrinus</i>          |                    |
| Pigeon guillemot                         | <i>Cephus columba</i>            |                    |
| Pink-footed shearwater                   | <i>Ardenna creatopus</i>         | 244 / 65 / 0.67    |
| Pomarine jaeger                          | <i>Stercorarius pomarinus</i>    |                    |
| Providence/Solander's petrel             | <i>Pterodroma solandri</i>       |                    |
| Red phalarope                            | <i>Phalaropus fulicaria</i>      | 1 / 1 / 0          |
| Red-billed tropicbird                    | <i>Phaethon aethereus</i>        | 3 / 3 / 0.01       |
| Red-footed booby                         | <i>Sula sula</i>                 | 1 / 1 / 0          |
| Red-necked grebe                         | <i>Podiceps grisegena</i>        |                    |
| Red-necked phalarope                     | <i>Phalaropus lobatus</i>        |                    |
| Red-tailed tropicbird                    | <i>Pheathon rubricauda</i>       |                    |
| Red-throated loon                        | <i>Gavia stellata</i>            |                    |
| Rhinoceros auklet                        | <i>Cerorhinca monocerata</i>     |                    |
| Ring-billed gull                         | <i>Larus delawarensis</i>        |                    |
| Royal tern                               | <i>Thalasseus maximus</i>        | 1 / 1 / 0          |
| Ruddy turnstone                          | <i>Arenaria interpres</i>        |                    |
| Sabine's gull                            | <i>Xema sabini</i>               |                    |
| Scripps's murrelet                       | <i>Synthliboramphus scrippsi</i> | 6 / 3 / 0.02       |
| 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>            | 4628 / 304 / 12.68 |
| 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 glaucoides thayeri</i>  |                    |
| Tufted puffin                            | <i>Fratercula cirrhata</i>       |                    |
| Unidentified albatross                   | (species group)                  |                    |

|                               |                                    |                  |
|-------------------------------|------------------------------------|------------------|
| Unidentified auklet           | (species group)                    |                  |
| Unidentified booby            | (species group)                    |                  |
| Unidentified cormorant        | (species group)                    | 1 / 1 / 0        |
| Unidentified gull             | (species group)                    | 33 / 33 / 0.09   |
| 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)                    | 5 / 4 / 0.01     |
| Unidentified small alcid      | (species group)                    |                  |
| Unidentified storm-petrel     | (species group)                    |                  |
| Unidentified tern             | (species group)                    | 5 / 2 / 0.01     |
| 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>          | 169 / 140 / 0.46 |
| Wilson's storm-petrel         | <i>Oceanites oceanicus</i>         |                  |
| Xantus's / Craveri's murrelet | (species group)                    |                  |
| Xantus's murrelet             | <i>Synthliboramphus hypoleucus</i> |                  |

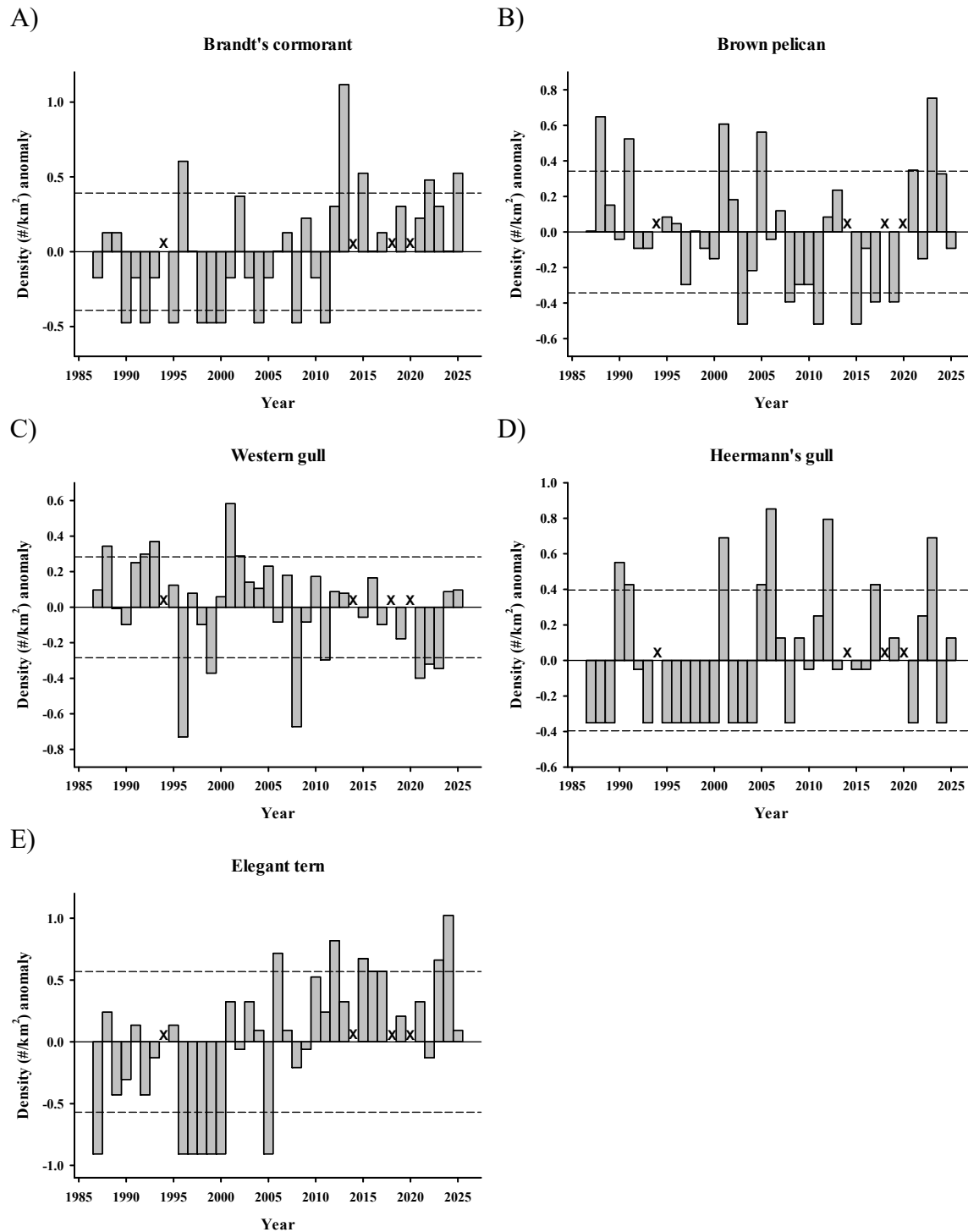
**Figure 4.** Log<sub>10</sub> density anomalies for select procellariiform seabird species, core survey area, 1987–2025. A) sooty shearwater, B) pink-footed shearwater, C) black-footed albatross, D) Cook’s petrel, and E) Leach’s storm-petrel complex (includes unidentified and subspecies identified since 2017). The shearwaters, albatrosses, and petrels are migrant species to the Southern California Bight region. Dashed lines indicate  $\pm 1$  s.d. of the long-term mean, and ‘X’ indicates years when no spring survey was conducted. A constant of 0.01 was added to each density prior to log<sub>10</sub> transformation and the anomaly calculation.



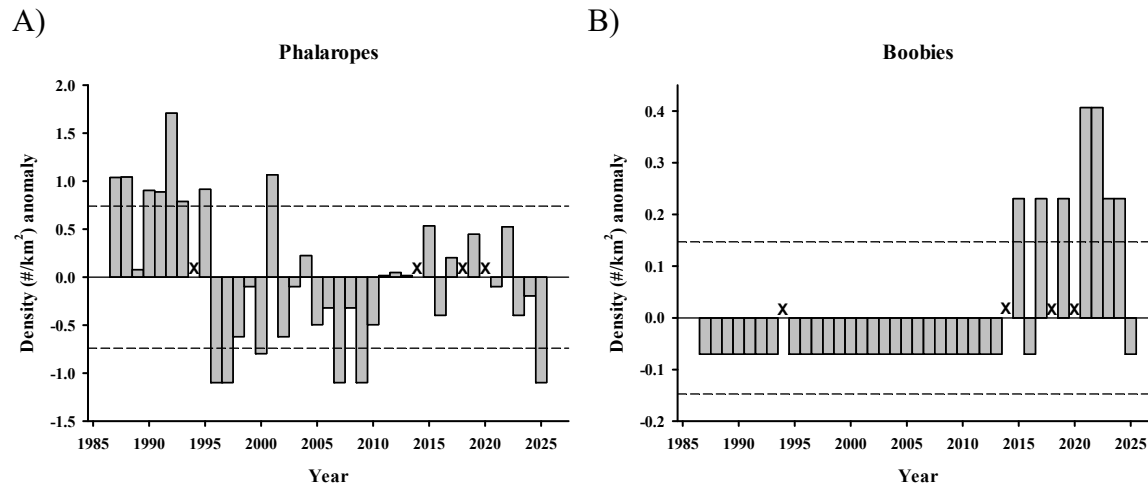
**Figure 5.** Log<sub>10</sub> density anomalies for select alcid species, core survey area, 1987–2025. A) Small alcids (Scripps' murrelet, Xantus'/Craveri's murrelet, and Guadalupe murrelet grouped), B) Cassin's auklet, and C) common murre. All of these species are locally breeding species in the California Current Ecosystem. The dashed lines indicate  $\pm 1$  s.d. of the long-term mean, and 'X' indicates years when no spring survey was conducted. A constant of 0.01 was added to each density prior to log<sub>10</sub> transformation and the anomaly calculation.



**Figure 6.** Log<sub>10</sub> density anomalies for select locally breeding seabird species, core survey area, 1987–2025. A) Brandt’s cormorant, B) brown pelican, C) western gull, D) Heermann’s gull, and E) elegant tern. The dashed lines indicate  $\pm 1$  s.d. of the long-term mean, and ‘X’ indicates years when no spring survey was conducted. A constant of 0.01 was added to each density prior to log<sub>10</sub> transformation and the anomaly calculation.



**Figure 7.** Log<sub>10</sub> density anomalies for select migrant seabird species, core survey area, 1987–2025. A) Phalaropes (grouped red and red-necked phalaropes) and B) boobies (grouped brown, Nazca, masked, blue-footed, and red-footed). The dashed lines indicate  $\pm 1$  s.d. of the long-term mean, and ‘X’ indicates years when no spring survey was conducted. A constant of 0.01 was added to each density prior to log<sub>10</sub> transformation and the anomaly calculation.



**Table 3.** Results of Spearman rank correlation of seabird density over time indicating trends.  
 Bold: significance  $p < 0.1$ .  $N = 35$  for all.

| n = 35                              | rho          | p-value          |
|-------------------------------------|--------------|------------------|
| Sooty shearwater                    | 0.04         | 0.827            |
| Pink-footed shearwater              | 0.04         | 0.819            |
| <b>Black-footed albatross</b>       | <b>0.53</b>  | <b>0.001</b>     |
| Cook's petrel                       | 0.20         | 0.239            |
| <b>Leach's storm-petrel complex</b> | <b>-0.41</b> | <b>0.015</b>     |
| Small alcids                        | 0.06         | 0.711            |
| Cassin's auklet                     | -0.12        | 0.502            |
| <b>Common murre</b>                 | <b>0.60</b>  | <b>&lt;0.001</b> |
| <b>Brandt's cormorant</b>           | <b>0.49</b>  | <b>0.003</b>     |
| Brown pelican                       | -0.19        | 0.279            |
| <b>Western gull</b>                 | <b>-0.34</b> | <b>0.043</b>     |
| <b>Heermann's gull</b>              | <b>0.36</b>  | <b>0.035</b>     |
| <b>Elegant tern</b>                 | <b>0.60</b>  | <b>&lt;0.001</b> |
| <b>Phalaropes</b>                   | <b>-0.33</b> | <b>0.050</b>     |
| <b>Boobies</b>                      | <b>0.64</b>  | <b>&lt;0.001</b> |

## 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>                  |
| 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>             |