



Landbird Monitoring at Channel Islands National Park

2022 Annual Report (Revised)



Island Loggerhead Shrike (*Lanius ludovicianus anthonyi*) nestlings on Santa Rosa Island in 2022.
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Landbird Monitoring at Channel Islands National Park: 2022 Annual Report (Revised)

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Abstract

The National Park Service has monitored landbirds at Channel Islands National Park (CHIS) during every breeding season since 1993 as part of the Mediterranean Coast Network Inventory and Monitoring Program. In this report, we summarize data collected during the breeding season (March through May) of 2022. We used distance-based sampling methods and a standardized protocol to count landbirds at 97% (331 of 338) of the CHIS permanent point count stations on East Anacapa Islet, Santa Barbara Island, Santa Cruz Island, San Miguel Island, and Santa Rosa Island. Counts were not made at seven point count stations on Santa Barbara Island due to the presence of nesting California Brown Pelicans, and at three of these stations, counts have not been made since 2015 to avoid disturbing nesting pelicans.

Across point stations on all five islands, 56 species of landbirds were counted in 2022, 40 of which breed at CHIS. In descending order, the ten most detected landbirds at CHIS in 2022 were Spotted Towhee, Song Sparrow, Orange-crowned Warbler, Bewick's Wren, Western Meadowlark, House Finch, Horned Lark, White-crowned Sparrow, Common Raven, and Pacific-slope Flycatcher. The fewest number of landbird species were counted on East Anacapa Islet (5), while the greatest number were counted on Santa Cruz Island (42). While non-native and invasive birds were counted on only one of the five islands in 2022 (17 European Starlings on Santa Rosa Island), anecdotal sightings of non-native species occurred more frequently on both Santa Cruz and Santa Rosa islands. For example, Santa Cruz Island had the highest number of anecdotal sightings of non-native species (19) in 2022: 12 European Starlings, four Eurasian Collared-Doves, and three Rock Pigeons. Density analyses were conducted for three species across Santa Cruz and Santa Rosa islands, and one species, Northern Flicker, had a significant decreasing density trend from 2016 to 2022.

Executive Summary

The National Park Service (NPS) began monitoring landbirds at Channel Islands National Park (CHIS) in 1993 as part of its long-term Inventory and Monitoring program, which became part of the NPS Inventory and Monitoring Program's Mediterranean Coast Network. Monitoring has been conducted during every breeding season since 1993, and in this report, we summarize data collected during the breeding season of 2022.

Monitoring was conducted between 1 March and 31 May 2022. Using distance-based sampling methods in a standardized protocol, birds were counted at 331 of 338 permanent point count stations (97% of all stations). Surveys were conducted at stations across CHIS as follows: 26 of 33 point count stations on Santa Barbara, 8 of 8 on East Anacapa, 112 of 112 on Santa Cruz, 40 of 40 on San Miguel, and 145 of 145 on Santa Rosa. Seven points on Santa Barbara Island were not counted due to nesting California Brown Pelicans (*Pelecanus occidentalis*): three of these seven points (17, 19, and 20) were also not counted in 2016–2021 to avoid disturbing breeding pelicans. This was the second monitoring season that line transects on Santa Barbara, East Anacapa, and San Miguel islands were not surveyed; for the 2021 monitoring season CHIS decided to stop using line transects and focus on point count stations only, based on an external review of the landbird monitoring program.

Fifty-six species were counted at point count stations across all islands in 2022. Forty of these species were breeders at CHIS. Parkwide, the ten most detected landbirds in 2022 were, in descending order: Spotted Towhee (*Pipilo maculatus*), Song Sparrow (*Melospiza melodia*), Orange-crowned Warbler (*Oreothlypis celata*), Bewick's Wren (*Thryomanes bewickii*), Western Meadowlark (*Sturnella neglecta*), House Finch (*Haemorhous mexicanus*), Horned Lark (*Eremophila alpestris*), White-crowned Sparrow (*Zonotrichia leucophrys*), Common Raven (*Corvus corax*), and Pacific-slope Flycatcher (*Empidonax difficilis*) (all nesting species observed in CHIS are listed in Appendix A).

On East Anacapa Islet, 26 landbird species have been counted since 1993; five species were counted in 2022. No new transient species were detected in 2022; six transient or visiting species have been counted on this island since 1993.

On Santa Barbara Island, 50 landbird species have been counted since 1993; ten species were counted in 2022. No new transient species were detected in 2022; 23 transient or visiting species have been counted on this island since 1993.

On Santa Cruz Island, 78 landbird species have been counted since 2013; 42 species were counted in 2022. No new transient species were detected in 2022; 21 transient or visiting species have been counted on this island since 2013.

On San Miguel Island, 70 landbird species have been counted since 1993; 20 species were counted in 2022. No new transient species were counted in 2022; 32 transient or visiting species have been counted on this island since 1993.

On Santa Rosa Island, 77 landbird species have been counted since 1994; 36 species were detected in 2022. No new transient species were counted in 2022; 21 transient or visiting species have been counted on this island since 1994.

Non-native and invasive birds were counted on only one of the five islands in 2022: 17 European Starlings (*Sturnus vulgaris*) on Santa Rosa Island. However, anecdotal sightings of non-native species occurred more frequently (i.e., outside of survey times) on Santa Cruz and Santa Rosa in 2022. The highest numbers of non-native species detections occurred on Santa Cruz Island, with 12 detections of European Starlings (primarily in the Central Valley), four Eurasian Collared-Doves (*Streptopelia decaocto*) (Main Ranch), and three Rock Pigeons (*Columba livia*) (Scorpion Anchorage). Other non-native species (e.g., House Sparrow, *Passer domesticus*) were not reported by CHIS landbird monitors or in eBird in 2022.

This was the second annual monitoring report since the trend report of Coonan and Dye (2016) to incorporate density estimates for avian species at CHIS. Density analyses were conducted for three species across two islands, Santa Cruz ($n = 1$) and Santa Rosa ($n = 2$) islands. Analyses were conducted using the Distance Package in R. Of the three species analyzed, one (i.e., Northern Flicker, *Colaptes auratus*; $r^2 = 0.62$, $p = 0.04$) had a significant decreasing density trend from 2016 to 2022. A Spearman's Rank Correlation Matrix was performed to test the dependence between three raptor species on Santa Barbara Island. Significant negative correlations (i.e., $P < 0.05$) occurred between all three species on the island.

The authors suggest several management recommendations in the coming years. European Starlings on Santa Rosa Island have increased since 2016. We suggest their roosting locations should be scouted and a removal strategy should be implemented. Chipping Sparrows (*Spizella passerina*) on Santa Rosa Island have decreased over the last six years. We recommend an increased sample size of count stations where Chipping Sparrows were observed in 2023, which could potentially increase the encounter rate for this species. Lastly, Orange-crowned Warblers on East Anacapa Islet have decreased from 2000 to 2015 and have been absent from point count surveys since 2017. We recommend a second visit during the monitoring season in 2023, to increase the likelihood of detecting, and being able to estimate density for, this species.

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Paul Collins, Stacey Ostermann, and Jolie Gareis provided critical reviews. In addition to the data collected by author Peter Larramendy of the Western Foundation of Vertebrate Zoology (WVZ) on Santa Barbara, Santa Cruz, Santa Rosa and San Miguel islands, data also were gathered by Stacy Baker of the National Park Service (East Anacapa, Santa Cruz, and San Miguel islands), Lyndal Laughrin (LL) of the University of California (UC) Reserve (Santa Cruz Island), Nick Todd (Santa Cruz Island), Sangeet Khalsa (Santa Rosa Island), and Hannah Horowitz of the Smithsonian Institution (Santa Rosa Island). NPS staff were instrumental in getting observers on, off, and around the islands safely. The UC Reserve on Santa Cruz Island provided lodging, and LL assisted with all logistics on this island. Island Packers provided additional transportation on and off island. The WVZ generously provided additional logistical and technical support. Thanks to all!

Introduction

Channel Islands National Park (CHIS) comprises five of the eight Channel Islands that lie off the coast of southern California. The park islands range in size from <300 hectares (East Anacapa and Santa Barbara islands) to >20,000 hectares (Santa Rosa and Santa Cruz islands). Fifty-four terrestrial bird species (hereafter “landbird species”), not including exclusively marine species, have been confirmed as breeding regularly or occasionally on the park islands (Appendix A; Collins and Jones 2015).

The National Park Service (NPS) began monitoring landbirds at CHIS in 1993 as part of its long-term Inventory and Monitoring program (Davis et al. 1994), which became part of the NPS Inventory and Monitoring Program’s Mediterranean Coast Network (MEDN; Cameron et al. 2005). Data were originally collected on line transects (van Riper et al. 1988) until the program shifted primarily to the point count method starting in 2001 as a result of a program review in 2000 (Coonan et al. 2011; Fancy 2000). Following the program review, a total of 338 point count stations were sampled across all five islands.

Prior to 2016, monitoring was conducted by experienced CHIS staff, partners, interns, and volunteers. Because of a loss of institutional knowledge due to a reduction in staffing and retirement of key personnel, the park partnered with the Western Foundation of Vertebrate Zoology to coordinate and conduct the landbird monitoring from 2016 to 2022.

The objectives of the landbird monitoring program (Coonan et al. 2011; van Riper et al. 1988) are as follows:

1. Determine long-term trends in species composition, distribution, and abundance of native and non-native landbird species in selected areas of Channel Islands National Park.
2. Improve our understanding of breeding bird–habitat relationships and the effects of management actions, such as alien plant and animal control, on bird populations by correlating changes in landbird species composition, distribution, and abundance with changes in specific habitat variables.

In this report, we summarize data collected during landbird monitoring in 2022. We present simple summaries of raw observational data and trends in density for selected species.

Methods

In 2022, landbird monitoring at CHIS was conducted on established point count sites called “stations” (Coonan et al. 2011) as per protocol review recommendations proposed in 2000. All transect counts were dropped in 2021 per recommendations from an external review of the landbird counting program conducted in 2021 (George 2022).

Six observers conducted landbird monitoring in 2022 (details available in [Larramendy et al. 2025, the report’s file of supplemental information](#)). Point count sampling occurred in the morning, beginning as soon as it was light enough to see a distance of at least 150 meters and ending no later than four hours after official sunrise. Counts were not conducted during high winds (wind strength on the Beaufort scale was sustained at 4 or greater) or heavy rain. Observations were made by sight and sound of either perched or flying birds, and included horizontal distances in meters from the observer to the bird. For a complete description of methods and Standard Operating Procedures see the *Landbird Monitoring Protocol for Channel Islands National Park – Version 2.0* (Coonan et al. 2011).

On Santa Cruz Island, we conducted a ninth year of monitoring at 100 non-random point count sites along trails and roads established in 1991 by R.C. Klinger of The Nature Conservancy. For these sites the access points were spaced by Klinger to be 0.5 miles (0.8 km) apart along the major roads and trails on the island. A random compass bearing and distance (within 150 meters) to the station were selected from these access points to the count stations. We also conducted a ninth year of monitoring at 12 non-random point count sites established by NPS in 2013 on the east side of Santa Cruz Island.

The methodology used in 2022 followed Coonan et al. (2011), except for the fog modification that was adopted in 2015 and repeated again during the 2016–2022 seasons: the minimum visibility distance necessary to conduct monitoring was reduced from 400 m to 150 m.

Data were entered into the CHIS Landbird Database by P. Larramendy, and then quality-checked and verified for errors by L. Hall. Validation queries were run to highlight field values that were not consistent with expected results (i.e., out-of-range values). These values were double-checked against field datasheets, and discrepancies were corrected as appropriate and/or noted in the database.

Data summaries were generated using an automated report run in the program R (R Core Team 2022). Density analyses were performed on three species using data from the 2016–2022 monitoring seasons. Species were selected from previous monitoring reports because their abundance averages indicated an increase or decrease over the last seven years. We used half-normal and hazard rate key functions with cosine and polynomial adjustments (Buckland et al. 2015; Coonan and Dye 2016). Distances were truncated to include 90% of observations recorded during point count surveys, while removing outlier distances. We ran models using the Distance Package in R, and the model with the lowest Akaike’s Information Criterion, and best goodness-of-fit based on Cramér-von Mises statistic, was used for density reports and interannual linear and non-linear regression analyses (Miller et al.

2019; R Core Team 2022). A descriptive statistical analysis using Spearman's Rank Correlation was also performed on the abundances of three raptor species—American Kestrel, Northern Harrier, and Peregrine Falcon—from Santa Barbara Island from 2002 to 2022 as a preliminary assessment for any interactions among the species. Of particular interest was evaluating whether American Kestrels are being replaced by Peregrine Falcons and Northern Harriers on the island.

Landbird monitoring point count stations and line transects are presented in Figures 1–5.

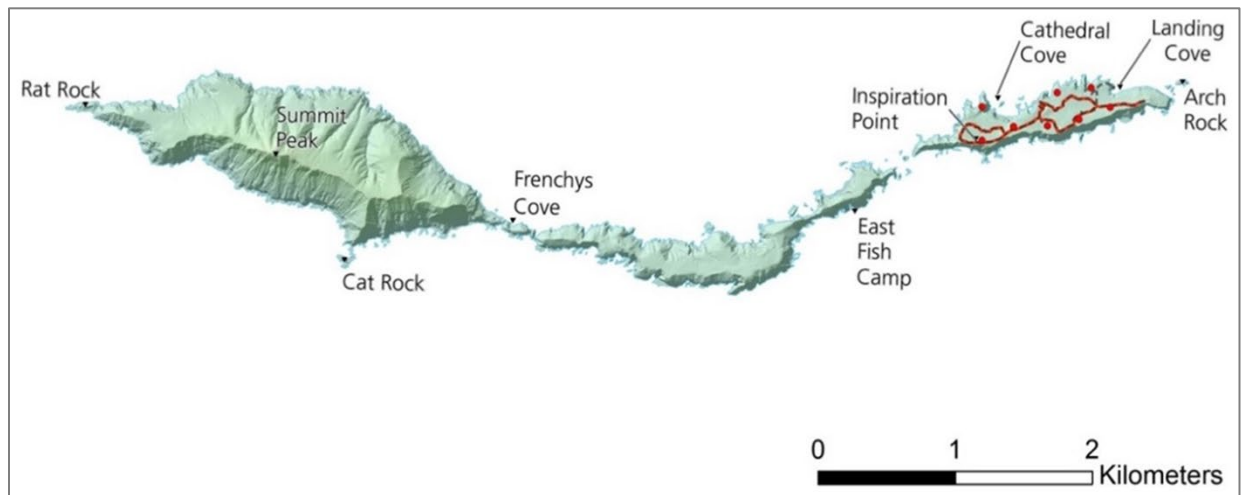


Figure 1. Landbird monitoring point count stations (red dots) and line transects (red lines) on East Anacapa Islet. Line transect surveys were eliminated after 2020.

NPS

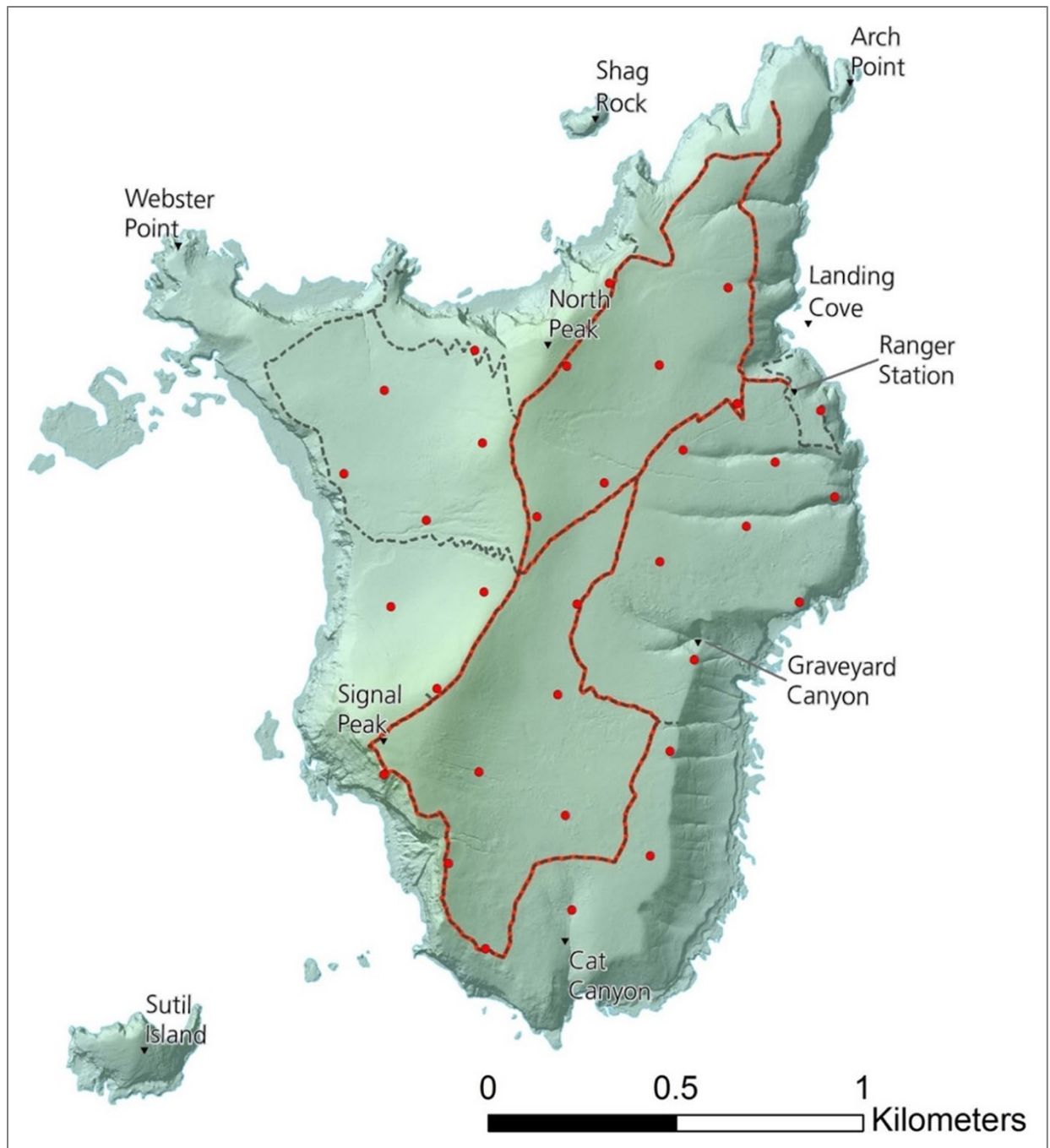


Figure 2. Landbird monitoring point count stations (red dots) and line transects (red lines) on Santa Barbara Island. Line transect surveys were eliminated after 2020.

NPS

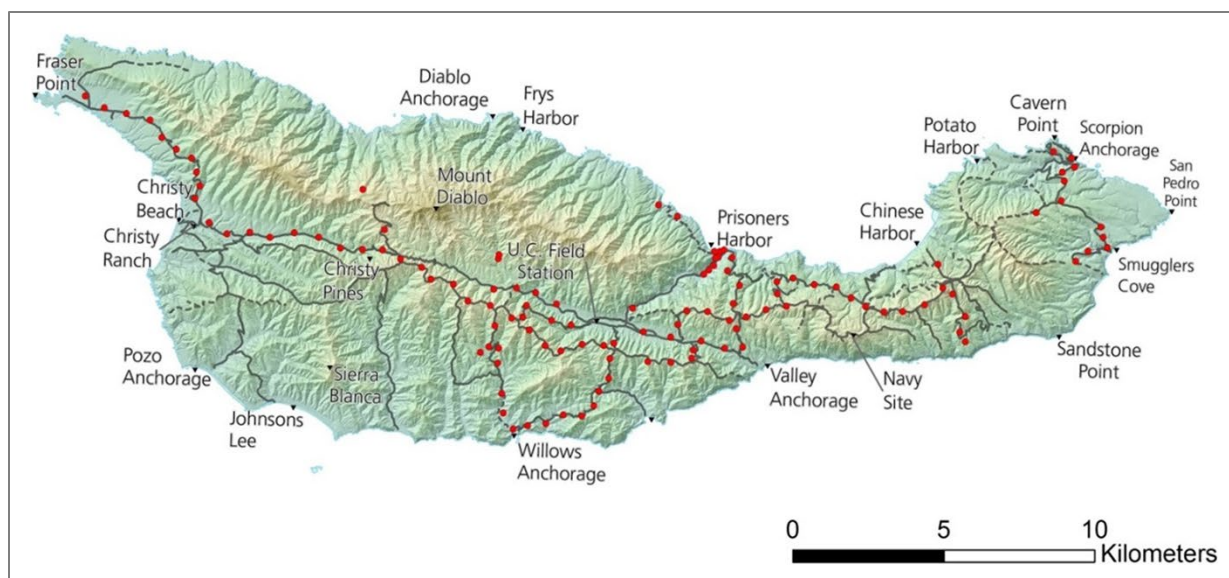


Figure 3. Landbird monitoring point count stations (red dots) on Santa Cruz Island.

NPS

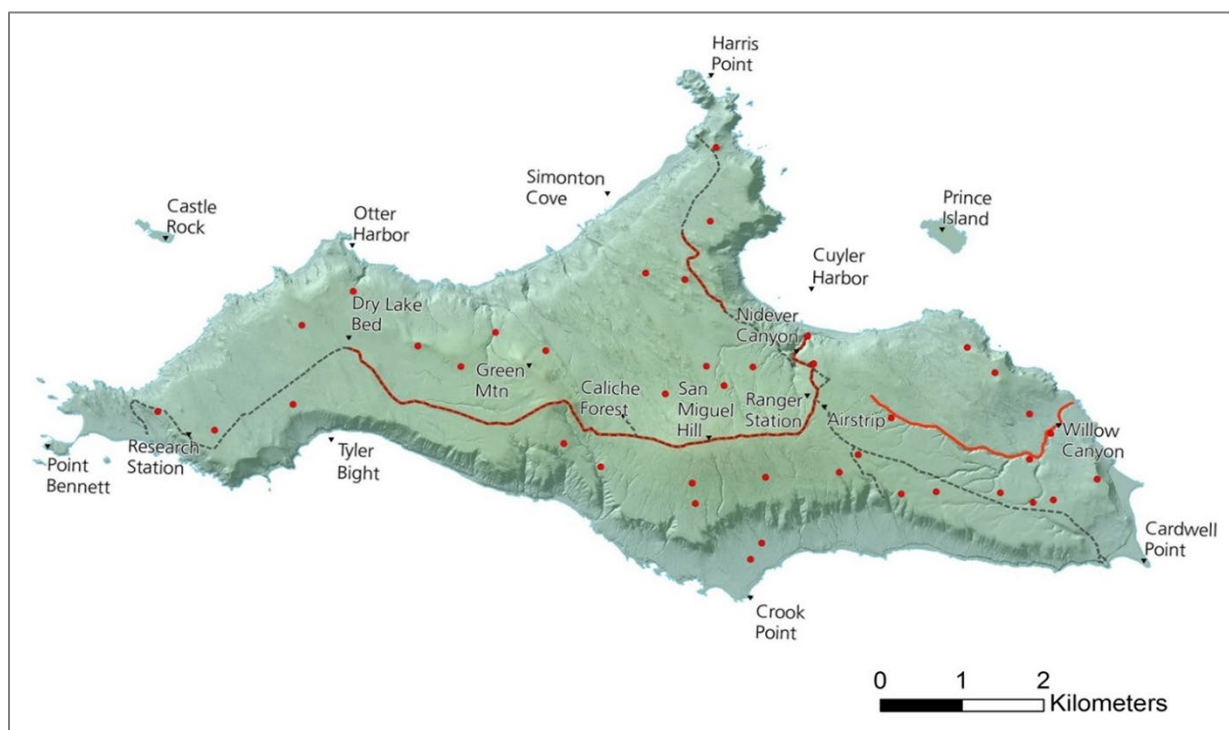


Figure 4. Landbird monitoring point count stations (red dots) and line transects (red lines) on San Miguel Island. Line transect surveys were eliminated after 2020.

NPS

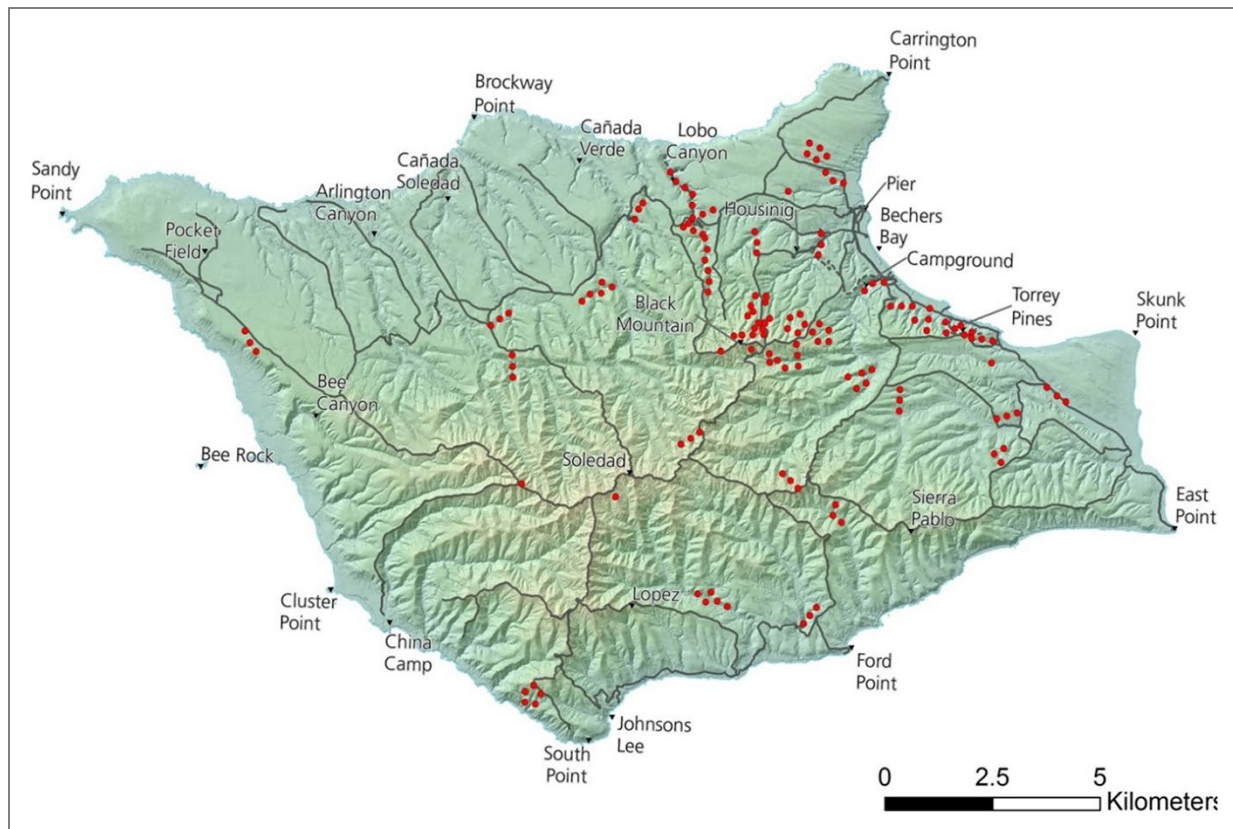


Figure 5. Landbird monitoring point count stations (red dots) on Santa Rosa Island.

NPS

Results

Monitoring was conducted between 1 March and 31 May, 2022 (Table 1). Using distance-based sampling methods (Buckland et al. 2015) for point counts, 331 of 338 permanent point count sites (97% of all stations) were sampled in 2022 (i.e., 26 of 33 points on Santa Barbara, 8 of 8 on East Anacapa, 112 of 112 on Santa Cruz, 40 of 40 on San Miguel, and 145 of 145 on Santa Rosa). Counts were not made at seven points on Santa Barbara Island due to nesting pelicans. Three of the seven points on the east side of the island (17, 19, and 20) have not been surveyed for the last six monitoring seasons, 2016–2022, due to nesting pelicans.

Table 1. Survey start and end dates with the number of point count stations monitored in 2022. Islands are listed in chronological order of surveying dates.

Island	Start Date	End Date	# Point Counts
Santa Barbara	03/01/2022	03/08/2022	26
East Anacapa	03/27/2022	03/28/2022	8
San Miguel	04/05/2022	04/12/2022	40
Santa Cruz	04/24/2022	05/15/2022	112
Santa Rosa	05/03/2022	05/31/2022	145

Bird Species Occurrence in 2022

The numbers of individuals of each species that were detected on all islands in 2022 are presented in Table 2. Indices of abundance on point counts (number of birds counted and mean number of birds per station) are presented by island in Tables 3–7.

Fifty-six bird species were counted during point counts across all islands in 2022, including one unknown genera (Table 2). Forty of these were breeding species on the islands (Table 2, Appendix A). Parkwide, the ten most detected breeding landbirds in 2022 were, in descending order: Spotted Towhee, Song Sparrow, Bewick’s Wren, Orange-crowned Warbler, House Finch, Western Meadowlark, Horned Lark, Common Raven, Island Scrub-Jay, and Pacific-slope Flycatcher (Table 2; scientific names given in Table 2 and Appendix A).

Table 2. Number of individuals of each species counted during bird surveys on all islands in 2022, Channel Islands National Park. Data are from point counts only and do not include birds observed before or after the counts.

Common Name	Scientific Name	Total # Detected	East Anacapa	Santa Barbara	Santa Cruz	San Miguel	Santa Rosa
Acorn Woodpecker ^A	<i>Melanerpes formicivorus</i>	79	–	–	27	–	52
Allen’s Hummingbird ^A	<i>Selasphorus sasin</i>	63	–	–	2	8	53
American Kestrel ^A	<i>Falco sparverius</i>	3	–	–	3	–	–
Anna’s Hummingbird ^A	<i>Calypte anna</i>	56	–	–	21	1	34
Ash-throated Flycatcher ^A	<i>Myiarchus cinerascens</i>	39	–	–	39	–	–
Bald Eagle ^A	<i>Haliaeetus leucocephalus</i>	2	–	–	2	–	–
Barn Swallow ^A	<i>Hirundo rustica</i>	30	–	–	22	–	8
Bewick’s Wren ^A	<i>Thryomanes bewickii</i>	316	1	–	116	3	196
Black-headed Grosbeak ^A	<i>Pheucticus melanocephalus</i>	25	–	–	25	–	–
Black Phoebe ^A	<i>Sayornis nigricans</i>	3	–	–	3	–	–
Blue-gray Gnatcatcher ^A	<i>Polioptila caerulea</i>	7	–	–	7	–	–
Bushtit ^A	<i>Psaltiriparus minimus</i>	28	–	–	4	–	24
California Quail ^A	<i>Callipepla californica</i>	74	–	–	49	–	25
Canyon Wren ^A	<i>Catherpes mexicanus</i>	1	–	–	1	–	–
Chipping Sparrow ^A	<i>Spizella passerina</i>	85	–	–	35	–	50
Common Raven ^A	<i>Corvus corax</i>	164	1	–	27	62	74
Common Yellowthroat	<i>Geothlypis trichas</i>	2	–	–	1	–	1
Cooper’s Hawk ^A	<i>Accipiter cooperii</i>	1	–	–	1	–	–
European Starling ^A	<i>Sturnus vulgaris</i>	17	–	–	–	–	17
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>	5	–	2	2	1	–
Grasshopper Sparrow ^A	<i>Ammodramus savannarum</i>	3	–	–	–	–	3
Hermit Warbler	<i>Dendroica occidentalis</i>	1	–	–	1	–	–
Horned Lark ^A	<i>Eremophila alpestris</i>	233	–	161	1	48	23

^A Resident breeding landbirds on at least one of the five islands in Channel Islands National Park. Data on nesting status from Collins and Jones (2015).

Table 2 (continued). Number of individuals of each species counted during bird surveys on all islands in 2022, Channel Islands National Park. Data are from point counts only and do not include birds observed before or after the counts.

Common Name	Scientific Name	Total # Detected	East Anacapa	Santa Barbara	Santa Cruz	San Miguel	Santa Rosa
House Finch ^A	<i>Carpodacus mexicanus</i>	277	–	6	55	19	197
Hutton's Vireo ^A	<i>Vireo huttoni</i>	23	–	–	21	–	2
Island Scrub-Jay ^A	<i>Aphelocoma insularis</i>	124	–	–	124	–	–
Lawrence's Goldfinch	<i>Carduelis lawrencei</i>	2	–	–	–	–	2
Lazuli Bunting	<i>Passerina amoena</i>	4	–	–	–	–	4
Lesser Goldfinch ^A	<i>Carduelis psaltria</i>	51	–	–	6	–	45
Loggerhead Shrike ^A	<i>Lanius ludovicianus</i>	12	–	–	3	–	9
Merlin	<i>Falco columbarius</i>	1	–	–	–	1	–
Mourning Dove ^A	<i>Zenaida macroura</i>	10	–	–	8	–	2
Northern Flicker ^A	<i>Colaptes auratus</i>	35	–	–	33	–	2
Northern Harrier ^A	<i>Circus cyaneus</i>	3	–	–	–	3	–
Northern Mockingbird ^A	<i>Mimus polyglottos</i>	24	–	–	4	–	20
Orange-crowned Warbler ^A	<i>Leiothlypis celata</i>	352	–	2	97	76	177
Osprey	<i>Pandion haliaetus</i>	1	–	–	1	–	–
Pacific-slope Flycatcher ^A	<i>Empidonax difficilis</i>	125	–	–	5	–	120
Peregrine Falcon ^A	<i>Falco peregrinus</i>	9	2	4	1	–	2
Red-tailed Hawk ^A	<i>Buteo jamaicensis</i>	8	–	–	–	2	6
Rock Wren ^A	<i>Salpinctes obsoletus</i>	10	–	2	2	2	4
Ruby-crowned Kinglet	<i>Regulus calendula</i>	1	–	–	–	1	–
Rufous-crowned Sparrow ^A	<i>Aimophila ruficeps</i>	34	–	–	34	–	–
Savannah Sparrow	<i>Passerculus sandwichensis</i>	12	–	12	–	–	–
Say's Phoebe	<i>Sayornis saya</i>	1	–	–	–	1	–
Song Sparrow ^A	<i>Melospiza melodia</i>	522	11	–	95	119	297

^A Resident breeding landbirds on at least one of the five islands in Channel Islands National Park. Data on nesting status from Collins and Jones (2015).

Table 2 (continued). Number of individuals of each species counted during bird surveys on all islands in 2022, Channel Islands National Park. Data are from point counts only and do not include birds observed before or after the counts.

Common Name	Scientific Name	Total # Detected	East Anacapa	Santa Barbara	Santa Cruz	San Miguel	Santa Rosa
Spotted Towhee ^A	<i>Pipilo maculatus</i>	710	–	–	277	–	433
Swainson's Thrush	<i>Catharus ustulatus</i>	1	–	–	1	–	–
Townsend's Warbler	<i>Dendroica townsendi</i>	2	–	–	–	–	2
Virginia Rail ^A	<i>Rallus limicola</i>	1	–	–	–	–	1
Warbling Vireo	<i>Vireo gilvus</i>	3	–	–	–	–	3
Western Meadowlark ^A	<i>Sturnella neglecta</i>	281	–	17	25	75	164
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	172	18	106	–	48	–
White-throated Swift ^A	<i>Aeronautes saxatalis</i>	8	–	–	7	–	1
Wilson's Warbler	<i>Wilsonia pusilla</i>	6	–	–	–	1	5
Yellow-rumped Warbler	<i>Dendroica coronata</i>	13	–	2	2	9	–
Total Number of Species per Island (Richness)	N/A	56	5	10	42	20	36

^A Resident breeding landbirds on at least one of the five islands in Channel Islands National Park. Data on nesting status from Collins and Jones (2015).

Table 3. Results from point count sampling at eight stations on East Anacapa Islet in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
BEWR	Bewick's Wren	1	1	12.5	0.12	0.12
CORA	Common Raven	1	1	12.5	0.12	0.12
PEFA	Peregrine Falcon	2	1	12.5	0.25	0.25
SOSP	Song Sparrow	11	6	75.0	1.38	0.32
WCSP	White-crowned Sparrow	18	7	87.5	2.25	0.70

Table 4. Results from point count sampling at 26 stations on Santa Barbara Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
GCSP	Golden-crowned Sparrow	2	1	3.9	0.08	0.08
HOLA	Horned Lark	161	25	96.2	6.19	0.59
HOFI	House Finch	6	3	11.5	0.23	0.14
OCWA	Orange-crowned Warbler	2	2	7.7	0.08	0.05
PEFA	Peregrine Falcon	4	4	15.4	0.15	0.07
ROWR	Rock Wren	2	1	3.9	0.08	0.08
SAVS	Savannah Sparrow	12	7	26.9	0.46	0.18
WEME	Western Meadowlark	17	6	23.1	0.65	0.33
WCSP	White-crowned Sparrow	106	18	69.2	4.08	1.07
YRWA	Yellow-rumped Warbler	2	1	3.9	0.08	0.08

Table 5. Results from point count sampling at 112 stations on Santa Cruz Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
ACWO	Acorn Woodpecker	27	17	15.2	0.24	0.06
ALHU	Allen's Hummingbird	2	2	1.8	0.02	0.01
AMKE	American Kestrel	3	3	2.7	0.03	0.02
ANHU	Anna's Hummingbird	21	18	16.1	0.19	0.04
ATFL	Ash-throated Flycatcher	39	30	26.8	0.35	0.06
BARS	Barn Swallow	22	9	8.0	0.20	0.08
BEWR	Bewick's Wren	116	69	61.6	1.04	0.10
BHGR	Black-headed Grosbeak	25	20	17.9	0.22	0.05
BLPH	Black Phoebe	3	3	2.7	0.03	0.02
BGGN	Blue-gray Gnatcatcher	7	6	5.4	0.06	0.03
BUSH	Bushtit	4	3	2.7	0.04	0.02
CAQU	California Quail	49	35	31.2	0.44	0.07
CANW	Canyon Wren	1	1	0.9	0.01	0.01
CHSP	Chipping Sparrow	35	26	23.2	0.31	0.06
CORA	Common Raven	29	17	15.2	0.26	0.07
COYE	Common Yellowthroat	1	1	0.9	0.01	0.01
COHA	Cooper's Hawk	1	1	0.9	0.01	0.01
GCSP	Golden-crowned Sparrow	2	1	0.9	0.02	0.02
HEWA	Hermit Warbler	1	1	0.9	0.01	0.01
HOLA	Horned Lark	1	1	0.9	0.01	0.01
HOFI	House Finch	55	31	27.7	0.49	0.09
HUVI	Hutton's Vireo	21	18	16.1	0.19	0.04
ISJA	Island Scrub-Jay	124	66	58.9	1.11	0.11
LEGO	Lesser Goldfinch	6	5	4.5	0.05	0.02
LOSH	Loggerhead Shrike	3	3	2.7	0.03	0.02
MODO	Mourning Dove	8	7	6.2	0.07	0.03
NOFL	Northern Flicker	33	30	26.8	0.29	0.05
NOMO	Northern Mockingbird	4	4	3.6	0.04	0.02
OCWA	Orange-crowned Warbler	97	53	47.3	0.87	0.10
OSPR	Osprey	1	1	0.9	0.01	0.01
PSFL	Pacific-slope Flycatcher	5	5	4.5	0.04	0.02

Table 5 (continued). Results from point count sampling at 112 stations on Santa Cruz Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
PEFA	Peregrine Falcon	1	1	0.9	0.01	0.01
ROWR	Rock Wren	2	2	1.8	0.02	0.01
RCSP	Rufous-crowned Sparrow	34	24	21.4	0.30	0.06
SOSP	Song Sparrow	95	57	50.9	0.85	0.10
SPTO	Spotted Towhee	277	104	92.9	2.47	0.13
SWTH	Swainson's Thrush	1	1	0.9	0.01	0.01
WEME	Western Meadowlark	25	14	12.5	0.22	0.06
WTSW	White-throated Swift	7	3	2.7	0.06	0.05
YRWA	Yellow-rumped Warbler	2	2	1.8	0.02	0.01

Table 6. Results from point count sampling at 40 stations on San Miguel Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
ALHU	Allen's Hummingbird	8	7	17.5	0.20	0.07
ANHU	Anna's Hummingbird	1	1	2.5	0.03	0.02
BEWR	Bewick's Wren	3	3	7.5	0.07	0.04
CORA	Common Raven	62	26	65.0	1.55	0.24
GCSP	Golden-crowned Sparrow	1	1	2.5	0.03	0.02
HOLA	Horned Lark	48	19	47.5	1.20	0.28
HOFI	House Finch	19	10	25.0	0.48	0.18
MERL	Merlin	1	1	2.5	0.03	0.02
NOHA	Northern Harrier	3	2	5.0	0.07	0.06
OCWA	Orange-crowned Warbler	76	31	77.5	1.90	0.26
RTHA	Red-tailed Hawk	2	2	5.0	0.05	0.03
ROWR	Rock Wren	2	2	5.0	0.05	0.03
RCKI	Ruby-crowned Kinglet	1	1	2.5	0.03	0.02

Table 6 (continued). Results from point count sampling at 40 stations on San Miguel Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
SAPH	Say's Phoebe	1	1	2.5	0.03	0.02
SOSP	Song Sparrow	119	38	95.0	2.98	0.22
WEME	Western Meadowlark	75	28	70.0	1.88	0.28
WCSP	White-crowned Sparrow	48	21	52.5	1.20	0.26
WIWA	Wilson's Warbler	1	1	2.5	0.03	0.02
YRWA	Yellow-rumped Warbler	9	6	15.0	0.22	0.09

Table 7. Results from point count sampling at 145 stations on Santa Rosa Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
ACWO	Acorn Woodpecker	52	26	17.9	0.36	0.08
ALHU	Allen's Hummingbird	53	38	26.2	0.37	0.06
ANHU	Anna's Hummingbird	34	31	21.4	0.23	0.04
BAEA	Bald Eagle	2	1	0.7	0.01	0.01
BARS	Barn Swallow	8	6	4.1	0.06	0.02
BEWR	Bewick's Wren	196	99	68.3	1.35	0.10
BUSH	Bushtit	24	11	7.6	0.17	0.06
CAQU	California Quail	25	17	11.7	0.17	0.05
CHSP	Chipping Sparrow	50	37	25.5	0.34	0.05
CORA	Common Raven	74	45	31.0	0.51	0.08
COYE	Common Yellowthroat	1	1	0.7	0.01	0.01
EUST	European Starling	17	6	4.1	0.12	0.07
GRSP	Grasshopper Sparrow	3	1	0.7	0.02	0.02
HOLA	Horned Lark	23	9	6.2	0.16	0.06
HOFI	House Finch	197	79	54.5	1.36	0.15
HUVI	Hutton's Vireo	2	2	1.4	0.01	0.01
LAGO	Lawrence's Goldfinch	2	1	0.7	0.01	0.01

Table 7 (continued). Results from point count sampling at 145 stations on Santa Rosa Island in 2022. Each landbird species is identified by its American Ornithological Union code and common name; the data reported for each species includes the number of individuals detected, the number of point count stations where it was detected, the species' frequency (expressed as a percentage of the total stations where a species was detected, % Stns), and the mean number (and standard error, S.E.) of each species detected per station where counts were made.

AOU Code	Common Name	# Detected	# Stns Detected	% Stns	Mean	S.E.
LAZB	Lazuli Bunting	4	3	2.1	0.03	0.02
LEGO	Lesser Goldfinch	45	20	13.8	0.31	0.07
LOSH	Loggerhead Shrike	9	7	4.8	0.06	0.02
MODO	Mourning Dove	2	2	1.4	0.01	0.01
NOMO	Northern Mockingbird	20	15	10.3	0.14	0.04
OCWA	Orange-crowned Warbler	177	91	62.8	1.22	0.10
PSFL	Pacific-slope Flycatcher	120	66	45.5	0.83	0.10
PEFA	Peregrine Falcon	2	1	0.7	0.01	0.01
RTHA	Red-tailed Hawk	6	6	4.1	0.04	0.02
ROWR	Rock Wren	4	3	2.1	0.03	0.02
SOSP	Song Sparrow	297	107	73.8	2.05	0.14
SPTO	Spotted Towhee	433	136	93.8	2.99	0.16
TOWA	Townsend's Warbler	2	2	1.4	0.01	0.01
UNHU	Unidentified Hummingbird	4	3	2.1	0.03	0.02
VIRA	Virginia Rail	1	1	0.7	0.01	0.01
WAVI	Warbling Vireo	3	2	1.4	0.02	0.02
WEME	Western Meadowlark	164	86	59.3	1.13	0.11
WTSW	White-throated Swift	1	1	0.7	0.01	0.01
WIWA	Wilson's Warbler	5	5	3.5	0.03	0.02

Bird Species Occurrence in 2022 Compared to All Years of Monitoring

Figures 6–10 summarize the mean number of birds per point count station on each island in 2022 compared to the mean number of birds per point count station across all years of sampling. Based on 2022 counts falling below the first quartile range of counts for all years, the following breeding bird species decreased in number in 2022:

- Bewick's Wren on East Anacapa Islet (Figure 6);
- Orange-crowned Warbler and Western Meadowlark on Santa Barbara Island (Figure 7);
- Allen's Hummingbird, Blue-gray Gnatcatcher, Common Raven, House Finch, Hutton's Vireo, Lesser Goldfinch, Northern Flicker, Song Sparrow, and Western Meadowlark on Santa Cruz Island (Figure 8);

- Common Raven, Orange-crowned Warbler, and Song Sparrow on San Miguel Island (Figure 9); and
- Chipping Sparrow on Santa Rosa Island (Figure 10).

Breeding bird species with increased detections (counts above the third quartile range of counts for all years) in 2022 were:

- Common Raven, Song Sparrow, Peregrine Falcon, and White-crowned Sparrow (a wintering species) on East Anacapa Islet (Figure 6);
- Horned Lark, House Finch, Peregrine Falcon, Savannah Sparrow (a wintering species), and White-crowned Sparrow (a wintering species) on Santa Barbara Island (Figure 7);
- Ash-throated Flycatcher and Chipping Sparrow on Santa Cruz Island (Figure 8);
- Bewick's Wren and White-crowned Sparrow (a wintering species) on San Miguel Island (Figure 9); and
- Acorn Woodpecker, Anna's Hummingbird, Bushtit, European Starling, Northern Mockingbird, and Spotted Towhee on Santa Rosa Island (Figure 10).

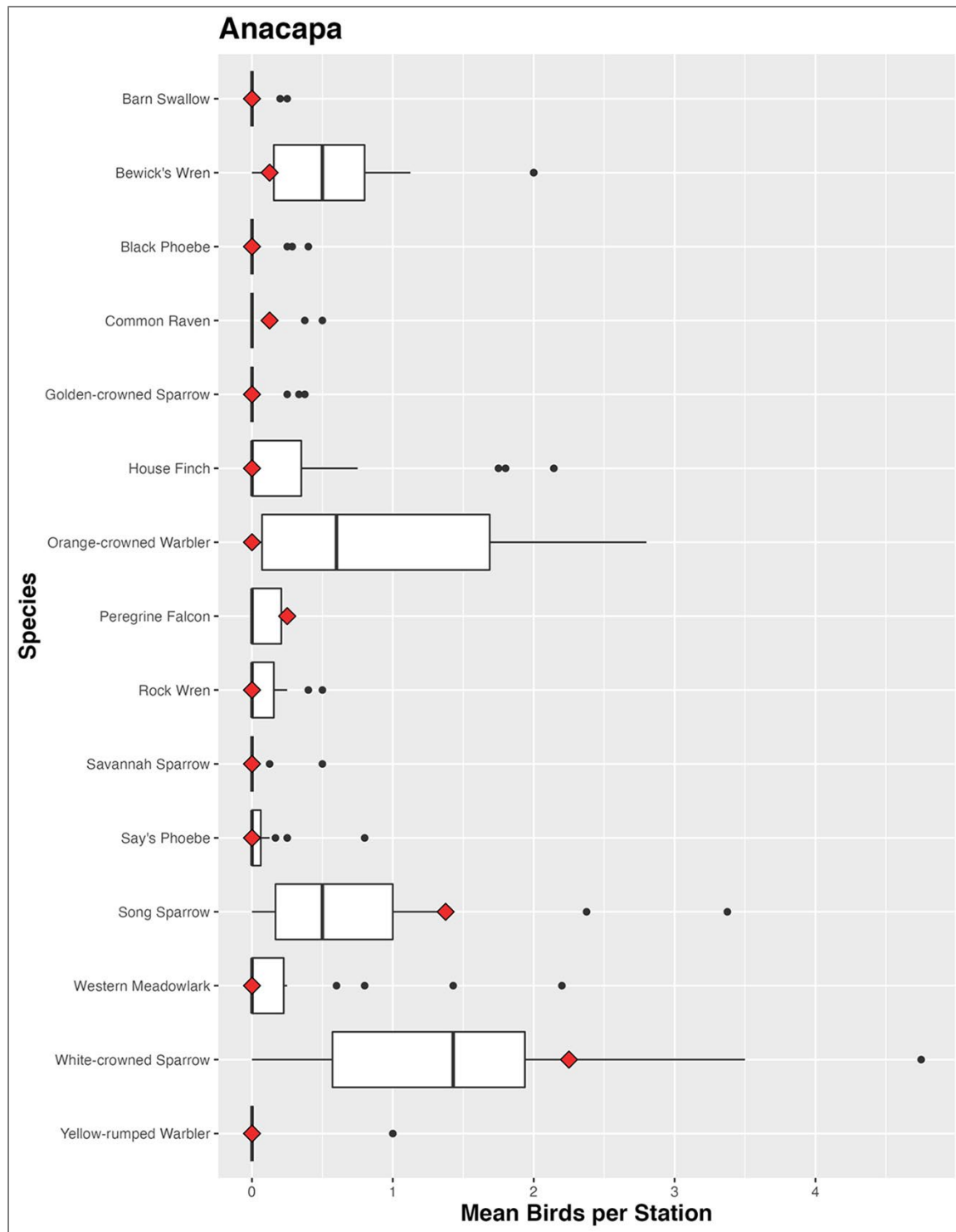


Figure 6. Boxplots showing detections of each breeding bird species at point count stations on East Anacapa Islet. Boxplots display the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum over the entire monitoring period (2001–2022). Red diamonds represent the mean value for 2022 across all point count stations. Note that ten of the 15 species were not observed in 2022.

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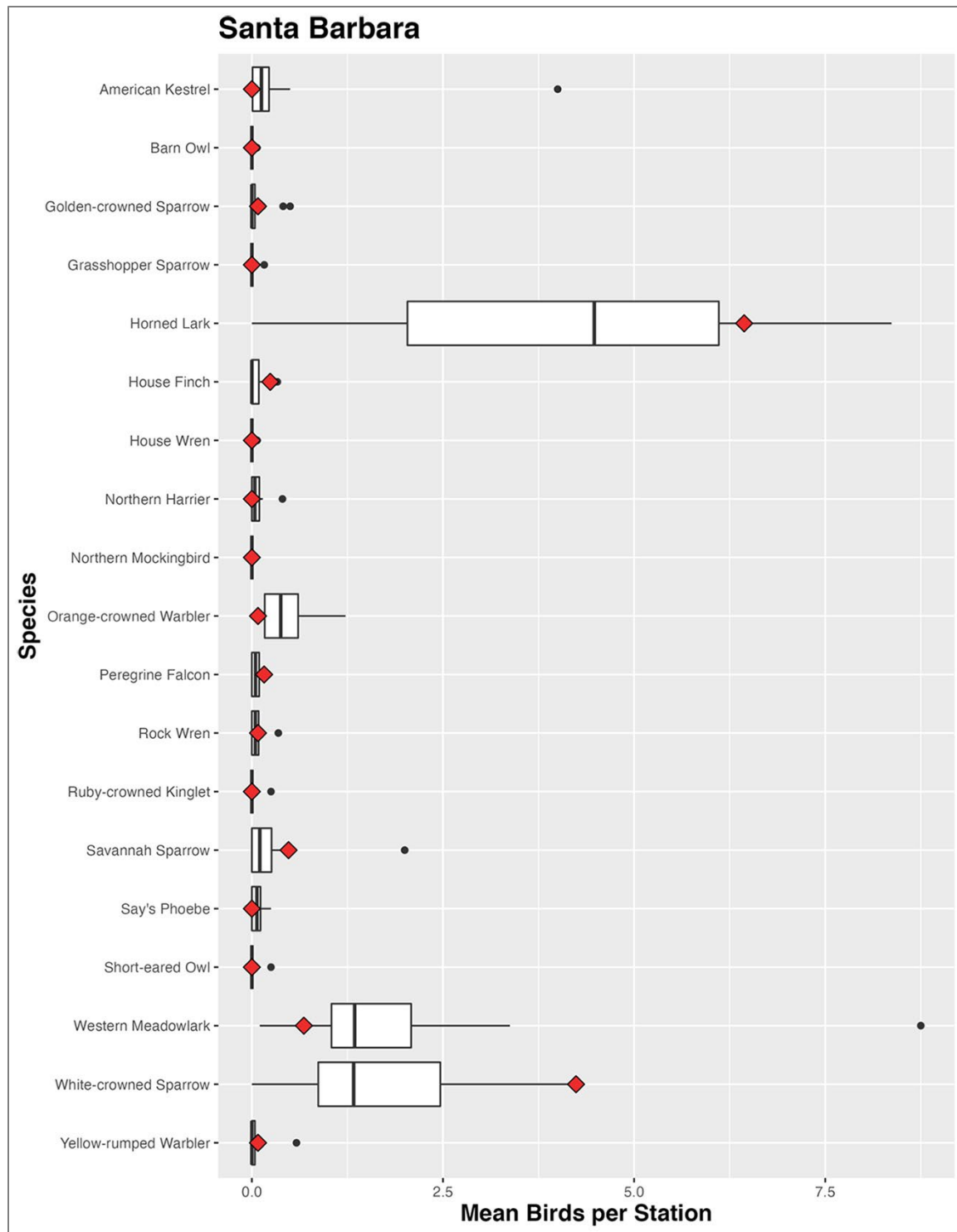


Figure 7. Boxplots showing detections of each breeding bird species at point count stations on Santa Barbara Island. Boxplots display the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum over the entire monitoring period (1995–2022). Red diamonds represent the mean value for 2022 across all point count stations. Note that nine of the 19 species were not observed in 2022.

NPS

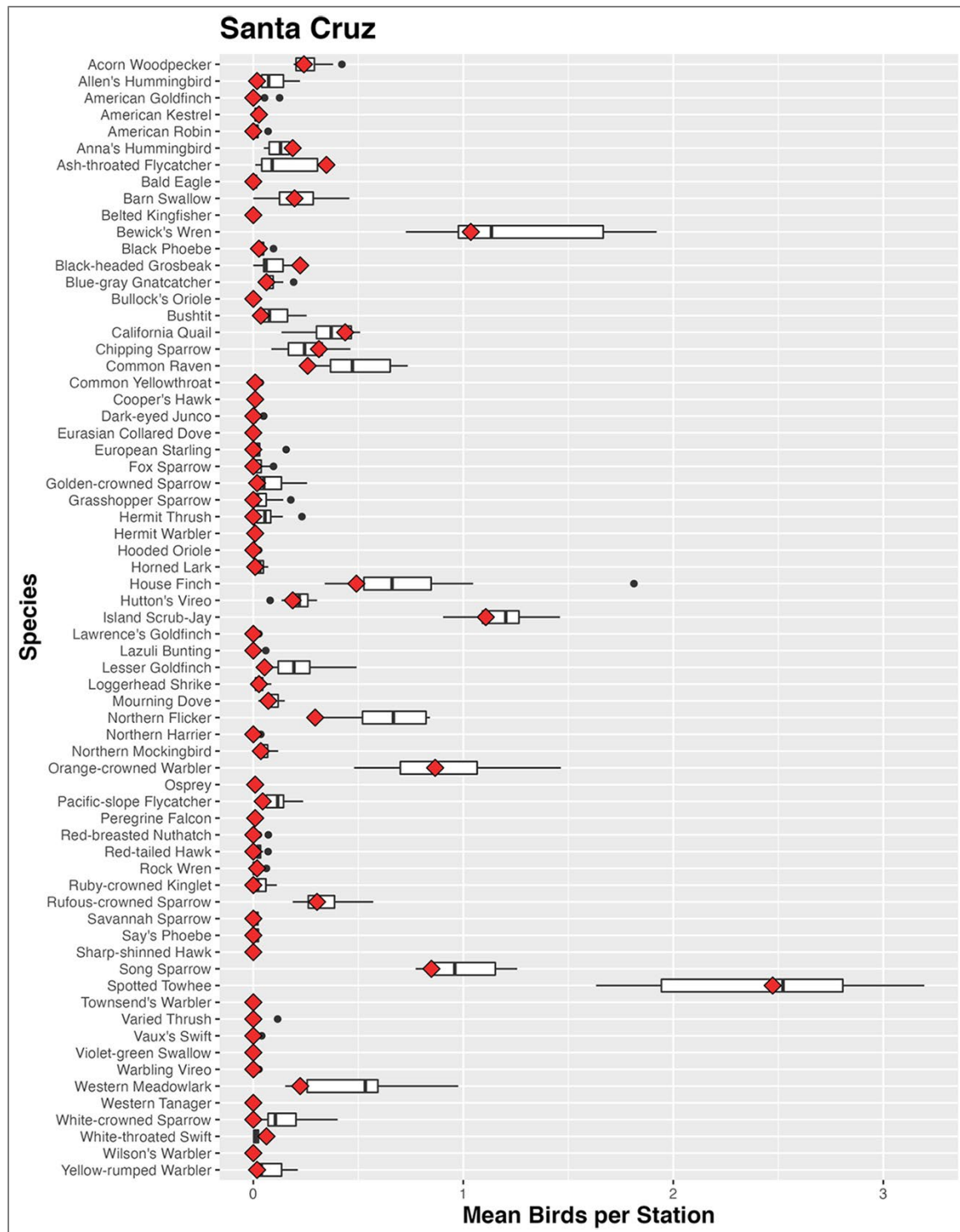


Figure 8. Boxplots showing detections of each breeding bird species at point count stations on Santa Cruz Island. Boxplots display the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum over the entire monitoring period (2013–2022). Red diamonds represent the mean value for 2022 across all point count stations. Note that 25 of the 67 species were not observed in 2022.

NPS

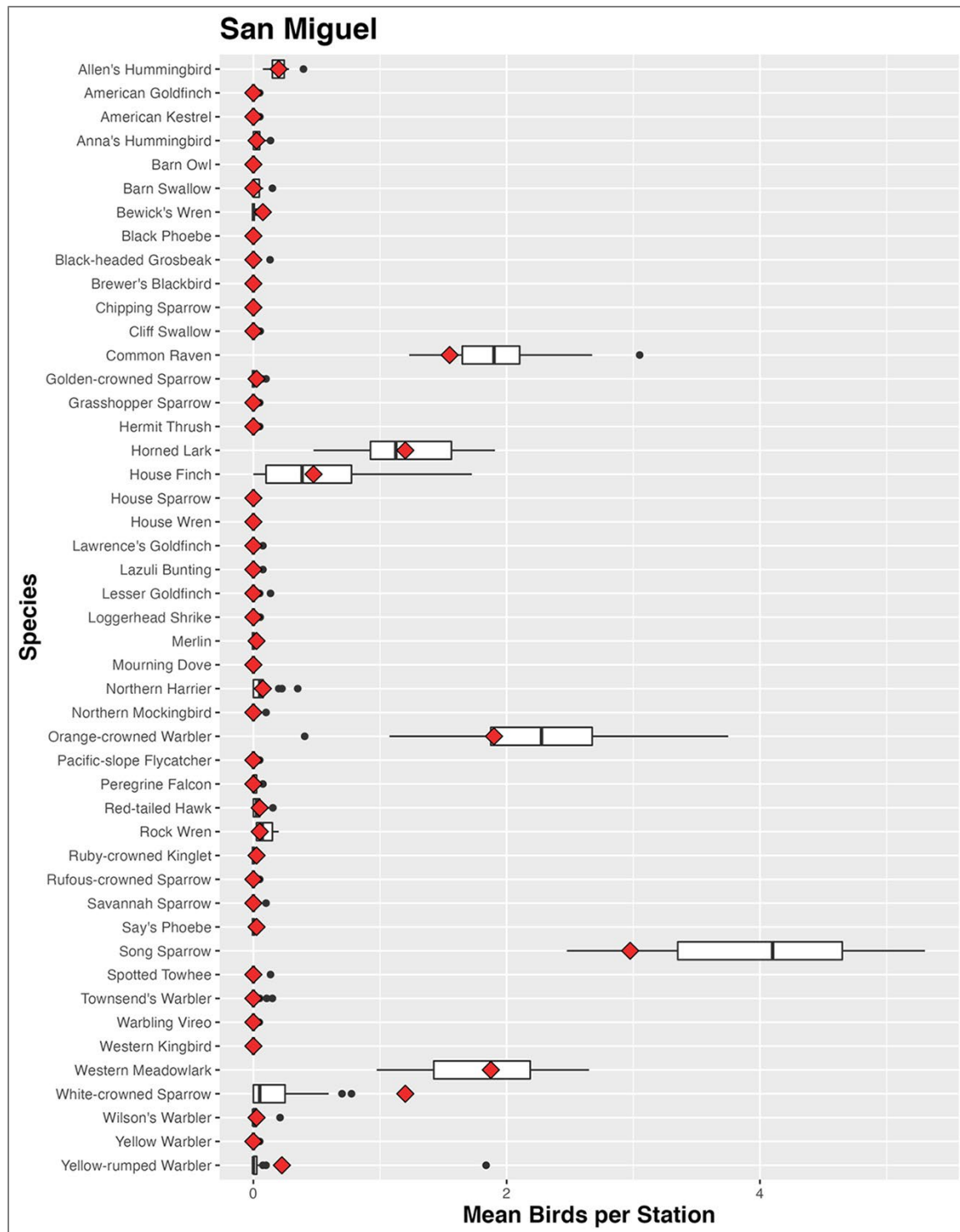


Figure 9. Boxplots showing detections of each breeding bird species at point count stations on San Miguel Island. Boxplots display the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum over the entire monitoring period (2002–2022). Red diamonds represent the mean value for 2022 across all point count stations. Note that 27 of the 47 species were not observed in 2022.

NPS

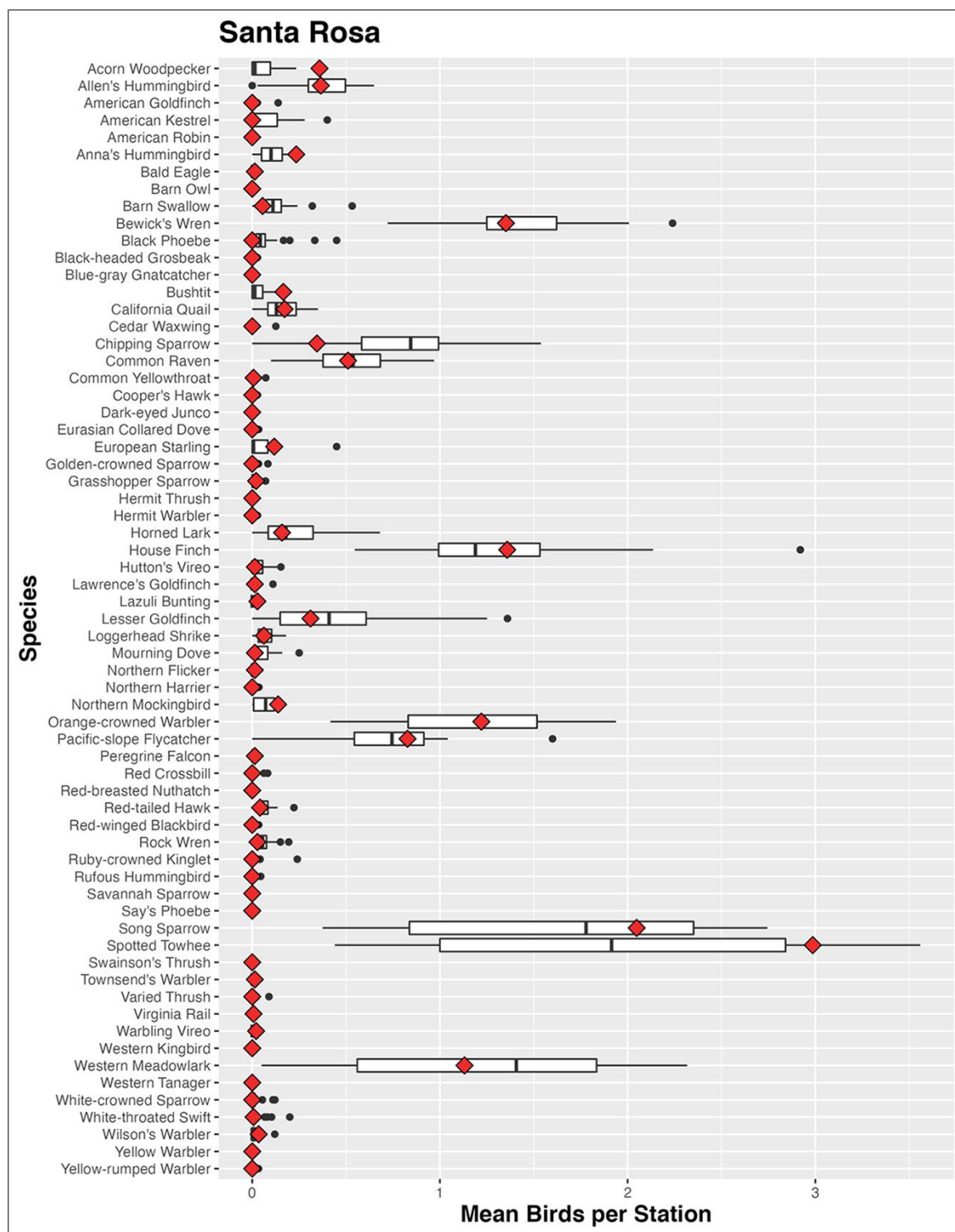


Figure 10. Boxplots showing detections of each breeding bird species at point count stations on Santa Rosa Island. Boxplots display the distribution of data based on the five number summary: minimum, first quartile, median, third quartile, and maximum over the entire monitoring period (1994–2022). Red diamonds represent the mean value for 2022 across all point count stations. Note that 29 of the 65 species were not observed in 2022.

NPS

Patterns in Bird Species Occurrence over Time

The figures in this section summarize patterns of species occurrences (detections) since 1993 for San Miguel, Santa Barbara, and East Anacapa islands; since 1994 for Santa Rosa Island; and since 2013 for Santa Cruz Island. This analysis includes data from both line transects (used in 1993–2020) and point counts, but does not include incidental observations of species that occurred outside of line transects or point counts. These graphs can be used to determine whether species are appearing in or disappearing from the counts. Also, in Table 8 and the following summaries of notable findings on each island, “transient or visiting” species are defined as native species that have been recorded only once or twice during point counts or transects on an island, do not breed on the islands, and occur either as transients or winter/spring visitors. These records were compared to the records summarized by Collins and Jones (2015) and are equivalent to their “transient” and “visitor” nomenclature. Birds that may be regular breeders on one island might also be classified as a transient non-breeding species on another (e.g., Spotted Towhee on Santa Rosa vs. San Miguel). For the purposes of this report, the definition of transient or visitor does not include non-native bird species or native invasive species (e.g., Brown-headed Cowbird).

Table 8. Transient and visiting species counted in all years since monitoring began (“X”) on each of the five northern Channel Islands. “Transient or visiting” species are defined here as native species that have been recorded only once or twice during point counts or line transects and do not breed on the islands. No new transient or visiting species were observed in 2022.

Species	East Anacapa	Santa Barbara	Santa Cruz	San Miguel	Santa Rosa
American Goldfinch	–	X	X	X	–
American Robin	–	–	–	–	X
Ash-throated Flycatcher	–	–	–	X	–
Bald Eagle	–	–	–	X	–
Barn Owl	–	–	–	–	X
Barn Swallow	–	X	–	–	–
Bewick’s Wren	–	X	–	–	–
Black-chinned Sparrow	–	–	X	–	–
Black-throated Gray Warbler	–	–	–	–	X
Blue-gray Gnatcatcher	–	X	–	–	–
Brewer’s Blackbird	–	–	X	X	–
Bullock’s Oriole	–	–	X	–	–
Burrowing Owl	–	–	–	X	–
Bushtit	–	–	–	X	–
Cedar Waxwing	–	–	–	–	X
Cliff Swallow	X	X	–	–	–
Common Raven	–	X	–	–	–
Common Yellowthroat	–	X	–	X	–

Table 8 (continued). Transient and visiting species counted in all years since monitoring began (“X”) on each of the five northern Channel Islands. “Transient or visiting” species are defined here as native species that have been recorded only once or twice during point counts or line transects and do not breed on the islands. No new transient or visiting species were observed in 2022.

Species	East Anacapa	Santa Barbara	Santa Cruz	San Miguel	Santa Rosa
Cooper’s Hawk	–	–	X	–	X
Dark-eyed (Oregon) Junco	–	X	X	X	–
Fox Sparrow	–	–	–	X	–
Grasshopper Sparrow	–	X	–	–	–
Hermit Warbler	–	–	X	–	X
Hooded Oriole	X	–	–	X	–
House Wren	–	–	X	X	–
Hutton’s Vireo	X	–	–	X	–
Lark Sparrow	–	X	–	–	–
Lawrence’s Goldfinch	–	–	X	X	X
Lazuli Bunting	–	–	X	X	–
Lesser Goldfinch	–	X	–	–	–
Lincoln’s Sparrow	–	X	–	–	–
Loggerhead Shrike	–	–	–	X	–
Long-eared Owl	–	X	–	–	–
Merlin	–	–	–	X	–
Nashville Warbler	–	–	–	X	X
Northern Flicker	–	–	–	X	–
Northern Mockingbird	–	X	–	X	–
Olive-sided Flycatcher	–	–	–	X	–
Osprey	X	–	X	–	–
Prairie Falcon	–	–	X	X	–
Red-breasted Sapsucker	–	–	X	–	–
Red-shouldered Hawk	–	X	–	–	–
Red-winged Blackbird	–	–	–	–	X
Rose-breasted Grosbeak	–	–	–	–	X
Ruby-crowned Kinglet	–	X	–	–	–
Rufous Hummingbird	–	–	–	X	X
Rufous-crowned Sparrow	–	–	–	X	–
Sharp-shinned Hawk	–	X	–	X	X
Short-eared Owl	–	–	–	X	–
Song Sparrow	–	X	–	–	–
Spotted Towhee	–	–	–	X	–

Table 8 (continued). Transient and visiting species counted in all years since monitoring began (“X”) on each of the five northern Channel Islands. “Transient or visiting” species are defined here as native species that have been recorded only once or twice during point counts or line transects and do not breed on the islands. No new transient or visiting species were observed in 2022.

Species	East Anacapa	Santa Barbara	Santa Cruz	San Miguel	Santa Rosa
Swainson’s Thrush	–	–	–	–	X
Townsend’s Solitaire	–	–	–	–	X
Townsend’s Warbler	–	–	X	–	–
Turkey Vulture	–	–	–	X	X
Varied Thrush	–	X	X	–	X
Vaux’s Swift	–	–	–	X	–
Vesper Sparrow	–	X	–	–	–
Violet-green Swallow	–	–	X	X	–
Warbling Vireo	–	X	X	X	X
Western Kingbird	X	X	X	X	X
Western Tanager	–	–	X	X	X
White-tailed Kite	–	–	–	–	X
Wilson’s Warbler	–	X	X	–	–
Yellow-rumped Warbler (Audubon’s)	X	–	–	–	–
Yellow Warbler	–	–	X	–	X
No. of transient/visiting species on each island	6	23	21	32	21
No. of new transient/visiting species in 2022	0	0	0	0	0

East Anacapa Islet

Since 1993, 26 landbird species have been counted on East Anacapa Islet (Figure 11); five species were counted in 2022 (Table 2, Table 3). In 2022, Song Sparrow counts were above the third quartile (i.e., >75%) of their historic average abundance for the third consecutive year (Figure 6). A common species on the island, Orange-crowned Warbler, has not been counted for five consecutive years, including the 2022 monitoring season (Figure 11). Furthermore, no Orange-crowned Warblers were seen outside of the counts. No new transient species were detected in 2022; six transient or visiting species have been counted on the island overall since 1993 (Table 8).



Figure 11. Species occurrence from 1993 to 2022 for East Anacapa Islet. A dot indicates that a species was detected during a line transect survey or a point count during that year.

NPS

Santa Barbara Island

Since 1993, 50 landbird species have been counted on Santa Barbara Island (Figure 12); ten species were counted in 2022 (Table 2, Table 4). In 2022, Western Meadowlark counts were below the first quartile (i.e., <25%) of their historic average abundance for the fourth consecutive year (Figure 7). No new transient species were counted in 2022 on Santa Barbara; 23 transient or visiting species have been counted on the island since 1993 (Table 8).

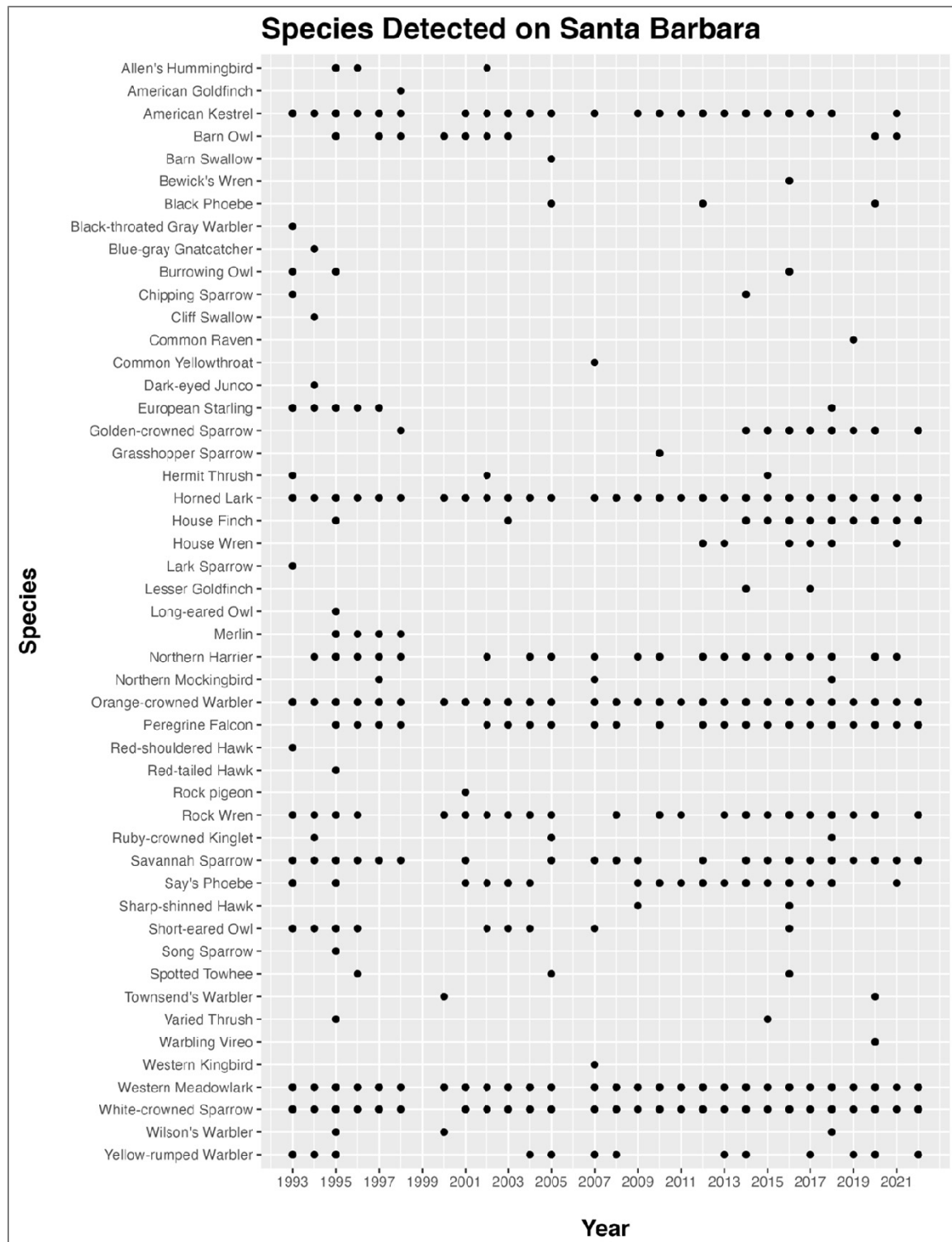


Figure 12. Species occurrence from 1993 to 2022 for Santa Barbara Island. A dot indicates that a species was detected during a line transect survey or a point count during that year.

NPS

Santa Cruz Island

Since 2013, 78 landbird species have been counted on Santa Cruz Island (Figure 13). A total of 42 species were counted in 2022 (Table 2, Table 5). This was the fifth consecutive year that Western Meadowlark counts were below the first quartile (i.e., <25%) of their historic average abundance on Santa Cruz (Figure 8). No new transient species were counted in 2022 on Santa Cruz; 21 transient or visiting species have been counted on this island since 2013 (Table 8).

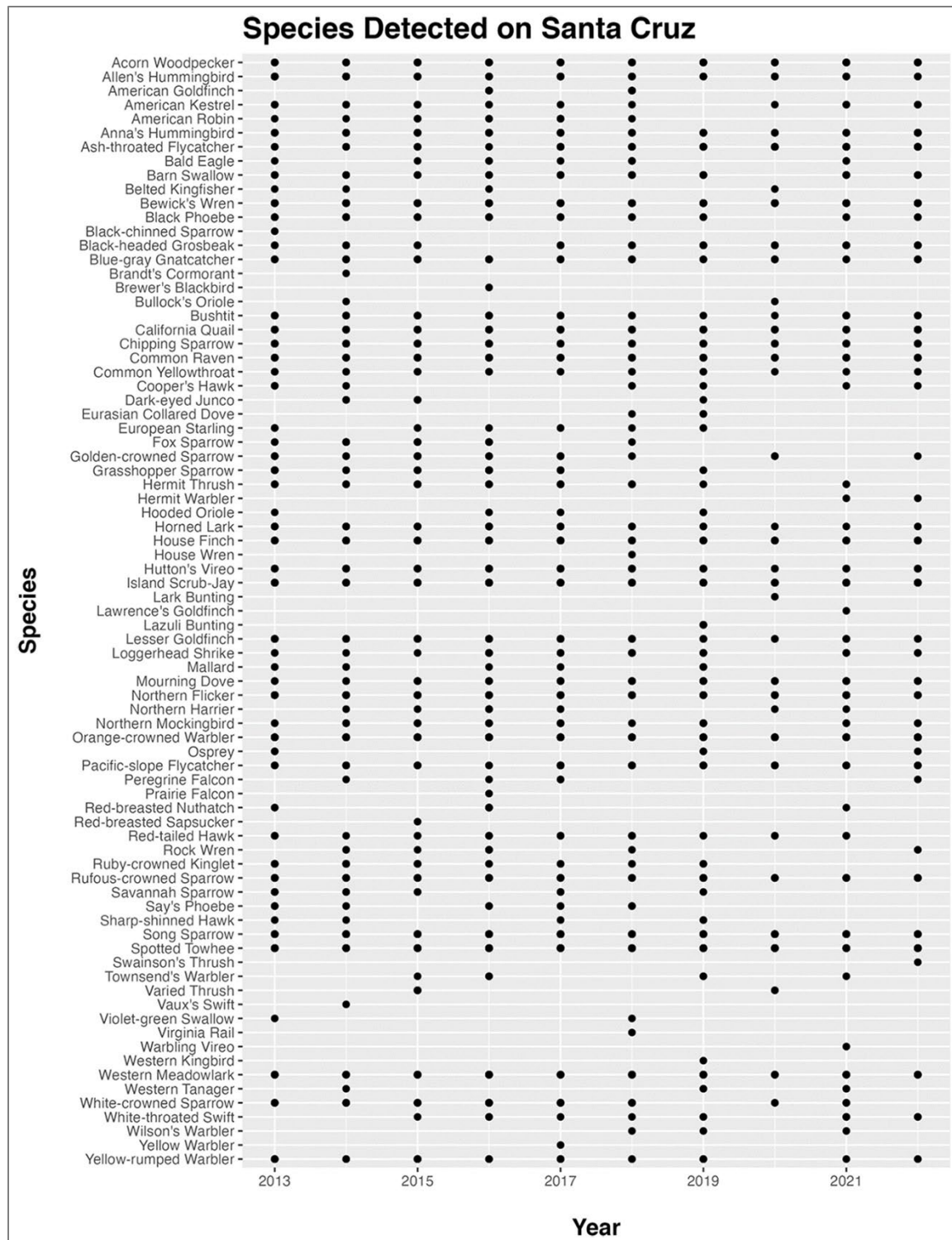


Figure 13. Species occurrence from 2013 to 2022 for Santa Cruz Island. A dot indicates that a species was detected during a point count during that year.

NPS

San Miguel Island

Since 1993, 70 landbird species have been counted San Miguel Island (Figure 14); 20 were counted in 2022 (Table 2, Table 6). Barn Swallow has not been detected for four consecutive monitoring seasons on San Miguel (Figure 14). For the second time, Bewick's Wren counts were above the third quartile (i.e., >75%) of their historic average abundance (Figure 9). Furthermore, observations for Bewick's Wren have expanded to canyons west of Simonton Cove, when previously they were only documented at Nidever and Willow canyons. No transient species were counted in 2022. Thirty-two transient or visiting species have been counted on the island since 1993 (Table 8).

Santa Rosa Island

Since 1994, 77 landbird species have been counted on Santa Rosa Island (Figure 15); 36 were detected in 2022 (Table 2, Table 7). In 2022, Chipping Sparrow counts were below the first quartile (i.e., <25%) of their historic average abundance for the second monitoring season, while counts of European Starling (a non-native species) were above the third quartile (i.e., >75%) of their historic average abundance for the third consecutive year (Figure 10). No new transients were recorded this year; 21 transient or visiting species have been counted on the island since 1994 (Table 8).

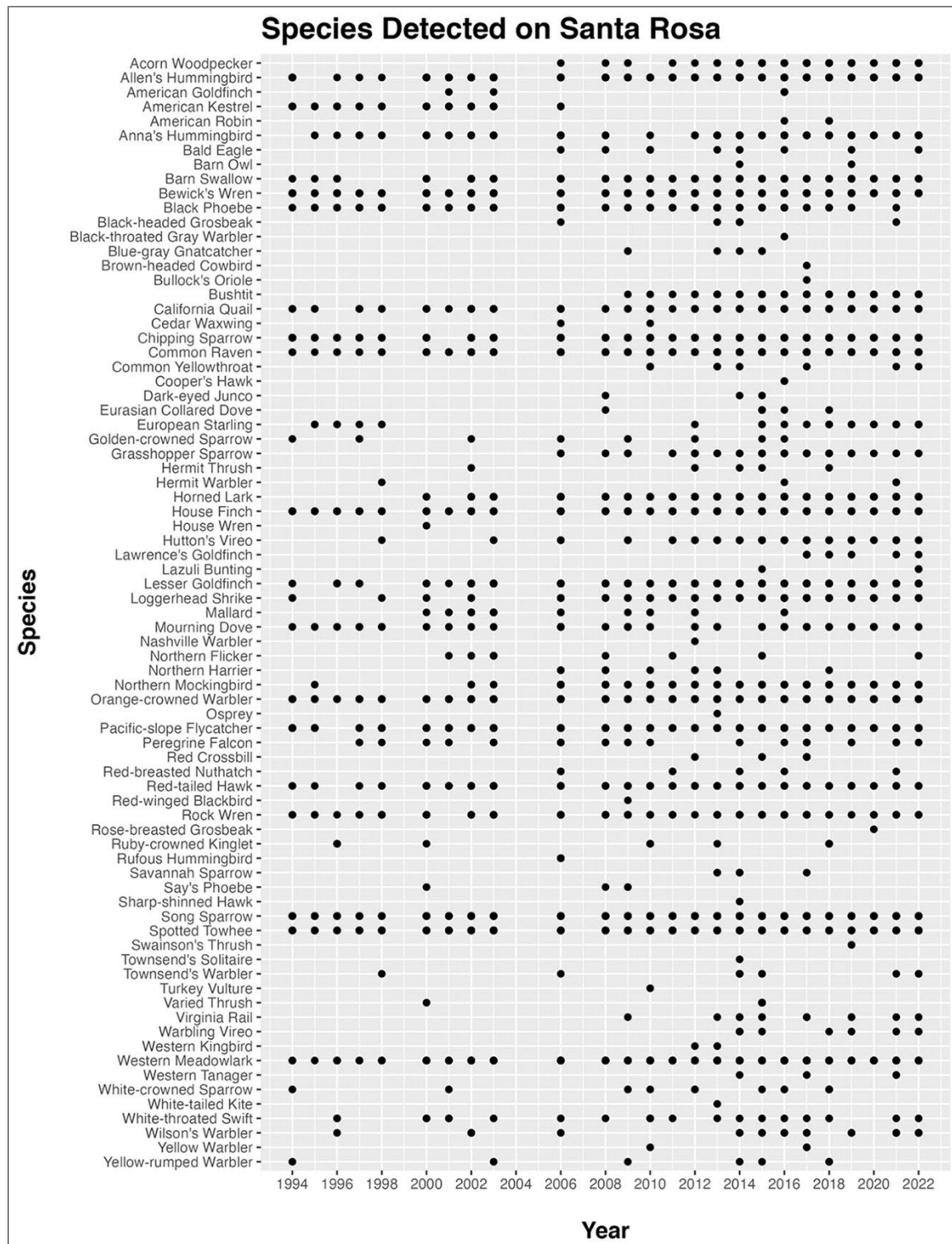


Figure 15. Species occurrence from 1994 to 2022 for Santa Rosa Island. A dot indicates that a species was detected during a point count during that year.

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Additional Observations

Anecdotal breeding observations from East Anacapa Islet on 25 March 2022 documented two Rock Wrens carrying nesting material at Landing Cove. Anecdotal breeding observations on Santa Rosa Island from 3 March to 17 May, 2022, included two Bushtit pairs building a nest in lower Cherry Canyon and near NPS housing. Additional migrant and notable resident sightings include one Bullock's Oriole (San Miguel), two Hooded Orioles (San Miguel), one Barn Owl (on both Santa Barbara and San Miguel), 15 Grasshopper Sparrows (Santa Rosa and San Miguel), five Lawrence's Goldfinch (Santa Rosa), and two Northern Harriers (Santa Rosa).

Non-Native and Parasitic Bird Species

Non-native and parasitic birds were counted on one of the five islands during 2022 NPS landbird surveys: 17 European Starlings on Santa Rosa Island (Table 2). However, anecdotal sightings (from eBird reports) of non-native and parasitic birds were recorded more frequently (i.e., outside of NPS surveys), especially on the larger islands, but did not occur on the small islands (i.e., Santa Barbara, East Anacapa, and San Miguel islands; Table 9). Anecdotal sightings of non-native species on East Anacapa and Santa Barbara islands have been limited because the island's docks were under construction or no landing was permitted, respectively. The highest number of eBird records of non-native species was on Santa Cruz Island ($n = 21$), with 12 detections of European Starlings (Central Valley), four detections of Eurasian Collared-Doves (Scorpion and Prisoners), three detections of Rock Pigeons (Scorpion), and two detections of Brown-headed Cowbirds (Scorpion).

Table 9. Summary of anecdotal observations of non-native and parasitic bird species observed on CHIS. Observations were reported to eBird (<https://ebird.org/home>) in 2022 (accessed August 2022).

Island	Eurasian Collared-Dove	Rock Pigeon	European Starling	Brown-headed Cowbird	House Sparrow
Santa Barbara	0	0	0	0	0
East Anacapa	0	0	0	0	0
Santa Cruz	4	3	12	2	0
Santa Rosa	3	0	8	4	0
San Miguel	0	0	0	0	0
Total	7	3	20	6	0

Density and Trend Data

Density and trend data for select species in monitoring years 2016–2022 are presented in Table 10 and Figure 16. Only one species had a significant trend during the period: Northern Flicker on Santa Cruz, which had a significant decreasing trend over time (Figure 16). Bushtit and European Starling on Santa Rosa did not show significant increasing or decreasing densities over time (Appendix B).

Table 10. Density analysis results for selected species on two CHIS islands. Average density values are estimates per hectare from 2016 to 2022, and are accompanied by standard errors (S.E.) of the estimate. The trend columns report significant ($P \leq 0.10$) increasing or decreasing density trends (linear regressions) from 2016 to 2022 and 1993 to 2015. “No trend” indicates a non-significant P-value ($P > 0.10$).

Island	Species	Average Density	S.E.	2016–2022 Trend	1993–2015 Trend
Santa Cruz	Northern Flicker	0.05	0.007	Decreasing	Increasing
Santa Rosa	Bushtit	0.81	0.290	No trend	Increasing
Santa Rosa	European Starling	0.07	0.040	No trend	Not analyzed

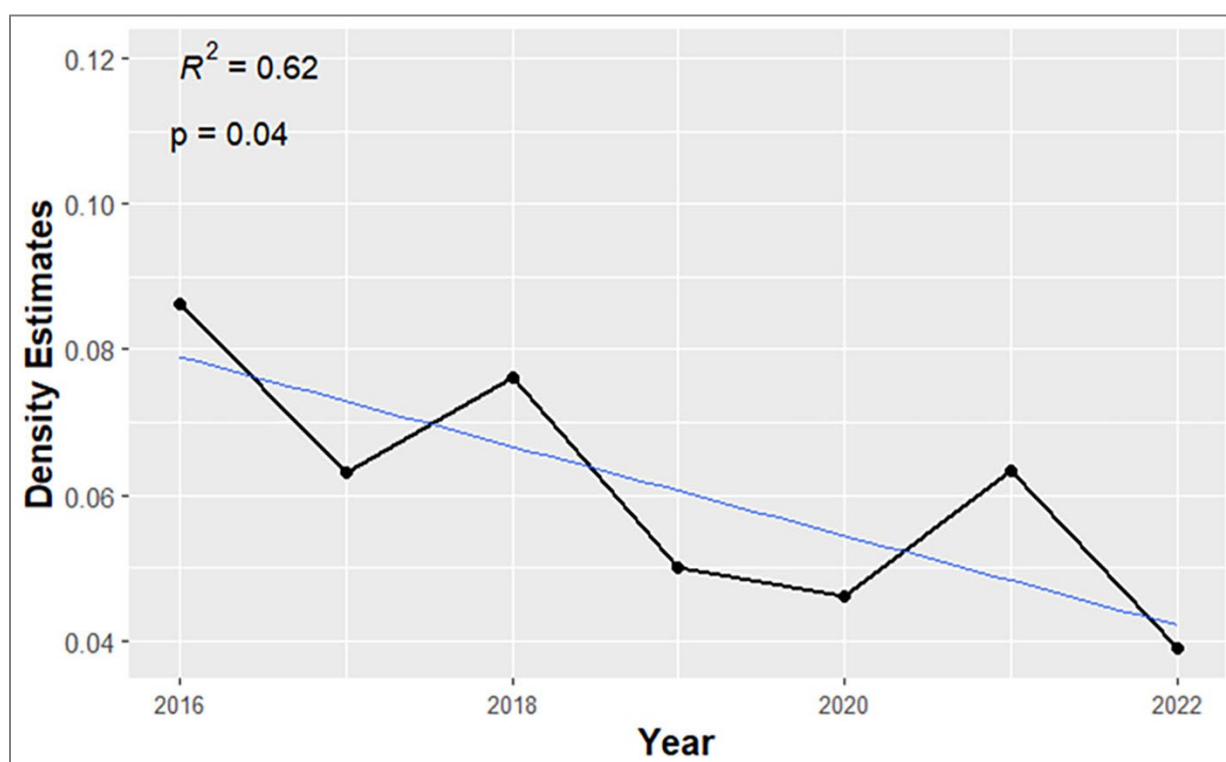


Figure 16. Northern Flicker density trend on Santa Cruz Island from 2016 to 2022. Distances were truncated at 300 meters. There was a significant decreasing trend from 2016 to 2022, while the historical trend (1993–2015) was reported as increasing in Coonan and Dye (2016).

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Abundances of American Kestrel, Peregrine Falcon, and Northern Harrier on Santa Barbara Island were all significantly negatively correlated with one another (Table 11). The r-squared (r^2) strength varied significantly among the three species, from 0.10 to 0.25 (Table 11, Figure 17).

Table 11. Spearman's Rank Correlation matrix results for three raptor species on Santa Barbara Island. The r-value is the degree of correlation for each relationship.

Interactions	r-value	r ²	P-value
American Kestrel and Northern Harrier	-0.43	0.18	<0.001
American Kestrel and Peregrine Falcon	-0.50	0.25	<0.001
Northern Harrier and Peregrine Falcon	-0.31	0.10	<0.001

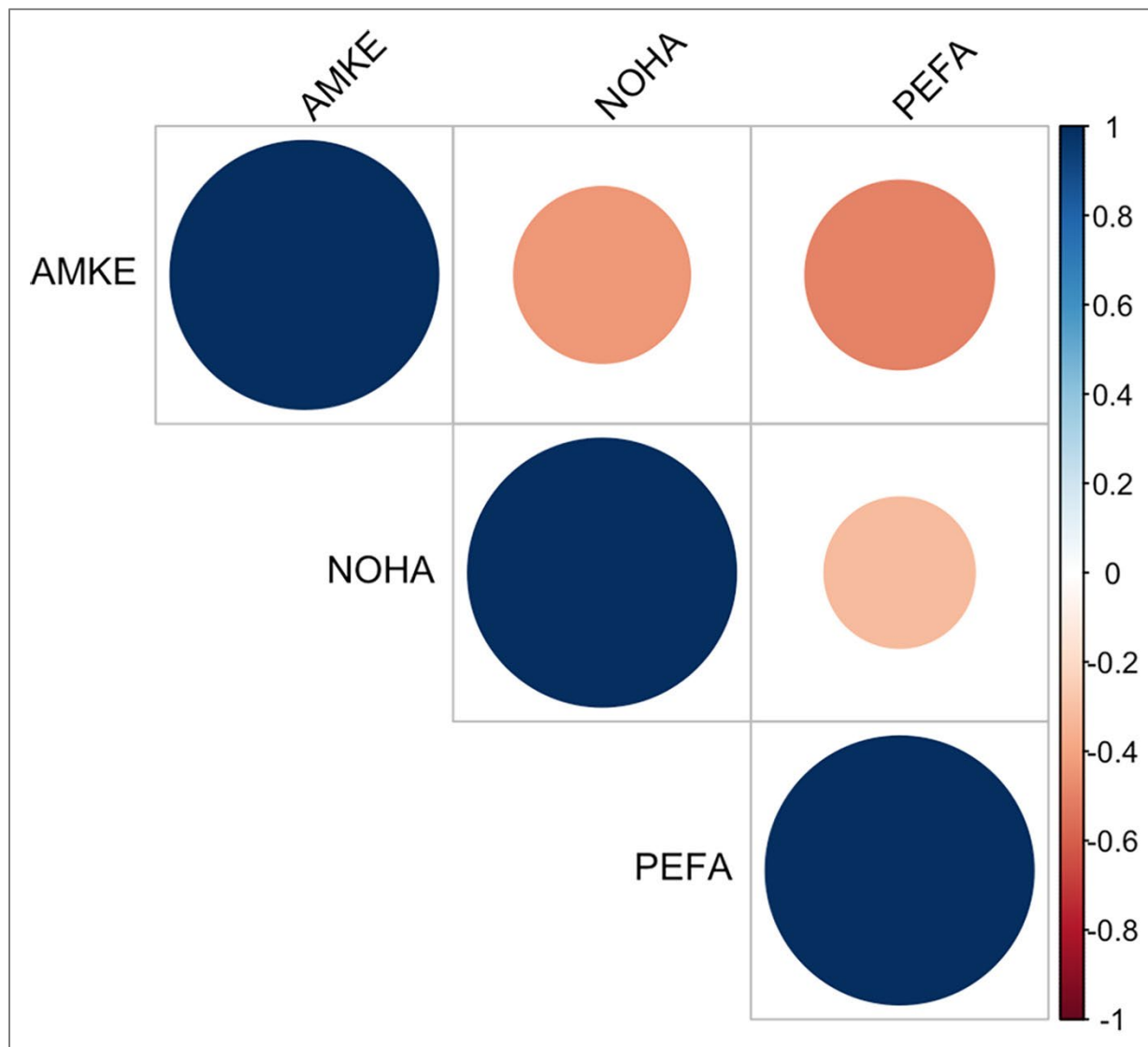


Figure 17. Spearman's Rank Correlation matrix among three raptor species from Santa Barbara Island. Blue circles represent same-species correlations (positive), while salmon-colored circles represent between-species negative correlations. Circle size and color saturation is proportional to the correlation coefficients. AMKE = American Kestrel, NOHA = Northern Harrier, PEFA = Peregrine Falcon.

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Discussion

Across all 56 terrestrial bird species counted at CHIS in 2022 (Table 2), island specificity was greatly evident. For example, no species was detected on all five islands, whereas eight species were detected on four islands, seven species were detected on three islands, 17 species were detected on two islands, and 25 species were detected on only one island. As would be predicted by island biogeography and has been observed over the 29 years of the landbird monitoring program, species richness (total number of species) was greatest on the larger islands (76 on Santa Cruz, 75 on Santa Rosa) and least on the smallest islands (49 on Santa Barbara, 26 on East Anacapa).

This was the second year that density analyses were conducted for a select group of species on two CHIS islands since the Coonan and Dye (2016) trend report. Northern Flicker significantly decreased from 2016 to 2022; however, Coonan and Dye (2016) reported Northern Flicker densities to be increasing over a 20-year period using a Poisson regression. This trend reversal may indicate a real decline of Northern Flickers on Santa Cruz, and further investigation may be necessary if this trend continues. Bushtit and European Starling densities were also analyzed, but no significant trends for either species occurred from 2016 to 2022. Abundances of both species have increased since 2016, but small sample sizes may lack the robustness needed to detect significant densities. If Bushtit abundances continue to increase, analyzing changes in density may reveal significant trends. Bushtit expansion to Santa Rosa Island may indicate recovery of coastal sage scrub and woodland communities after the removal of elk and deer in 2011 (Coonan and Dye 2016; Davidson et al. 2019).

European Starlings have continued to expand into the interior of Santa Rosa Island, as previous monitoring reports have mentioned (e.g., Hall et al. 2017). The authors recommend that CHIS management consider implementing removal strategies before starling populations expand to unmanageable numbers. We recommend that in 2023 the roost sites for starling populations on Santa Rosa be determined during the spring and winter seasons with one to two surveys per season. In 2024 a removal strategy at the known roosting locations should be conducted using a modified Australian crow trap, as is often used for trapping Brown-headed Cowbirds, because it has been shown to be effective at catching European Starlings (Conover and Dolbeer 2007).

The analysis of three raptor species—American Kestrel, Peregrine Falcon, and Northern Harriers—on Santa Barbara Island was done to evaluate if American Kestrels are being replaced by Peregrine Falcons and Northern Harriers on this island. Significant negative relationships among the three raptor species were indicated, with a moderate negative correlation between American Kestrel and Peregrine Falcon being the strongest relationship ($r^2 = 0.25$). However, all r -squared values were <0.25 , and thus the results do not strongly indicate negative interactions among and between species. However, American Kestrels have been observed less frequently than Peregrine Falcons and Northern Harriers since 2017 (Appendix B), and the question still remains as to why. One possible explanation is simple island biogeography: as a smaller island farther from the mainland, Santa Barbara Island could be experiencing higher natural turnover due to less space and resources compared to those islands that are larger and closer to the mainland (*sensu* MacArthur and Wilson 1967).

Several other species could be experiencing decreasing abundances that should be investigated further. For example, Chipping Sparrow on Santa Rosa Island was reported in 2021 to have a significantly decreasing density trend from 2016 to 2021 (Larramendy et al. 2021). In 2022, fewer sparrows were counted ($n = 50$) than in 2021 ($n = 56$). A continued decrease in density may indicate the species is experiencing a real decline. Santa Catalina has also observed a decrease in Chipping Sparrows on their Breeding Bird Survey route since records began in 1989 (Robbins et al. 2021). We therefore recommend that CHIS management begin investigating if this species is indeed declining on Santa Rosa. A recommendation would be to increase monitoring effort (i.e., make two visits) at point count stations where Chipping Sparrows occurred in 2021 and 2022. This would double the sample size (K), and thus may increase the encounter rate (n/K), which helps with precision when calculating densities (Buckland et al. 2015).

During the last two monitoring seasons, Hutton's Vireo on Santa Cruz Island has also experienced abundance averages below its first quartile. This may indicate the species is declining, and so density analyses should be performed in the 2023 monitoring report after another season of monitoring data collection.

On East Anacapa, Orange-crowned Warbler has not been detected during point count surveys since 2017. They experienced a decreasing linear trend from 2000 to 2015 (Coonan and Dye 2016). Despite efforts to eradicate invasive plant species (e.g., iceplant) and restore native vegetation (Davidson et al. 2019) on East Anacapa, Orange-crowned Warblers continue to be absent from landbird monitoring surveys. We recommend further investigation of whether Orange-crowned Warblers are indeed declining on East Anacapa Islet by increasing sampling effort on the islet (i.e., increasing K from 8 to 16), and possibly deploying Autonomous Recording Units (ARUs) to passively detect this species.

Several point count stations on Santa Barbara Island—17, 19, and 20—have not been surveyed for seven years due to the presence of nesting pelicans. These stations are within coastal sage scrub and boxthorn habitats, and thus several species (e.g., House Finch) could be undercounted due to their association with these particular habitats. Furthermore, this is a large data gap for these point count stations. Management strategies should be explored to reduce disturbances to nesting seabirds so landbird surveys can be completed at the three point count stations, or the point count stations should be removed permanently.

East Anacapa and Santa Barbara islands have the potential to have two surveys per season instead of one due to their small area and the support of island personnel. This would increase statistical power for both islands (George 2022). Furthermore, this could help with encounter rates for some species such as Orange-crowned Warbler. We therefore recommend implementing two counts on East Anacapa and Santa Barbara islands in the 2023 season. A standardized survey could also be established on West Anacapa Islet to account for a data gap of species that live on that islet (Davidson et al. 2019; George 2022). In-person point counts on West Anacapa are not feasible due to the presence of nesting Brown Pelicans, thus we recommend the implementation of passive monitoring with the use of autonomous recording units (Shonfield and Bayne 2017). Obtaining

estimates of density using such passive monitoring technology is possible (Pérez-Granados and Traba 2021; Yip et al. 2019).

Additionally, we recommend that habitat classifications should be re-recorded within a 50-m radius of all point stations where landbird counts take place, since the classifications have not been updated for ten years. Doing so would better quantify avian-habitat relationships, which was an objective outlined in the recent landbird review (Coonan et al. 2011; George 2022).

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Appendix A: Resident Breeder Species List

Table 12 consists of a list of 54 terrestrial avian species confirmed to be nesting on at least one of the five northern Channel Islands monitored in this study (East Anacapa, Santa Barbara, Santa Cruz, San Miguel, and Santa Rosa). Data on nesting status from Collins and Jones (2015). This list does not include either exclusively marine species that are not monitored during the landbird program, or species only suspected of breeding on an island.

Table 12. Resident breeding landbirds on at least one of the five islands in Channel Islands National Park.

Scientific Name	Common Name
<i>Melanerpes formicivorus</i>	Acorn Woodpecker
<i>Selasphorus sasin</i>	Allen's Hummingbird
<i>Fulica americana</i>	American Coot
<i>Falco sparverius</i>	American Kestrel
<i>Turdus migratorius</i>	American Robin
<i>Calypte anna</i>	Anna's Hummingbird
<i>Myiarchus cinerascens</i>	Ash-throated Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Tyto alba</i>	Barn Owl
<i>Hirundo rustica</i>	Barn Swallow
<i>Thryomanes bewickii</i>	Bewick's Wren
<i>Pheucticus melanocephalus</i>	Black-headed Grosbeak
<i>Sayornis nigricans</i>	Black Phoebe
<i>Polioptila caerulea</i>	Blue-gray Gnatcatcher
<i>Psaltiriparus minimus</i>	Bushtit
<i>Callipepla californica</i>	California Quail
<i>Catherpes mexicanus</i>	Canyon Wren
<i>Spizella passerina</i>	Chipping Sparrow
<i>Corvus corax</i>	Common Raven
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Junco hyemalis</i>	Dark-eyed Junco
<i>Sturnus vulgaris</i>	European Starling
<i>Ammodramus savannarum</i>	Grasshopper Sparrow
<i>Icterus cucullatus</i>	Hooded Oriole
<i>Eremophila alpestris</i>	Horned Lark
<i>Haemorhous mexicanus</i>	House Finch
<i>Vireo huttoni</i>	Hutton's Vireo
<i>Aphelocoma insularis</i>	Island Scrub-Jay

Table 12 (continued). Resident breeding landbirds on at least one of the five islands in Channel Islands National Park.

Scientific Name	Common Name
<i>Charadrius vociferus</i>	Killdeer
<i>Spinus psaltria</i>	Lesser Goldfinch
<i>Lanius ludovicianus</i>	Loggerhead Shrike
<i>Anas platyrhynchos</i>	Mallard
<i>Zenaida macroura</i>	Mourning Dove
<i>Colaptes auratus</i>	Northern Flicker
<i>Circus hudsonius</i>	Northern Harrier
<i>Mimus polyglottos</i>	Northern Mockingbird
<i>Aegolius acadicus</i>	Northern Saw-whet Owl
<i>Oreothlypis celata</i>	Orange-crowned Warbler
<i>Empidonax difficilis</i>	Pacific-slope Flycatcher
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Phainopepla nitens</i>	Phainopepla
<i>Sitta canadensis</i>	Red-breasted Nuthatch
<i>Buteo jamaicensis</i>	Red-tailed Hawk
<i>Agelaius phoeniceus</i>	Red-winged Blackbird
<i>Columba livia</i>	Rock Pigeon
<i>Salpinctes obsoletus</i>	Rock Wren
<i>Aimophila ruficeps</i>	Rufous-crowned Sparrow
<i>Asio flammeus</i>	Short-eared Owl
<i>Melospiza melodia</i>	Song Sparrow
<i>Pipilo maculatus</i>	Spotted Towhee
<i>Tachycineta thalassina</i>	Violet-green Swallow
<i>Rallus limicola</i>	Virginia Rail
<i>Sturnella neglecta</i>	Western Meadowlark
<i>Aeronautes saxatalis</i>	White-throated Swift

Appendix B: Figures Showing Species Density and Abundance

Figures 18 and 19 show density estimates for two landbird species on Santa Rosa Island, and Figure 20 shows the abundance of three raptor species on Santa Barbara Island.

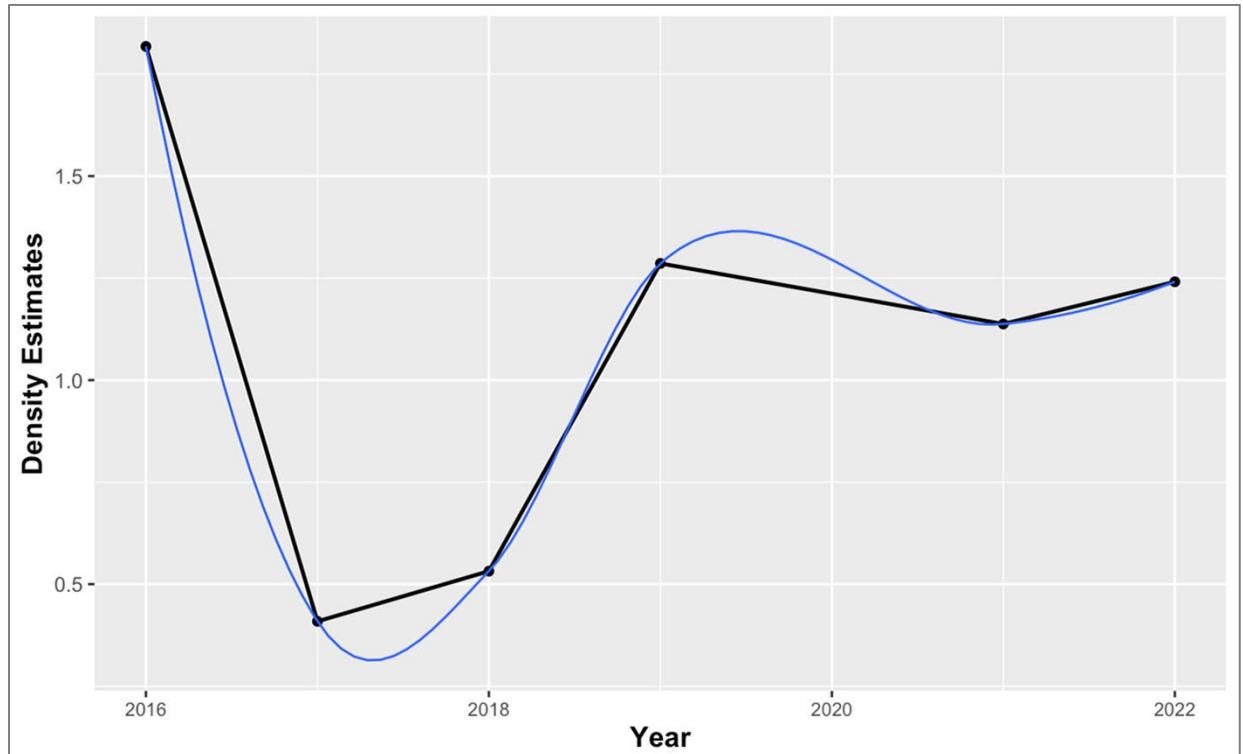


Figure 18. Bushtit density estimates on Santa Rosa Island from 2016 to 2022. A loess line was fit to show the non-linear change in density over the seven years.

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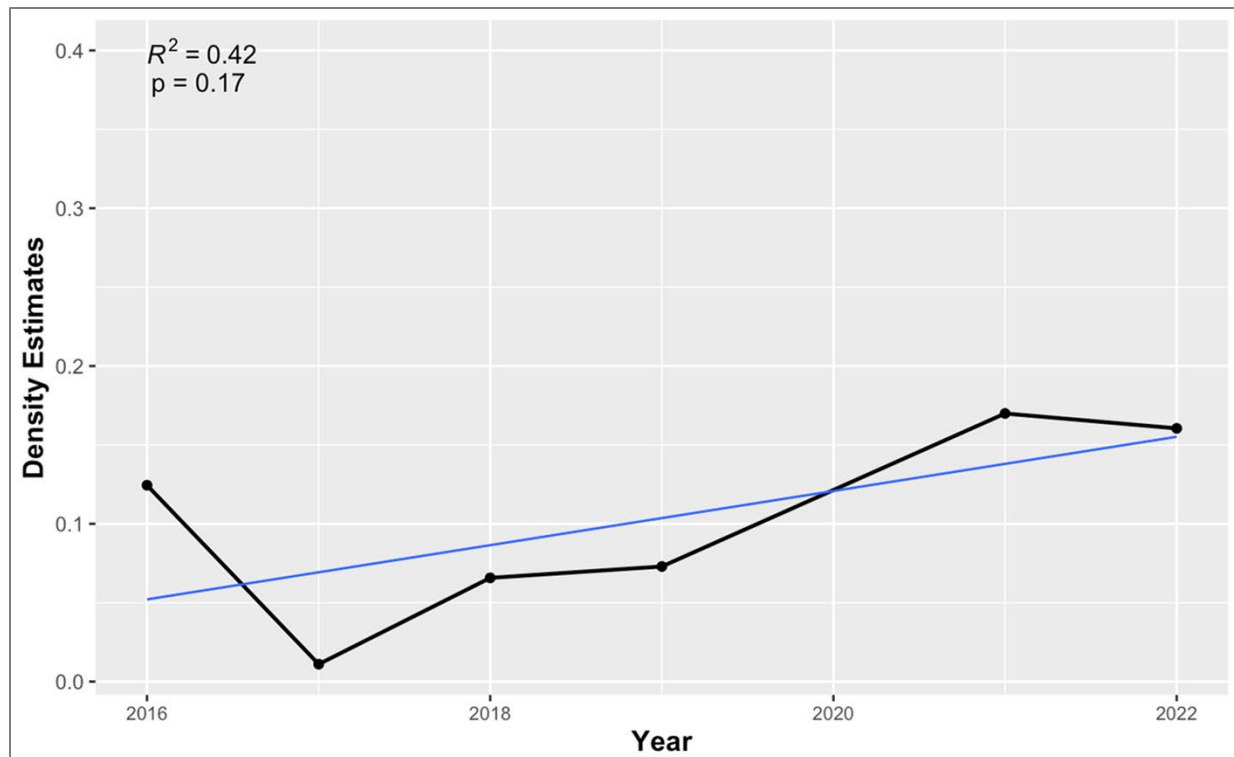


Figure 19. European Starling density estimates on Santa Rosa Island from 2016 to 2022. Although no significant linear trend occurred over the seven years, starling densities have increased over that time.
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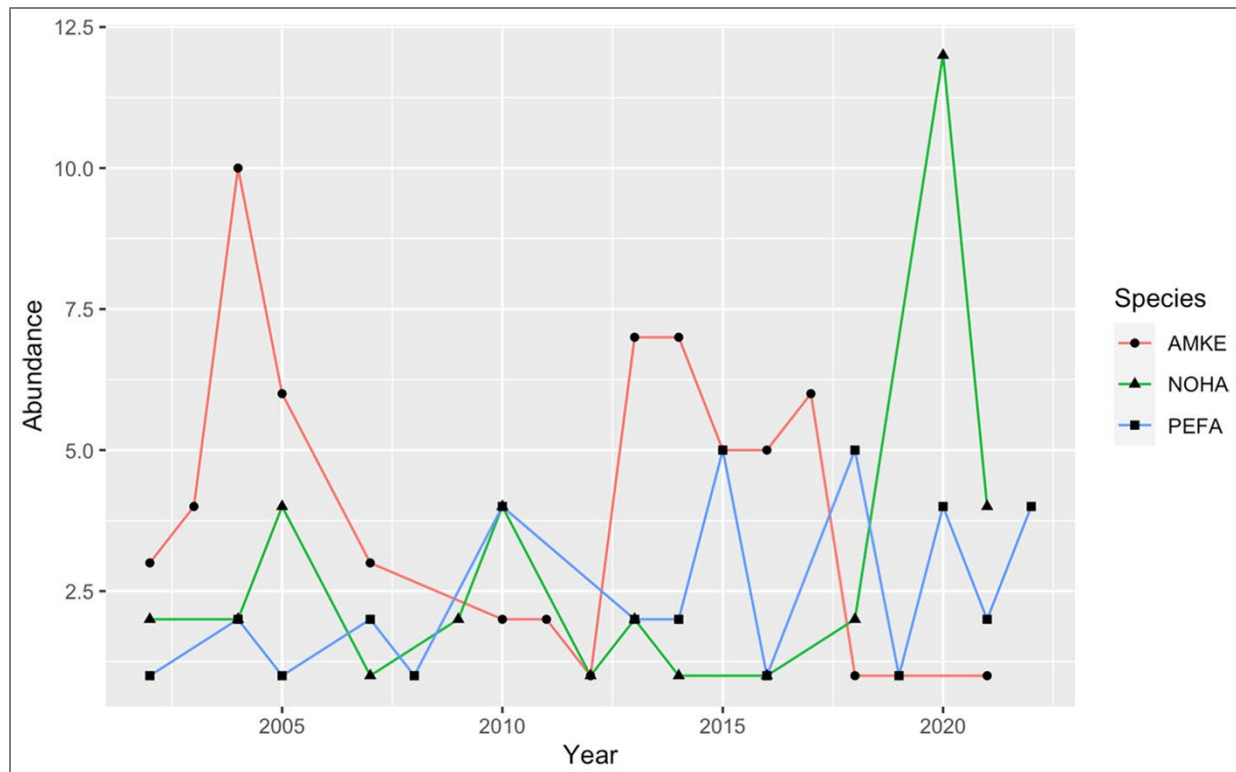


Figure 20. Abundances of American Kestrel (AMKE), Northern Harrier (NOHA), and Peregrine Falcon (PEFA) on Santa Barbara Island from 2002 to 2022. Kestrels have been less frequent on point count surveys as Peregrine Falcon and Northern Harrier occurrences have increased since 2017.

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