



Breeding Activity of Colonial Waterbirds in the San Francisco Bay Region: a Summary of 2025 Community Science Monitoring Efforts



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January 22, 2026

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Executive Summary

The San Francisco Bay Bird Observatory (SFBBO) is a nonprofit organization dedicated to the conservation of birds and their habitats through science and outreach. The Colonial Waterbird Program (CWB) is one of SFBBO's longest-standing community science programs, initiated in 1982 to monitor waterbird nesting colonies in the San Francisco Bay region. Over the past four decades the program has engaged hundreds of community scientists in waterbird nest-monitoring activities. Each year, trained community scientists repeatedly visit selected colonies to independently collect observational data on breeding abundance, behavior, timing, and success, as well as impacts of disturbance. Community scientists also assist SFBBO staff in conducting annual walkthrough nest counts at all known California Gull colonies in the South San Francisco Bay (South Bay). Together, these data are used to track changes in colony size over time and breeding success. This keystone dataset has informed many scientific publications (Jennings et al. 2024, Rauzon et al. 2019, Burns et al. 2018, Adkins et al. 2014, Pitkin & Woods 2011, Kelly et al. 2007, Kelly et al. 2006, Strong et al. 2004) and is used by landowners, resource agencies, and other conservation organizations to guide the conservation and management of colonial waterbirds.

In 2025, SFBBO community scientists and staff monitored 82 colonial waterbird colonies across the San Francisco Bay region, of which 76 had active nesting. Monitoring efforts documented 2,741 heron, egret, and cormorant nests across 72 active colonies, with Double-crested Cormorants being the most abundant species. The largest colony was at Alviso A5/A6/A7/A8 with 155 cormorant nests. We also monitored 6 active gull, tern, and shorebird colonies with 747 total nests, the largest being Alviso A16.

California Gull walkthrough surveys estimated 36,820 breeding adults across 9 colonies, a 9% decrease from the previous year. The South Bay population continues to represent a significant portion of the state's breeding California Gulls, particularly as the Mono Lake colony faces ongoing challenges from drought and water management issues. This species was once listed as a species of special conservation concern by the State of California, and we argue that ongoing issues facing the species warrant reconsideration of the decision to delist it. We recommend that land managers carefully consider how to balance the impacts of this species on local Bay Area ecosystems with the significant declines it is facing elsewhere in California and take a cautious approach to its management.

A total of 118 community scientists contributed 1,020 volunteer hours to the CWB Program. This dedicated network of volunteers continues to make long-term waterbird monitoring possible across this expansive region. Many community scientists in the program develop relationships with landowners and communities living with the colonies, and both volunteers and staff lead presentations and bird viewings to educate community members about these birds and their needs for protection and management.

Introduction

Colonial waterbirds are essential components of wetland and aquatic habitats across the globe (Hoffmann et al. 1996). This group of species covers a wide variety of foraging guilds including many wading birds (e.g., herons and egrets), seabirds (e.g., cormorants, terns, and gulls), and shorebirds (e.g., avocets and stilts), but are united by two key shared characteristics: they forage within aquatic habitats and breed in colonies in trees or islands (U.S. Fish and Wildlife Service 2002). Since these species require these specific habitat types and qualities in order to survive and play key roles in the ecosystem, they can serve as indicators of environmental health and function (Kushlan 1993, Hoffmann et al. 1996).

Colonial waterbirds declined historically due to a number of threats including habitat loss and degradation, competition for water from domestic and agricultural use, water pollution, disease, introduced predators, and climate change (Shuford 2010, Shuford 2014, Shuford et al. 2020). Falling water levels in wetlands due to unsustainable water extraction or drought can risk exposing nesting trees or islands, exposing them to predation. The greatest threat, however, is habitat loss due to human development (Shuford et al. 2020). In densely inhabited areas like the San Francisco Bay, human encroachment and habitat degradation are a few of the many factors that affect wetland habitats and therefore colonial waterbird populations (Lotze et al. 2006). Ongoing monitoring can detect trends that can shed light on these threats and the impacts of ongoing habitat restoration efforts such as the South Bay Salt Pond Restoration Project (Callaway et al. 2011).

Colonial waterbirds are attractive candidates for community science monitoring. In addition to their ecological value, they are conspicuous and intriguing animals, especially when aggregated in large breeding groups (Parnell et al. 1988). Since colonial waterbird colonies can be comprised of several species utilizing a large geographic area, significant changes within these populations may not be detectable for many years by standard research methods. In addition, funding and personnel limitations may prohibit professional monitoring at the required scale (Hoffmann et al. 1996). Community science initiatives are excellent methods for contributing to long-term, geographically expansive research goals at low cost (Dickinson et al. 2010, Cooper et al. 2014). Furthermore, community science studies provide opportunities for public involvement, which foster local stewardship and environmental appreciation.

Since 1982, SFBBO has annually recruited and trained community scientists to monitor nesting herons, egrets, cormorants, shorebirds, terns, and gulls in the San Francisco Bay as part of our Colonial Waterbird (CWB) Program. The CWB Program emphasizes community engagement and community science in order to: 1) monitor a large geographic area, and 2) generate public interest in protecting waterbirds and their habitats. This provides information on the health of the ecosystems of the San Francisco Estuary and helps educate the public on wetland ecosystem services and species, helping to cultivate sentiment that fuels local conservation efforts. In this report we summarize results from SFBBO's Colonial Waterbird Nest Monitoring Program in 2025.

Methods

Study area

The program began in 1980 with monitoring of California Gull colonies in South Bay and expanded in 1982 to cover a wider range of colonial waterbirds, with the addition of colonies spanning Santa Clara,

San Mateo, Alameda, San Francisco, San Joaquin, and southern Contra Costa counties. From 1991–2023, Audubon Canyon Ranch operated a parallel community science project monitoring herons, egrets, and cormorants in Marin, Sonoma, Napa, and northern Contra Costa counties. Audubon Canyon Ranch ended their monitoring program and transferred the oversight of 44 colonies in these counties to SFBBO in 2024 (Condeso et al. 2024). Colonies within our survey area now span nine Bay Area counties, from Cloverdale in Sonoma County in the north to Coyote Valley in Santa Clara County in the south, and from Brentwood in Contra Costa County in the east to Pescadero in San Mateo County in the west (Fig. 1). Sites that were active and surveyed prior to 2006 are described in detail in Kelly et al. (2006).

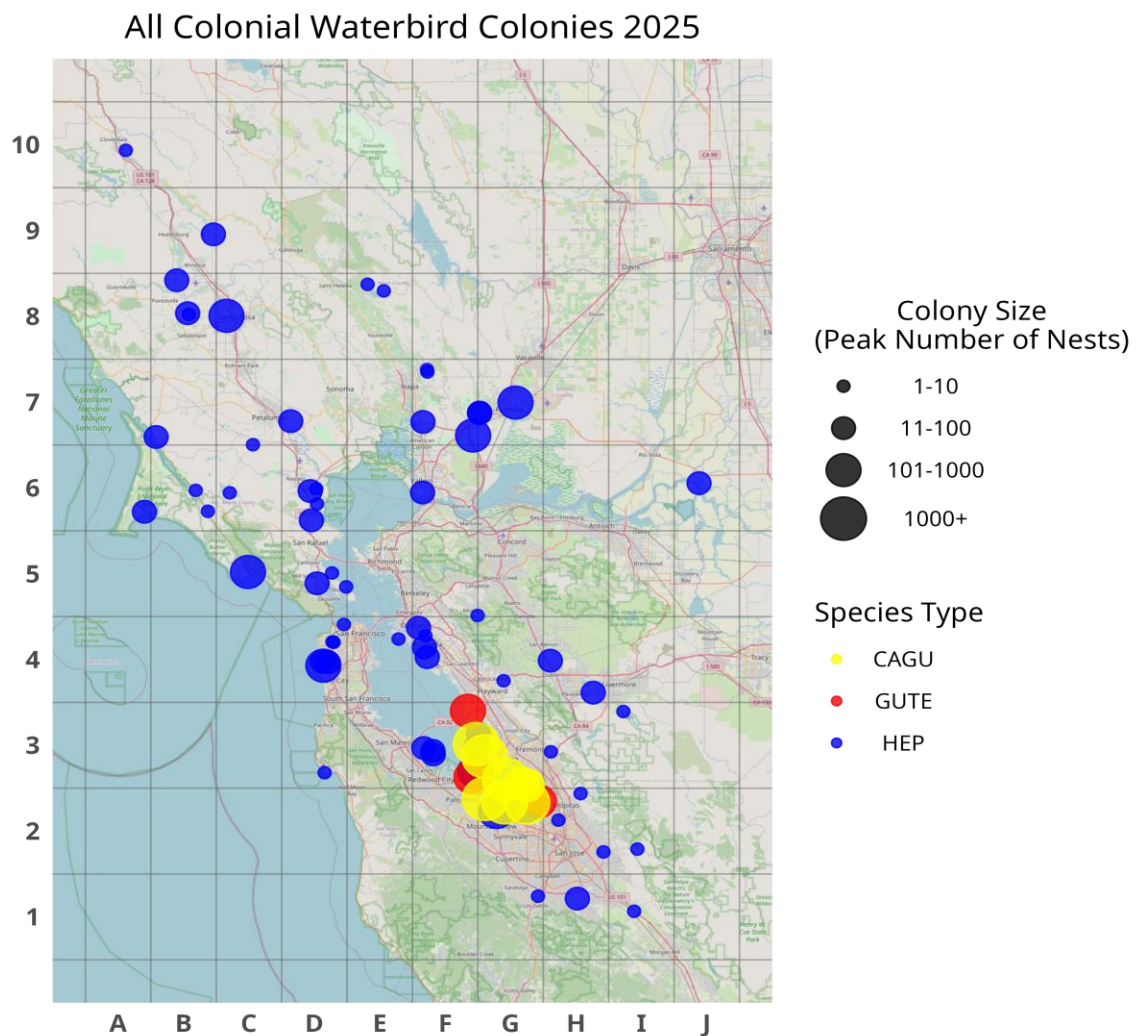


Figure 1. Locations and peak nest counts of colonies monitored as part of SFBBO’s Colonial Waterbird Program, San Francisco Bay, CA. Circle sizes represent the peak nest counts of each colony in 2025. Blue circles show colonies of herons, egrets, and cormorants, and red circles show colonies of gulls, terns, and shorebirds. Data include colonies monitored using observational methods only (i.e., California Gull walkthrough data are not included).

Table 1. Common name, scientific name for all species monitored.

Species Code	Common Name	Scientific Name	Protocol
AMAV	American Avocet	<i>Recurvirostra americana</i>	GUTE
BLSK	Black Skimmer	<i>Rhynchops niger</i>	GUTE
BCNH	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	HEP
BNST	Black-necked Stilt	<i>Himantopus mexicanus</i>	GUTE
CAGU	California Gull	<i>Larus californicus</i>	Walkthrough
CATE	Caspian Tern	<i>Sterna caspia</i>	GUTE
ELTE	Elegant Tern	<i>Thalasseus elegans</i>	GUTE
FOTE	Forster's Tern	<i>Sterna forsteri</i>	GUTE
GBHE	Great Blue Heron	<i>Ardea herodias</i>	HEP
GREG	Great Egret	<i>Ardea alba</i>	HEP
GRHE	Green Heron	<i>Butorides virescens</i>	HEP
LETE	Least Tern	<i>Sterna antillarum browni</i>	GUTE
SNEG	Snowy Egret	<i>Egretta thula</i>	HEP
WEGU	Western Gull	<i>Larus occidentalis</i>	Walkthrough

Observational monitoring

Our monitoring protocols were divided based on two guilds: 1) herons, egrets, and cormorants (HEP), and 2) gulls, terns, and shorebirds (GUTE; Table 1). California Gull breeding colonies are monitored under a separate protocol, as described in the next section.

Not all known sites can be monitored in each year, and priority for monitoring is based on the number of years the colony has been monitored, date of most recent nesting activity, accessibility, and community scientist availability. Colonies are located on both public and private lands and are either detected opportunistically or visited with the existing knowledge of nesting activity.

Monitoring occurs from February to August and includes 7–9 survey dates per colony, depending on the species observed. Great Blue Heron colonies were monitored from early February to July, Double-crested Cormorant and egret colonies were monitored from early March to early August, and gull, tern and shorebird colonies were monitored from early April to early August. During the peak of the breeding season, colonies were surveyed twice a month (first and third weekends). Sites were monitored only during the first weekend of each month during the early and late breeding season (March–April and July–August for most herons and egrets; February–March and July for Great Blue Herons; and April and May for gulls and terns). Double-crested Cormorant colonies nesting in close proximity to California Gull colonies were surveyed only once, in May, to minimize disturbance and nest predation risk.

At the start of the season, community scientists received training in waterbird identification, nest staging and natural history, proper etiquette around nesting birds, and observational study methods through a standardized protocol. During each monitoring session, surveyors used binoculars and spotting scopes to count the number of visible breeding adults, active nests, and chicks. When disturbance events were observed, surveyors recorded the type (human, avian predator, mammalian predator, weather, or other), a description of the event, and any observable impact on nesting birds.

Surveyors also noted nesting behaviors, such as incubation, nest-building and courtship displays to determine the development stage of nests. For each active heron and egret nest, observers recorded the developmental stage using a standardized classification system: Stage 0 (nest building and courtship, adult continuously present), Stage 1 (egg incubation, adult continuously on nest), Stage 2 (early nestling, adult continuously at nest and brooding downy chicks), Stage 3 (middle nesting, adult continuously present but often standing next to nest with partially feathered chicks), Stage 4 (late nestling, adults not continuously present and nearly fully feathered chicks visible on nest), and Stage 5 (ready to fledge, adults often absent and chicks often off the nest). Given that Stage 5 nests often already had some individuals that had fledged and left the nest, counts of Stage 4 chicks were used to estimate the number of chicks fledged. If surveyors could not clearly see the nest (e.g., because it was obscured by foliage), they could also list it as Stage Unknown.

Gulls, terns, and shorebirds were staged differently. Stage 0 was a count of the number of *adults* engaging in nest building and courtship, Stage 1 was a count of the number of *nests* with adults incubating eggs, while Stages 3, 4, and 5 were a count of the number of downy, partially feathered, and fully feathered *chicks* in the colony, respectively.

Colonies of Black-crowned Night-Herons within Oakland, California (Downtown Oakland and Oakland Museum) were of special management interest due to ongoing human-wildlife conflict in this community. An in-depth study was carried out at these colonies, which gathered tree-specific data on nesting, tree species and characteristics, food availability, and disturbance, and used these to assess tree habitat selection. While data from the two downtown Oakland colonies is summarized here, the new data gathered in that study is not covered by this report; data for 2024 is in Nuñez-Garro et al. (2025).

California Gull walkthroughs

SFBBO biologists also led surveys of California Gulls through a walkthrough method during the peak of late incubation and early hatching from May 7-14, 2025. During surveys, teams of observers (most often 3 people) systematically walked through each colony and visually tally all active nests present. The number of eggs and chicks in each nest were recorded, as well as any loose or dead chicks, eggs, or adults. Empty and fully depredated nests were recorded but excluded from final tallies of active nesting.

To minimize the potential for opportunistic gull predation of other species' nests due to human disturbance, areas where other waterbirds nest (generally Double-crested Cormorants) were avoided during walkthroughs. Active California Gull nest numbers were estimated at a distance by observers in kayaks. In order to estimate the number of nests of these other waterbirds, they were also surveyed using the same kayak method; thus, observational counts for colonies of other waterbirds at California Gull colonies include only a single count of the number of nests in early May.

Data analysis

We used the following methods to summarize nesting activity and reproductive output from the field observations collected by community scientists.

A colony was considered “active” if at least one nest was observed during the monitoring period. The *peak nest* for each species at each colony was determined as the maximum single-day count of active nests observed across all survey visits. For California Gulls, we report the total number of nests as the

direct count from the walkthrough surveys, and estimated of the total breeding population by multiplying these nest counts by two birds per nest.

Fledgling production was estimated by tracking the progression of nests through developmental stages across multiple visits, counting chicks that reached fledging. Our basic measure of fledgling production at each colony was the total number of chicks for each species that reached Stage 4. Stage 4 (pre-fledging) was used rather than Stage 5 (fledging) because for herons and egrets, some chicks had often already left the nest by Stage 5 (there is no Stage 5 for gulls, terns, and shorebirds).

Gulls, terns, and shorebirds are precocial chicks that generally go from hatching to fledging within a month, so biweekly surveys are unlikely to double-count Stage 4 chicks. Therefore, we estimated fledgling production at each colony simply as the total number of Stage 4 chicks for each species observed over all visits. We note that because of imperfect detection, this is almost certainly an underestimate of true fledgling production.

For herons and egrets, development is slower (up to three months for Great Blue Herons) and detectability of nests was often lower because nests of these tree-nesting species could be significantly obscured by foliage. We therefore applied multiple mathematical corrections to (1) avoid double-counting nests that remained in Stage 4 on consecutive surveys, and (2) account for imperfect detection of Stage 4 nests (Appendix I).

Results

Waterbird Colonies

SFBBO monitored a total of 82 potential heron and egret and gull, tern, and shorebird colony sites following the observational method of repeat visits. Of these sites, 76 had active breeding colonies in 2025.

Some known colony sites were not surveyed due to access issues or observer availability. Sites that were monitored last season, but were not monitored this year comprise: Alcatraz, Oddfellows, and Sand Point Cabin. Sites in the North Bay that required boat access and were historically monitored by Audubon Canyon Ranch have been discontinued due to a lack of equipment. These sites include Bolinas, East Marin Island, West Marin Island, Red Rock, Brooks Island, Brooks Island Spit, Yerba Buena Island, Bohannon, Hidden Cove, Joice Island, Simmons Island, Volanti, Joice Island South, Joice Island Annex, Spoonbill, Sherman Lake, and Wheeler Island East. These sites may be revisited in the future as monitoring needs in the San Francisco Bay change. Conversely, sites that were not monitored last season but were monitored this year comprise: Coast Guard Island Alameda, Mission Creek, and the Mokelumne River Marina.

Waterbirds nested in a variety of habitats, including islands within former salt ponds (e.g., Alviso A16), power towers along the Dumbarton Bridge (e.g., Dumbarton PG&E Towers), and eucalyptus trees in residential neighborhoods (e.g., Ruus Park). The number of nests at each colony site varied from one Great Blue Heron nest (Moffett A3N) to over 100 nests (e.g., West 9th St., Santa Rosa, Alviso A16, Dover Park, Ravenswood Pond RSF2, Gold Hill, Hayward Shoreline, Shorebird Way, Alviso A5/A6/A7/A8, Bolinas, Lake Merced South, Dumbarton PG&E Towers). Species composition at the colony sites monitored also varied considerably. In 2025, Almaden Lake had four heron and egret species nesting:

Great Egrets, Black-crowned Night-Herons, Great Blue Herons, and Snowy Egrets. Gull, tern, and shorebird colonies often had multiple species, such as Alviso pond A16 which had nesting American Avocet, Black Skimmer, Black-necked Stilt, Caspian Terns, and Forster's Terns.

Hérons, egrets, and cormorants

We monitored 72 sites with active heron, egret and cormorant colonies using observational methods (Table 2). Double-crested Cormorants were the most abundant nesting species at these sites. The largest cormorant colony monitored was at Alviso A5/A6/A7/A8 with an estimated 155 nests, but this species also nested in large numbers at Lake Merced South and Dumbarton PG&E Towers.

Great Blue Herons occupied several large colonies in the North Bay in 2025, with 10 or more nests observed at the Petaluma Wastewater Treatment Plant, Riverfront Park, Shuey Drive, and Drake's Estero (Table 2). In addition to these major sites, numerous smaller colonies were scattered throughout the region. In the South Bay, Great Blue Heron colonies were slightly less numerous, with the largest containing eight or more nests located at Alameda NWR, Shadow Cliffs, and Coyote Ranch Rd.

We monitored 8 colonies that included Snowy Egret nests. Nesting for this species was most active at Dover Park, with 108 nests. The majority of Snowy Egret nests were concentrated in the North Bay, with Dover Park and West 9th St. in Santa Rosa together accounting for over half of all nests observed.

We monitored 13 colonies that included Black-crowned Night-Heron nests. The most active nesting area for this species was Dover Park with 144 nests. Nearly three-quarters of Black-crowned Night-Heron nests were in the North Bay, with Dover Park and West 9th St. in Santa Rosa together accounting for 70% of all nests observed. Outside the North Bay, Shorebird Way (77 nests) and Oakland Museum (12 nests) were the largest colonies.

Green Herons were the most rarely observed species. We monitored only two colonies (Lake Cunningham and Vasona Reservoir Island), both in Santa Clara County, for a total of 6 nests. Vasona Reservoir Island had only one nest, which failed.

Shorebirds and terns

We monitored 6 sites with tern and shorebird colonies, all of which were active (Table 3). Of the species monitored using the observational protocol (i.e., excluding California Gulls), Forster's Terns were the most abundant nesting species at the monitored sites. Alviso A16 and Ravenswood Pond RSF2 supported the highest numbers of Forster's Terns, with 136 nests and 129 nests respectively.

Caspian Terns nested at 3 sites. They again nested on islands at Alviso A16, where monitors noted nesting activity on Island 7 in addition to the historically used Island 11. They also nested on one island in Ravenswood Pond RSF2 and Hayward Shoreline.

American Avocets nested at 4 sites. Nesting was concentrated at Hayward Shoreline (51 nests), while the remaining sites each had fewer than 10 nests. Notably, there were no nests recorded at New Chicago Marsh this year.

Black-necked Stilts nested at 4 sites, with Alviso A16 supporting the highest number of nests (14). For the first time in our records dating back to 2014, Black-necked Stilts nested at Moffett AB2 (2 nests).

Table 2. Nest productivity within heron, egret and cormorant nesting colonies in San Francisco Bay, CA in 2025. The *peak number of active nests* observed over biweekly surveys during the height of the nesting season is listed, while numbers in parentheses are the estimated *total number of fledged chicks* over the entire nesting season. Cormorant colonies marked * were surveyed only once in walkthrough surveys of California Gull colonies in early May and may not reflect the true peak of nesting. DESFBNWR = Don Edwards San Francisco Bay National Wildlife Refuge, EBRPD = East Bay Regional Park District, SFPUC = San Francisco Public Utilities Commission, SFRP = San Francisco Recreation & Parks. See Table 1 for species codes.

Organization	Colony	DCCO	GBHE	GREG	GRHE	SNEG	BCNH	Total
Alameda National Wildlife Refuge	Alameda National Wildlife Refuge	-	8 (0)	-	-	-	-	8 (0)
CDFW	Eden Landing E2/4/7	-	13 (10)	-	-	-	-	13 (10)
City of Oakland	Downtown Oakland	-	-	-	-	53 (125)	23 (41)	76 (166)
City of Oakland	Lake Merritt	-	-	-	-	3 (9)	70 (42)	73 (51)
City of Oakland	Lake Merritt BART	-	-	-	-	-	2 (0)	2 (0)
City of Oakland	Oakland Museum	-	-	-	-	-	12 (12)	12 (12)
City of San Jose	Almaden Lake	-	5 (7)	9 (12)	-	8 (28)	3 (0)	25 (48)
City of San Jose	Alviso A18	-	-	-	-	-	-	-
City of San Jose	Lake Cunningham	-	-	-	5 (5)	-	3 (1)	8 (6)
City of San Jose	Ovation Court	-	7 (7)	-	-	-	-	7 (7)
DESFBNWR	*Alviso A5/A6/A7/A8	155 (NA)	-	-	-	-	-	155 (0)
DESFBNWR	*Coyote Hills 2A/3A/4A levees	74 (NA)	-	-	-	-	-	74 (0)
DESFBNWR	Moffett A2E	-	-	-	-	-	-	-
DESFBNWR	Moffett A2W	4 (0)	-	-	-	-	-	4 (0)
DESFBNWR	Moffett A3N	-	1 (2)	-	-	-	-	1 (2)
DESFBNWR	Moffett A3W	-	-	-	-	-	-	-
DESFBNWR	Moffett AB1	19 (15)	-	-	-	-	-	19 (15)
DESFBNWR	Moffett AB2	10 (8)	-	-	-	-	-	10 (8)
DESFBNWR	Mountain View A1-Power Towers	-	-	-	-	-	-	-
DESFBNWR	Steinberger Slough	25 (0)	-	-	-	-	-	25 (0)
EBRPD	Don Castro	-	7 (15)	-	-	-	-	7 (15)
EBRPD	Shadow Cliffs	14 (4)	7 (2)	3 (0)	-	1 (0)	-	25 (6)

Organization	Colony	DCCO	GBHE	GREG	GRHE	SNEG	BCNH	Total
Other	Bahama Reef Island	-	-	8 (13)	-	-	-	8 (13)
Other	Bay Farm Island, Alameda	-	-	13 (0)	-	-	-	13 (0)
Other	Belmont Slough Power Towers	30 (3)	-	-	-	-	-	30 (3)
Other	Blake's Landing South	-	7 (6)	46 (47)	-	-	-	53 (53)
Other	Bolinas	111 (103)	8 (17)	19 (11)	-	-	-	138 (132)
Other	Chalk Hill Road	-	11 (5)	15 (16)	-	-	-	26 (21)
Other	Chiles Creek North	1 (4)	6 (12)	-	-	-	-	7 (16)
Other	Cloverdale, River Road	-	3 (9)	-	-	-	-	3 (9)
Other	Coast Guard Island	-	6 (10)	-	-	-	1 (0)	7 (10)
Other	Cypress Road South	-	5 (0)	-	-	-	-	5 (0)
Other	Delta Pond North	17 (0)	-	-	-	-	-	17 (0)
Other	Delta Pond South	10 (3)	-	-	-	-	-	10 (3)
Other	Desilva Island	58 (110)	16 (30)	8 (18)	-	-	-	82 (158)
Other	Dover Park	-	-	-	-	108 (75)	144 (37)	252 (113)
Other	Drake's Estero	-	18 (27)	10 (10)	-	-	-	28 (37)
Other	Dumbarton PG&E Towers	116 (31)	-	-	-	-	-	116 (31)
Other	Gold Hill	-	-	207 (284)	-	-	2 (0)	209 (284)
Other	Hagen Road West	-	5 (10)	-	-	-	-	5 (10)
Other	Keel Court	-	1 (3)	11 (22)	-	-	-	12 (24)
Other	Lake Hennessey Inlet	-	3 (8)	-	-	-	-	3 (8)
Other	Lake Nicasio	-	6 (0)	-	-	-	-	6 (0)
Other	Lake Nicasio Pond	-	-	-	-	-	-	-
Other	Livermore VA Park & Hospital	-	6 (6)	-	-	-	-	6 (6)
Other	Mare Island Saltwater Reservoir	-	3 (4)	8 (8)	-	-	-	11 (12)
Other	Mission Creek	-	4 (0)	-	-	-	-	4 (0)
Other	Mokelumne Marina	38 (46)	2 (2)	28 (16)	-	-	-	68 (64)
Other	North Circle	-	4 (10)	-	-	-	-	4 (10)
Other	Olive Hill Lane	-	5 (8)	-	-	-	-	5 (8)
Other	Pacheco Pond Island	-	2 (2)	59 (82)	-	-	-	61 (84)

Organization	Colony	DCCO	GBHE	GREG	GRHE	SNEG	BCNH	Total
Other	Paradise Cay	-	2 (3)	-	-	-	-	2 (3)
Other	Petaluma Wastewater Plant	35 (70)	13 (18)	18 (31)	-	-	-	66 (120)
Other	Powell St Lagoon	33 (67)	-	-	-	-	-	33 (67)
Other	Raccoon Straits	-	10 (20)	-	-	-	-	10 (20)
Other	Red Hill Rd	-	5 (6)	3 (0)	-	-	-	8 (6)
Other	Redwood Shores Water Treatment Plant	-	-	-	-	44 (57)	19 (13)	63 (70)
Other	Riverfront Park	-	15 (22)	-	-	-	-	15 (22)
Other	San Ramon Braeburn	-	-	-	-	-	-	-
Other	San Ramon Northland	-	5 (0)	11 (0)	-	-	-	16 (0)
Other	Sandy Wool Lake	-	2 (4)	-	-	-	-	2 (4)
Other	Shorebird Way	-	-	34 (41)	-	59 (6)	77 (3)	170 (50)
Other	Shuey Dr.	-	10 (0)	-	-	-	-	10 (0)
Other	South Kelly	-	12 (26)	43 (75)	-	-	-	55 (101)
Other	St. Francis Yacht Club	-	8 (10)	-	-	-	-	8 (10)
Other	Vedanta	-	1 (1)	-	-	-	-	1 (1)
Other	West 9 th St., Santa Rosa	-	-	69 (55)	-	50 (36)	139 (73)	258 (164)
Other	Willota Dr. South	-	-	28 (48)	-	-	-	28 (48)
Other	Willota Drive	-	4 (5)	8 (16)	-	-	-	12 (21)
SFRP	Blue Heron Lake-Boat House	-	6 (18)	-	-	-	-	6 (18)
SFRP	Blue Heron Lake-Waterfall	-	1 (3)	-	-	-	-	1 (3)
SFRP	Lake Merced Mesa	50 (38)	2 (4)	-	-	-	-	52 (42)
SFRP	Lake Merced North	32 (37)	-	-	-	-	-	32 (37)
SFRP	Lake Merced South	134 (NA)	-	-	-	-	-	134 (NA)
San Mateo County	Pillar Point	-	7 (0)	-	-	-	-	7 (0)
San Mateo County	Coyote Ranch Rd Colony	-	10 (10)	-	-	-	-	10 (10)
San Mateo County	Grant Lake	-	4 (6)	-	-	-	-	4 (6)
San Mateo County	Vasona Reservoir Island	-	1 (0)	-	1 (0)	-	3 (0)	5 (0)
	TOTAL	966 (539)	287 (370)	658 (804)	6 (5)	326 (336)	498 (222)	2741 (2276)

Table 3. Nest productivity within gull, tern, and shorebird nesting colonies in San Francisco Bay, CA in 2025. The *peak number of active nests* observed over biweekly surveys during the height of the nesting season is listed, while numbers in parentheses are the estimated *total number of fledged chicks* over the entire nesting season. California Gull data are not included in this table. DESFBNWR = Don Edwards San Francisco Bay National Wildlife Refuge; EBRPD = East Bay Regional Park District. See Table 1 for species codes.

Organization	Colony	AMAV	BLSK	BNST	CATE	FOTE	LETE	ELTE	Total
DESFBNWR	Alviso A16	5 (8)	7 (0)	14 (9)	95 (17)	136 (151)	0 (0)	0 (0)	257 (185)
EBRPD	Hayward Shoreline	51 (0)	0 (14)	11 (10)	35 (74)	86 (20)	0 (0)	0 (0)	183 (118)
DESFBNWR	Moffett A2E	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
DESFBNWR	Moffett AB1	3 (0)	0 (0)	0 (0)	0 (0)	65 (40)	0 (0)	0 (0)	68 (40)
DESFBNWR	Moffett AB2	2 (0)	0 (0)	2 (0)	0 (0)	6 (37)	0 (0)	0 (0)	10 (37)
DESFBNWR	New Chicago Marsh	0 (2)	0 (0)	11 (39)	0 (0)	0 (0)	0 (0)	0 (0)	11 (41)
DESFBNWR	Ravenswood Pond RSF2	0 (0)	15 (4)	0 (0)	74 (42)	129 (119)	0 (0)	0 (0)	218 (168)
Other	Redwood Shores Water Treatment Plant	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	TOTAL	61 (10)	22 (18)	38 (58)	204 (133)	422 (368)	0 (3)	0 (0)	747 (590)

Black Skimmers nested at 2 sites (Ravenswood Pond RSF2 and Alviso A16), with 22 total nests recorded. This total is typical for recent years, though notably no skimmers were observed at Hayward Shoreline this season.

Colony disturbances

Community scientists recorded 338 disturbance events across monitored colonies in 2025. Human activity was the most frequently observed disturbance type (130 events, 38%), including pedestrians and cyclists near colonies, vehicle traffic, ongoing construction, and drone activity. Avian predators were the second most common disturbance (121 events, 36%), with observers noting raptors such as Red-tailed Hawks, Red-shouldered Hawks, Northern Harriers, and Common Ravens flying over or perching near rookeries. Other disturbance types included weather events such as storms and high winds (19 events, 6%), mammalian disturbances primarily involving dogs walked near or under colonies (16 events, 5%), and other or unknown sources (52 events, 15%).

The majority of observed disturbances (226 events, 67%) did not result in observable impacts to nesting birds. 112 events (33%) were associated with some level of behavioral response or nest disturbance.

California Gulls (walkthrough)

In 2025, SFBBO monitored 9 California Gull colonies via walkthrough surveys from May 7–14. These colonies encompass all known South Bay breeding locations of this species. We estimated a total of 36,820 California Gulls breeding in the San Francisco Bay in 2025, a 9% decrease from the 40,356 estimated in 2024 (Figure 2).

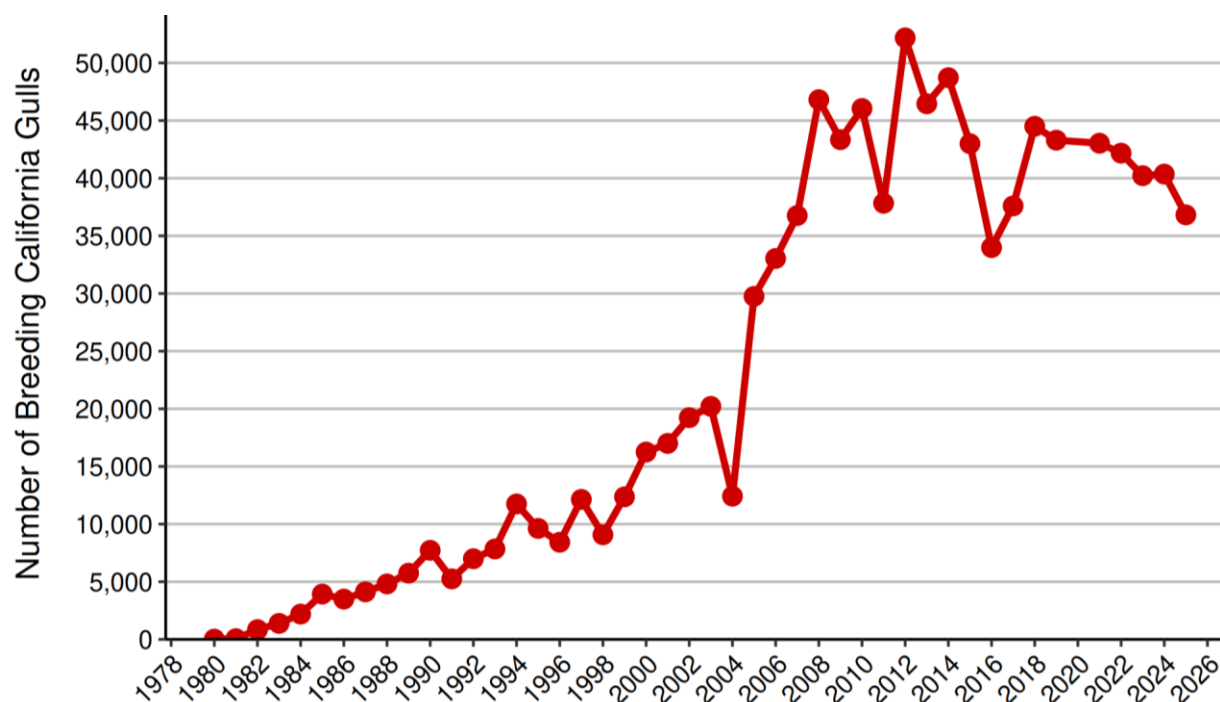


Figure 2. Estimated number of breeding California Gulls in the South San Francisco Bay, CA from 1980–2025.

California Gull colony sizes ranged from 4 breeding birds (RSF2) to 12,712 birds (PAFCC; Table 4). The magnitude and direction of the change varied greatly by colony, from a near-total abandonment of the colony at Ravenswood Pond RSF2 (99% decrease) to a colony reformation at Mowry M3 after that site had two years of no breeding activity. This range indicates that gulls are changing their distribution and selection of breeding sites (Figure 3). The fluctuation in size and location of active gull colonies over the study period is likely due to a suite of changing environmental and demographic factors (Table 4).

We re-sighted 10 banded gulls on our walkthrough counts and through volunteer submissions. All 10 gulls were originally banded at the A6 colony from 2008–2010 (Table 5).

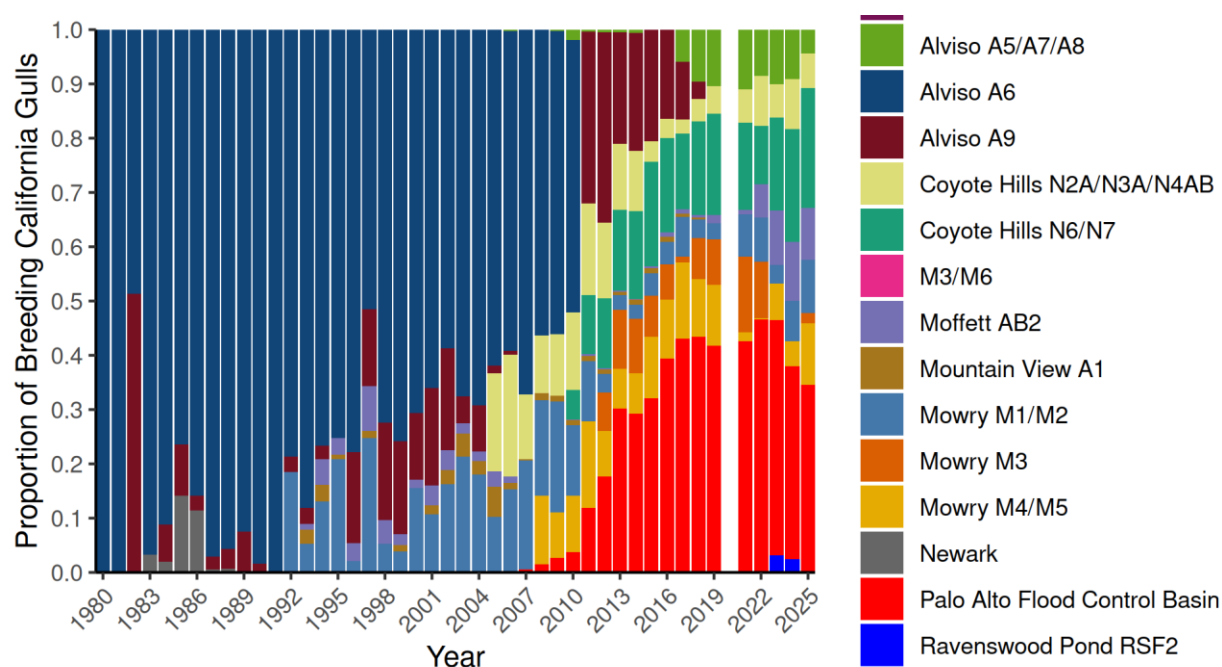


Figure 3. Percentage of breeding California Gulls within each colony site from 1980–2025 in South San Francisco Bay, CA. Alviso A6 provided dry habitat suitable for nesting gulls until 2010, when the levees were breached and the site was opened to tidal action. Following the loss of Alviso A6 as suitable nesting habitat, gulls redistributed to other nesting sites in the South Bay. PAFCC = Palo Alto Flood Control Channel.

Table 4. Number of breeding adult California Gulls by colony in the South San Francisco Bay from 1980–2025. Estimates were generated by doubling nest counts obtained from walkthrough surveys in late spring, except where otherwise noted. In 2004, several colonies were counted from a single flight over the area and are likely conservative. Dashes (–) indicate that colonies were not surveyed.

Year	A1	A5/ A7/ A8	A9	AB2	M1/ M2	M3	M4/ M5	N2A/ N3A/ N4AB	N6/ N7	PAFCB	RSF2	A6	Newark	A3W	Total
1980	0	-	-	0	-	-	-	0	-	-	-	24	-	-	24
1981	0	-	-	0	-	-	-	0	-	-	-	60	-	-	60
1982	0	-	434	0	0	-	-	0	-	-	-	412	-	-	846
1983	0	-	-	0	0	-	-	0	-	-	-	1342	46	-	1,388
1984	0	-	150	0	0	-	-	0	-	-	-	2000	44	-	2,194
1985	0	-	374	0	0	-	-	0	-	-	-	3000	554	-	3,928
1986	0	-	97	0	0	-	-	0	-	-	-	3000	398	-	3,495
1987	0	-	100	0	0	-	-	0	-	-	-	4000	22	-	4,122
1988	0	-	180	0	0	-	-	0	-	-	-	4600	30	-	4,810
1989	0	-	434	0	0	-	-	0	-	-	-	5310	0	-	5,744
1990	2	-	122	0	0	-	-	0	-	-	-	7600	0	-	7,724
1991	0	-	0	0	0	-	-	0	-	-	-	5250	0	-	5,250
1992	0	-	200	0	1294	-	-	0	-	-	-	5500	0	-	6,994
1993	200	-	234	82	415	-	-	0	-	-	-	6912	0	-	7,843
1994	350	-	300	556	1540	-	-	0	-	-	-	9000	0	-	11,746
1995	74	-	4	300	2009	-	-	0	-	-	-	7236	0	-	9,623
1996	0	-	1410	282	174	-	-	0	-	-	-	6558	0	-	8,424
1997	164	-	1722	1000	3000	-	-	0	-	-	-	6256	0	-	12,142
1998	0	-	1628	400	480	-	-	0	-	-	-	6562	0	-	9,070
1999	145	-	2117	248	475	-	-	0	-	-	-	9380	0	-	12,365
2000	0	-	1986	254	2526	-	-	0	-	-	-	11482	0	-	16,248
2001	278	-	3056	624	1824	-	-	0	-	-	-	11216	0	-	16,998

Year	A1	A5/ A7/ A8	A9	AB2	M1/ M2	M3	M4/ M5	N2A/ N3A/ N4AB	N6/ N7	PAFCB	RSF2	A6	Newark	A3W	Total
2002	510	-	3590	712	3120	-	-	0	-	-	-	11302	0	-	19,234
2003	862	-	1010	384	4310	-	-	0	-	-	-	13644	0	-	20,210
2004	321	-	1047	219	2233	-	-	0	-	0	-	8600	0	-	12,420
2005	1664	-	426	830	3044	-	-	5370	-	-	-	18418	-	-	29,752
2006	380	84	234	374	5068	-	-	7442	-	-	-	19456	0	-	33,038
2007	92	-	0	-	7384	-	-	4384	-	206	-	24696	-	-	36,762
2008	616	30	0	-	8224	-	5934	4952	-	690	-	26366	-	-	46,812
2009	446	110	0	8	8842	-	3640	4944	-	1164	-	24190	0	-	43,344
2010	428	890	0	20	6020	-	4780	6594	2506	1704	-	23108	0	-	46,050
2011	390	156	11956	112	4164	-	6068	6394	4110	4478	-	0	0	2	37,830
2012	422	230	18328	122	1770	3700	4414	7248	6738	9200	-	0	0	0	52,172
2013	268	238	9520	120	1252	5076	3408	5656	6912	14006	-	-	-	-	46,456
2014	404	276	10624	82	1300	4878	3616	5412	7864	14264	-	-	-	-	48,720
2015	404	0	8862	142	1788	3226	4894	1588	8302	13788	-	-	-	-	42,994
2016	344	0	5584	262	1390	2224	3658	1198	5918	13406	-	-	-	-	33,984
2017	238	2234	3996	330	2752	402	5256	970	5222	16198	-	-	-	-	37,598
2018	172	4274	1390	208	1514	3368	4716	1846	7678	19340	-	-	-	-	44,506
2019	2	4524	4	652	1310	3626	4858	2158	8094	18070	-	-	-	-	43,298
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2021	0	4750	2	362	3336	6008	704	2640	6896	18338	-	-	-	-	43,036
2022	-	3592	-	2562	3470	4346	98	3902	4530	19584	90	-	-	-	42,174
2023	0	4068	-	4038	1370	0	2736	2440	6894	17398	1276	-	-	-	40,220
2024	-	3608	-	5020	2914	0	1840	3664	8226	14098	986	-	-	-	40,356
2025	-	1634	-	3558	3590	694	4188	2318	8122	12712	16	-	-	-	36,820

Table 5. California Gull band re-sightings in 2025; San Francisco Bay, CA. Birds were banded at the Alviso A6 colony from 2008–2010 as part of SFBBO’s California Gull banding program.

Date	Band Number	Banding Date	Location	Color Band	Leg	Reporter
05/07/2025	Not recorded	Unknown	AB2	637/	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	033White/Black	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	062Black/White	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	495/	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	054Black/	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	145/	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	432White/Black	L	SFBBO staff
05/08/2025	Not recorded	Unknown	Palo Alto Flood Control Basin, CA	026/Black	L	SFBBO staff
05/14/2025	Not recorded	Unknown	A5/A6/A7Levee	559White/Black	L	SFBBO staff
08/14/2025	106520885	05/09/2008	Pismo Dunes State Vehicular Recreation Area	162White/Black	L	Other organization

Discussion

SFBBO has consistently annually monitored many sites for 20-30 years, which provides local managers detailed histories of particular colony sites and accounts of activity around these localized populations. These long-term datasets can uniquely inform large-scale assessments of the health of the San Francisco Bay ecosystem (c.f., Pitkin & Wood 2011). While there are important limitations to data interpretation for community science data (described in the following sections), analyses that correct for biases or incomplete sampling can infer region-wide trends based on calculated indices.

These data have proven valuable for identifying trends within sub-regions of the estuary, timing of breeding activity, nest success, and even identifying species-habitat associations with different land uses (Jennings et al. 2024, Kelly et al. 2007, Kelly et al. 2006). Most recently, we collaborated with Audubon Canyon Ranch to analyze 24 years of data to assess long-term trends in heron and egret nesting abundance throughout different sub-areas of the San Francisco Bay region (Jennings et al. 2024). Other past applications include synthesizing counts from Double-crested Cormorant colonies and developing a population model showing regional trends over the recent decades (Rauzon et al. 2019), modeling the relationship between Double-crested Cormorants and special-status fish species along the Pacific Flyway (Adkins et al. 2014), and informing the San Francisco Bay Heron and Egret Atlas by Kelly et al. (2007).

Herons, egrets, and cormorants

Within the Bay Area, breeding populations of most heron and egret species appear to be stable over the past three decades, with Great Egrets showing signs of recovery and Black-crowned Night-Herons signs of decline (Jennings et al. 2024). Identified changes in breeding activity may be related to natural species composition changes over time, or to other factors such as species' differential tolerance of, response to, or habituation to disturbances (Carney and Sydeman 1999). Shuford et al. (2020) identified nest predation as a possible driver of Black-crowned Night-Heron declines. Many heron and egret rookeries are located in urban greenspaces such as parks, residential areas, and athletic fields and many waterbird nests are found on artificial structures such as old hunting blinds and power towers, or in exotic vegetation such as eucalyptus trees. Impacts of anthropogenic habitat may offer an alternative explanation. Understanding changes in long-term datasets, in addition to characterizing anthropogenic habitats and disturbances, may be able to identify drivers of changes. This could in turn help resource managers make well-informed decisions when altering habitats that support key breeding colonies throughout the San Francisco Bay region.

In downtown Oakland, California, there are significant efforts underway by the Heron Partners Alliance (a consortium that includes SFBBO, Oakland Zoo, International Bird Rescue, and Golden Gate Bird Alliance) to rescue Black-crowned Night-Herons fledglings that end up injured on city streets there (Nuñez-Garro et al. 2025). This suggests that the urban environment of the Bay Area could be a driving factor in local declines, but this has not been demonstrated. In our research on the population, models suggested that herons were selecting for exotic tree species in Chinatown, particularly Chinese banyan (*Ficus macrocarpa*) and Brazilian peppertree (*Schinus terebinthifolia*), and to a lesser degree possibly attracted to food waste on city streets (Nuñez-Garro et al. 2025). These data have already informed collaboration with the City of Oakland on future tree plantings. This analysis is currently being revised to incorporate this year's data and will be prepared for publication in order to advance our understanding of waterbird ecology in urban environments.

Care should be taken in interpreting our data because the nesting sites monitored were not a comprehensive list of the region's active heron and egret colonies. Sampling of waterbird colonies was also not random, with a greater focus on sites that were known to be recently occupied with larger population sizes, accessible, and more central to the study area (i.e., few sites were visited on the margins of the nine-county region). Though in the past these data have been used to analyze changes in nest survivorship over time (Kelly et al. 2007), the protocol change in 2021 from tracking focal nests to general nest and fledgling counts (which was designed to improve scalability and sustainability of the project) means that individual nest success and individual fledge rates can no longer be extracted from the data. Studies with a more formal site sampling approach over a clearly defined area and with more intensive nest-monitoring would be better suited to such goals. While SFBBO community scientists visited some colonies that were also surveyed by other agencies, the data collected by the different entities should not be directly compared due to the difference in monitoring methods used.

Shorebirds and terns

Past applications of our monitoring data found that even prior to the South Bay Salt Pond Restoration Project, Forster's Tern populations were declining in South Bay while gulls were increasing (Caspian Terns were stable; Strong et al. 2004). Likewise, nesting American Avocets and Black-necked Stilts have declined over the past two decades, likely due to the loss of nesting island habitat due to tidal marsh restoration and a growing population of California Gulls (Hartman et al. 2021). Creation of a small number of long, linear islands within pond habitats that are far from nearby levees or mainlands may improve nest success and help these populations recover (Hartman et al. 2016).

Formal scientific surveys of breeding avocets, stilts, and terns within South Bay are carried out by researchers at SFBBO (Schwarz et al. 2024), U.S. Geological Survey (Ackerman et al. 2022), and East Bay Regional Parks District (Riensch et al. 2018). We did not monitor many key avocet, stilt, and tern colonies because they were covered by these existing monitoring efforts. Furthermore, we only monitored gull, tern, and shorebird nesting within the South Bay, so we cannot draw conclusions about trends outside of that subregion. Our data on these guilds is therefore less complete and more biased than our monitoring of herons, egrets, and cormorants. The intention of our data collection for these guilds was to fill gaps in monitored sites and provide a backbone of data to persist through variable funding availability for these formal scientific surveys. We therefore strongly caution against assessing region-wide trends for these species using only our data, and encourage interpreting them in the context of the other formal monitoring data. Site-specific trends may still be appropriately analyzed with our data, but even then caution is warranted. For example, only species nesting outside of the "Tern Town" Island were recorded for Hayward Shoreline in some years because that island was being monitored by Riensch et al. (2018)'s group.

Colony disturbances

The disturbance data collected by community scientists provides valuable insight into the types of pressures facing nesting waterbirds in the San Francisco Bay region. Human activity was the most commonly recorded disturbance type, reflecting the proximity of many colonies to urban areas, recreational trails, and ongoing development. While most observed disturbances did not result in measurable impacts to nesting birds, the cumulative effects of repeated low-level disturbances are difficult to assess and may contribute to nest abandonment or reduced reproductive success over time

(Carney and Sydeman 1999). Continued collection of disturbance data will help identify colonies that may benefit from management interventions, such as improved signage, seasonal access restrictions, or predator deterrents.

California Gulls

The gull walkthrough program has been instrumental in tracking the exponential growth and subsequent impacts of California Gulls within San Francisco Bay over the past four decades (Burns et al. 2018, Strong et al. 2004). Band re-sighting data gathered through this project, as well as from other long-term banding efforts (Schacter et al. 2008, Robinson-Nilsen et al. 2010, and Ackerman et al. 2013) provide useful information regarding gull life span, dispersal, and the potential impact of encroachment into breeding areas for other sensitive species. As management and habitats shift both within and beyond the Bay Area, these data on the locations and abundances of breeding birds can inform management of an increasingly complex set of conservation challenges that center on California Gulls.

Alviso pond A6 formerly held an average of 76% of the breeding population of California Gulls in San Francisco Bay (Strong et al. 2004, Table 4). In December 2010, A6 was restored to tidal action as part of the South Bay Salt Pond Restoration Project. Following this event, gulls apparently redistributed to several nearby colonies, particularly A9/A10/A11/A14 and the Palo Alto Flood Control Basin (Figure 3). In 2019, the colony at A9/A10/A11/A14 declined sharply, prompting further redistribution to other sites, including A5/A7. More recently, gulls have begun to establish new colonies at AB1 and Ravenswood RSF2.

Given the size and geographic proximity of South Bay gull colonies to other sensitive species' nesting habitats, there is an urgent need to protect rare species, such as the Western Snowy Plover (*Anarhynchus nivosus nivosus*), against potential gull impacts (Robinson-Nilsen et al. 2011). High rates of gull predation on chicks have been documented and identified as a potential driver of documented declines in other waterbird species including American Avocets, Black-necked Stilts, Forster's Terns, and Western Snowy Plover. Gulls have been responsible for between 10–54% of Forster's Tern chick mortality events, with fledging rates higher the further breeding sites were from California Gull colonies (Ackerman et al. 2013). Studies have also found California Gull were responsible for 38%, 15%, and 13–55% of chick deaths for Western Snowy Plover, Black-necked Stilt, and American Avocet, respectively (Herring et al. 2011, Ackerman et al. 2014a, Ackerman et al. 2014b).

In response, SFBBO and the U.S. Fish and Wildlife Service pursued selective, nonlethal gull hazing during the gull nest initiation stage from 2011-2015. Following the relocation of one colony, Forster's Tern chick fledging success increased from 3% to 35% (Ackerman et al. 2013), and hazing has also been shown to improve California Least Tern breeding success (Riensch et al. 2012). In subsequent years, the U.S. Fish and Wildlife Service removed California Gull nests from habitats proximate to colonies of sensitive shorebird species, specifically Moffett AB2. SFBBO and USGS carried out similar work at RSF2 2023–2024, and USGS at AB1 in 2024. Nest numbers from their efforts are included in our population estimates and can be found, along with additional details, in their breeding season report (Ackerman et al. 2025). Ongoing monitoring, hazing and evaluation of other actions will be required over the long-term to limit gull impacts to sensitive species.

While the explosive growth of California Gulls in anthropogenic habitats of the South Bay poses a management challenge for threatened waterbirds that nest in the region, it is important to note that

California Gull are also imperiled in their natural habitats. In 2024, Mono Lake was historically the largest breeding colony in California; along with San Francisco Bay, these two sites historically accounted for more than 90% of the state's breeding birds (Shuford & Ryan 2000, Doster & Shuford 2018). In 2024, Mono Lake had its lowest ever number of breeding California Gulls (20,258) since monitoring began in 1983 (Burnett et al. 2025). Chick production also reached a record low, declining 97% due to widespread nest abandonment, with only 324 young estimated to have fledged and several island sub-colonies producing zero chicks (Burnett et al. 2025). This was attributed to widespread nest abandonment due to extreme low invertebrate productivity caused by lake stratification due to an exceptionally large snowpack in 2023 coupled with heightened salinity due to chronic water overdraft to supply Los Angeles (Burnett et al. 2025). Climate change is projected to potentially double the frequency of "whiplash" years (very wet followed by very dry, or vice-versa), making such occurrences more frequent (Chen et al. 2022). Importantly, the exceptional decline last year is part of a longer-term trend: nesting abundance has declined each year since 2020, productivity has not exceeded 1 chick per year since 2015, and the species has seen a long-term decline since the 1990s when there were over 60,000 breeding pairs (Burnett et al. 2025). The largest breeding colony of California Gulls is at Great Salt Lake, where gull populations have been stable over the past two decades (Tavernia et al. 2023), but the Great Salt Lake ecosystem is at risk of catastrophic collapse under climate change due to unsustainable water diversions (Hassan et al. 2022, Abbott et al. 2023). Similar conditions face many of America's saline lakes, imperiling waterbird populations across the intermountain west (Herring et al. 2024).

With 36,820 California Gulls estimated to breed in South Bay—more than the 20,258 at Mono Lake in 2024—the local population appears to now represent over 60% of the total California breeding population for this species and approximately 10% of the global population of around 330,000 birds (Doster & Shuford 2018). California Gull was historically listed by the California Department of Fish and Wildlife as a "Species of Special Concern", but was removed from the list in 2006 because (1) the 1994 California State Water Board order to maintain water levels at Mono Lake was believed to be sufficient to protect the colony there, and (2) the population in San Francisco Bay was growing exponentially. Since then, water elevation in Mono Lake has still not recovered to the board-mandated level, gull breeding there has fallen by half, and the San Francisco Bay population has plateaued (Burnett et al. 2025). Therefore, despite the challenges their presence in San Francisco Bay poses other species, it is important to recognize that at present, the region represents California Gulls' most stable breeding grounds within the state.

Research and management recommendations

1. Regulatory agencies, such as the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife, should work directly with private landowners to protect colonies on privately-owned land. In the case of wading birds, Kelly et al. (2007) urged prioritized protection for larger, more stable colonies of 20 or more nests, and especially for those with 100 or more nests. Within our study area, this would include 19 sites: Bay Farm Island, Blake's Landing South, Bolinas, Brooks Island Spit, Desilva Island, Dover Park, Drake's Estero, Gold Hill, Pacheco Pond Island, Petaluma Wastewater Plant, Red Rock, Redwood Shores Water Treatment Plant, Riverfront Park, Shorebird Way, South Kelly, and Willota Dr. South, as well as all three of the urban Black-crowned Night-Heron colonies (Downtown Oakland, Oakland Museum, and West 9th St. in Santa Rosa). Many small colonies (<20 active nests) exist in the South Bay, which may

be more vulnerable to human disturbance and abandonment than larger colonies; protection and management efforts should also take these factors into consideration (Kelly et al. 2007).

2. Continued monitoring of South Bay waterbirds, from broad topics of study to focused, localized populations will be crucial as the South Bay Salt Pond Restoration Project progresses with its Phase Two actions. This includes construction activity near or at waterbird colony sites and conversion of some habitats currently supporting breeding waterbirds to tidal marsh. We believe that the combined efforts of professional scientists and community scientists alike are needed in this endeavor. However, we advise against direct comparisons of waterbird nesting data collected using different methods and encourage future collaboration and communication among different entities collecting these data in the South Bay.
3. Given concerning trends for California Gull elsewhere in its range and negative impacts on other waterbird species in San Francisco Bay, we recommend managers pay special attention to this challenging and evolving management situation. Recovery of the Mono Lake population by recovering water elevations there to levels legally mandated by the State Water Board should be a top priority. Until such a time, land managers within San Francisco Bay should carefully consider how to balance the potential needs of this species for a refugia in South Bay with the negative impacts on other nesting waterbird species (e.g., Western Snowy Plover). Restoration of A6 to tidal marsh caused the abandonment of the colony there and likely dispersal of those birds elsewhere in the pond complexes; planned future restoration of up to 90% of former salt marshes in the Alviso and Ravenswood complexes is likely to disrupt the breeding colonies there, potentially dispersing them to other nearby levees or concentrating them along with other nesting waterbirds in a smaller number of ponds, potentially increasing predation (Strong et al. 2004). We recommend managers develop a proactive plan to identify areas where California Gull can nest while minimizing negative impacts on other species. Waterbird chick predation rates by California Gulls can decrease when they nest further from gull colonies, especially when as close as 1 km from the colony, though gulls have been documented preying chicks up to 11 km away (Ackerman et al. 2014a). Significant nesting colonies within the Newark and Mowry pond complexes are likely to remain or grow, as these pond complexes are managed by Cargill salt and not slated for tidal marsh restoration.
4. California Gulls have been observed nesting along the levee at Pond AB1 and on the islands at Ravenswood RSF2, both of which provide important breeding habitat for sensitive species such as the American Avocet and Forster's Tern. We recommend further intensive surveys and removal of nest bowls from sensitive habitats. Without these nest hazing activities, gulls may colonize new nesting habitats preferred by Western Snowy Plovers or other sensitive waterbird species, such as the islands at Alviso pond A16. We do not recommend large-scale lethal control of California Gull to attempt to reduce the population as this approach would likely be costly and ineffective (Burns et al. 2018, Thomas 1972, Oro and Martinez-Abrain 2007), as well as controversial given the ongoing declines at Mono Lake.
5. It remains largely unknown what factors influenced the rapid population growth and the recent stabilization of the California Gull population in San Francisco Bay. The stabilization occurred immediately after abatement efforts began in South Bay in 2008, which suggests that abatement may have helped curtail the previous population growth, but this remains an

untested hypothesis. Intensive nest hazing efforts at the former largest colony were carried out from 2011–2015, which overlapped with the peak years, but a population decline was not seen until the very last of these years. No systematic study of California Gull reproductive success has been conducted – as a result, we recommend a comprehensive study of California Gull demographics in San Francisco Bay. Enhanced monitoring of gull nest success, breeding site fidelity/movement, chick survival, and adult and chick diets (to assess use and importance of “natural” vs. landfill-derived food items) could be especially informative.

6. Significant decreases in the number of California Gulls using the Newby Island Landfill have been recorded in response to on-site abatement programs. Controlling access to anthropogenic food sources may affect the location and size of active gull colonies and, though causation is hard to establish, current strategies may have helped stabilize the population at a reasonable level. The degree to which individual gulls move between anthropogenic sources of food is unknown. In 2025, SFBBO began a partnership with the Scott Shaffer lab at San Jose State University to pilot a study to describe the movement of gulls between sites and the impact of coordinated control efforts on gull populations.

Community Outreach through Community Science

In addition to generating valuable scientific data, the CWB Program is a key pillar of SFBBO’s outreach efforts. Since its founding in the early 1980s, this program has engaged hundreds of community scientists to help carry out this research. This special section summarizes the community engagement activities and outcomes of the CWB Program.

In 2025, 118 SFBBO community scientists contributed 1,020 volunteer hours to the CWB Program, equivalent to over \$40,954 in donated labor (estimated value in California of \$40.14 per hour; Independent Sector 2025). Each nesting season, new and veteran community scientists receive the CWB Volunteer Manual, attend a training and orientation with SFBBO staff, and then spend one or two mornings each month observing breeding activity (recording birds, nests, and chicks, environmental conditions, and human impacts), and performing data management. Many CWB community scientists are long-term participants and supporters, highlighting the interest in and value of this community science program. The commitment of this strong network of community scientists has produced a valuable, long-term dataset that helps land managers, organizations, and the public make informed decisions to conserve birds.

Community science experiences may have deeper and more positively significant socioecological impacts than are currently recognized, that affect not only the quality of scientific studies but also the function of members within their social community (Jordan et al. 2012). By engaging people from the community in avian research, staff build volunteers’ awareness about birds and conservation and nurture their understanding of and appreciation for science. In turn, our community scientists carry their experiences and passion for birds, conservation, and science into the wider community.

Over the past decade, we have developed several initiatives within the CWB Program to emphasize this ambassador approach. These initiatives help community scientists and the program support each other, expand ecological science, educate the community, and impact bird conservation. In 2025, community scientists participated as ambassadors in the following ways:

1. *Community Partnerships:* CWB community scientists helped SFBBO share our data with land managers and others working to conserve Bay Area birds. In addition to this report, we wrote reports and shared data on specific colonies in response to requests from landowners, community members, and researchers, including the DeSilva Island HOA, the Marin Breeding Bird Atlas, and the Napa County Planning, Building, and Environmental Services. These requests for information grew from relationships that were developed and nurtured by our community scientists as they worked in the field, and with their help we plan to build on this process and provide more site-specific information for people in the community in 2026.
2. *Outreach:* SFBBO also engaged community scientists in outreach efforts by tabling at community events. Participants helped us conduct fundraising in 2025 to benefit our programs by helping with our online silent auction and disseminating shirts during our California Fall Challenge fundraising drive.
3. *Mentoring:* Our Mentoring Program pairs new community scientists with veteran ones to provide an opportunity to learn the monitoring protocols. New volunteers can also engage in scouting, a less directed survey method where community scientists visit either previously unsurveyed potential nesting sites or previously surveyed abandoned colony sites. This grows the program through the discovery of new colonies.

We are excited about the direction our community scientists are helping SFBBO take the CWB Program and grateful for their energy and dedication. From collecting data and strengthening the field training program to educating the public and raising funds, these community scientists continue to be an invaluable asset that allows SFBBO to achieve our mission to conserve birds and their habitats through science and outreach. The scientific and social benefits that these educational opportunities provide, not only to our research but also to our community members, are still not fully understood (Jordan et al. 2012). We encourage community engagement in ecological research and recommend that scientists work to develop multi-disciplinary measures of success for such programs.

Acknowledgements

Our deepest thanks to SFBBO's donors who have provided nearly all the funding for over 40 years of the CWB Program. Special thanks to Linda Sullivan, Edward Perry, and Bill Rose for adopting a colony to help support this program. This work was also funded in part by DeSilva Island Homeowners' Association.

We wish to thank the following community scientists especially for their hard work and dedication to this project in 2025: Nancy Abreu, Vanessa Aczon, Larry Baer, Cyndi Bakir, Lucy Barnes, Bob Battagin, Umesh Bellur, Janice Bernal, Deepa Bhatt, David Blomdal, Patti Blumin, Ronald Brown, Pam Browning, Stanton Chan, Emily Chan, May Chen, Emily Cheng, Connor Christensen, Katt Clark, Emiko Condeso, Fen Conway, Phil Cotty, Eva Czirr, Dianne Decastro, Matthew Dionisio, Eileen Duff, Sam Eberhard, Vickie Eggert, Jeff Englander, Jessie Farinholt, Jesse Fichman, Rhonda Florence, Mandy Frazen, Liz Frith, Mookie Fudenberg, Isabella Garcia, Karan Gathani, Susie Graven, John Aaron Graves, Michael Grunow, Peter Grunow, Ryan Guan, Jan Hintermeister, Erika Hoytt, Traci Ikegami, Vinish Janardhanan, Scott Jennings, Cole Jower, Janice Juarez, Robin Keister, Stephanie Klein, Neha Kumar, Liz Lewis, Kerry Lin, Ann Linder, Stephanie Liu, Megan Loh, Olinge Lotane, Barbara Luedtke, David Lumpkin, Vivek Madasu, Kaitlin Magoon, Larry Manning, Ron Mcdow, Wim Meeussen, Alex Miner, Safiya Mirza, Michelle Muir, Len

Nelson, Chris Ng, Cynthia Padula, Emma Paradise, Jean Perata, Ellen Peterson, Sue Pilipauskas, Nico Pino, Linda Pors, Marta Porter, Gordon Porter, Penny Proteau, Katherine Raspet, Sonja Raub, Kristen Rogers, Jacob Rueben, Karen Rush, Molly Sandomire, Elka Seward-Katzmiller, Joah Sheehan, Linda Sheppard, Sarah Sherertz, Shweta Shidhore, Ken Shih, Sylvie Silverstein, Tom Slyker, Judith Souza, Neela Srinivasan, Manuel Stevos, Prathibha Sundaresan, Natalie Tam, Susan Teefy, Olivia Townsend, Karen Tu, Hari Venkataramani, Sarah Wang, Barbara Wechsberg, Sandy X, Tristan Yoo, Albert Young, Jacky Young, Jim Young, Christine Zack.

Thank you to the staff at Audubon Canyon Ranch for their collaboration as we expanded the program to include North Bay sites. A special thanks to Isabella Nuñez-Garro who helped develop and execute the Oakland Black-crowned Night-Heron project and to Gabbie Burns who managed the CWB database. Thank you also to the following staff for providing their field and fundraising skills to the California Gull walkthrough counts in 2025: Kristin Butler, Cole Jower, Fen Conway, Sam Eberhard, and Chris Overington. Rachel Tertes of the Don Edwards San Francisco Bay National Wildlife Refuge (DESFBNWR) and John Krause of the California Department of Fish and Wildlife provided access permits, field and logistical support. Thank you also to Santa Clara County Parks, San Francisco Public Utilities Commission, East Bay Regional Park District, Don Edwards San Francisco Bay National Wildlife Refuge, and many private land owners for working with us to allow permission for monitoring.

Literature Cited

- Ackerman, J. T., J. Y. Takekawa, C. Strong, N. Athearn, and A. Rex. 2006. California Gull distribution, abundance, and predation on waterbird eggs and chicks in South San Francisco Bay. Final report. U.S. Geological Survey, Western Ecological Research Center, Davis and Vallejo, California, USA.
- Ackerman, J. T., M. P. Herzog, C. A. Hartman, and G. Herring. 2014a. Forster's Tern chick survival in response to a managed relocation of predatory California Gulls. *Journal of Wildlife Management* 78:818–829.
- Ackerman, J. T., M. P. Herzog, C. A. Hartman, and J. Y. Takekawa. 2014b. Comparative reproductive biology of sympatric species: nest and chick survival of American Avocets and Black-necked Stilts. *Journal of Avian Biology* 45:609–623.
- Ackerman, J. T., C. A. Hartman, and M. P. Herzog. 2023. Monitoring nesting waterbirds for the South Bay Salt Pond Restoration Project—2022 breeding season. U.S. Geological Survey Open-File Report 2023–1067, USA.
- Ackerman, J. T., C. A. Hartman, and M. P. Herzog. 2025. Monitoring nesting waterbirds for the South Bay Salt Pond Restoration Project—2024 breeding season. U.S. Geological Survey Open-File Report, USA.
- Adkins, J. Y., D. D. Roby, D. E. Lyons, K. N. Courtot, K. Collis, H. R. Carter, W. D. Shuford, and P. J. Capitolo. 2014. Recent population size, trends, and limiting factors for the double-crested cormorant in western North America. *Journal of Wildlife Management* 78:1131–1142.
- Burns, C. E., J. T. Ackerman, N. B. Washburn, J. Bluso-Demers, C. Robinson-Nilsen, and C. Strong. 2018. California Gull population growth and ecological impacts in the San Francisco Bay estuary, 1980–2016. Pages 180–189 in W. D. Shuford, R. E. Gill Jr., and C. M. Handel, editors. *Trends and traditions: avifaunal*

change in western North America. Studies of Western Birds 3. Western Field Ornithologists, Camarillo, California, USA.

Callaway, J. C., V. T. Parker, M. C. Vasey, L. M. Schile, and E. R. Herbert. 2011. Tidal wetland restoration in San Francisco Bay: history and current issues. San Francisco Estuary and Watershed Science 9(3).

Carney, K. M., and W. J. Sydeman. 1999. A review of human disturbance effects on nesting colonial waterbirds. Waterbirds 22:68–79.

Cooper, C. B., J. Shirk, and B. Zuckerberg. 2014. The invisible prevalence of citizen science in global research: migratory birds and climate change. PLoS ONE 9:e106508.

Demers, S. A., and C. W. Robinson-Nilsen. 2012. Monitoring Western Snowy Plover nests with remote surveillance systems in San Francisco Bay, California. Journal of Fish and Wildlife Management 3:123–132.

Dickinson, J. L., B. Zuckerberg, and D. N. Bonter. 2010. Citizen science as an ecological research tool: challenges and benefits. Annual Review of Ecology, Evolution and Systematics 41:149–172.

Doster, R. H., and W. D. Shuford. 2009. Recent trends in population size and distribution of Ring-billed and California gulls in the western United States. Western Birds 40:1–18.

Hartman, C. A., J. T. Ackerman, and M. P. Herzog. 2016. Island characteristics within wetlands influence waterbird nest success and abundance. Biological Conservation 200:55–63.

Hartman, C. A., J. T. Ackerman, M. P. Herzog, C. Strong, D. Trachtenbarg, and C. A. Shore. 2018. Social attraction used to establish Caspian tern (*Hydroprogne caspia*) nesting colonies on modified islands at the Don Edwards San Francisco Bay National Wildlife Refuge, California—final report. U.S. Geological Survey Open-File Report 2018-1136, USA.

Hartman, C. A., J. T. Ackerman, C. R. Schacter, M. P. Herzog, L. M. Tarjan, and Y. Wang. 2021. Breeding waterbird populations have declined in South San Francisco Bay: an assessment over two decades. San Francisco Estuary and Watershed Science 19(3).

Hoffmann, L., H. Hafner, and T. Salathé. 1996. The contribution of colonial waterbird research to wetland conservation in the Mediterranean region. Colonial Waterbirds 19:12–30.

Jennings, S., N. Warnock, E. Condeso, D. Lumpkin, G. Burns, and B. Wechsberg. 2024. Status and trends of breeding Ardeidae in the San Francisco Bay region. San Francisco Estuary and Watershed Science 22(3).

Jordan, R. C., H. L. Ballard, and T. B. Phillips. 2012. Key issues and new approaches for evaluating citizen-science learning outcomes. Frontiers in Ecology and the Environment 10:307–309.

Kelly, J. P., K. Etienne, C. Strong, M. McCaustland, and M. L. Parkes. 2006. Annotated atlas and implications for the conservation of heron and egret nesting colonies in the San Francisco Bay area. ACR Technical Report 90-3-17. Audubon Canyon Ranch, California, USA.

Kelly, J. P., K. Etienne, C. M. Strong, M. McCaustland, and M. L. Parkes. 2007. Status, trends and implications for the conservation of heron and egret nesting colonies in the San Francisco Bay Area. Waterbirds 30:455–478.

- Kushlan, J. A. 1993. Colonial waterbirds as bioindicators of environmental change. *Colonial Waterbirds* 16:223–225.
- Kushlan, J. A., M. J. Steinkamp, K. C. Parsons, J. Capp, M. A. Cruz, M. Coulter, and K. Wohl. 2002. Colonial-nesting waterbirds: a glorious and gregarious group. *Waterbirds* 25(Special Publication 1):8–17.
- Lotze, H. K., H. S. Lenihan, B. J. Bourque, R. H. Bradbury, R. G. Cooke, M. C. Kay, S. M. Kidwell, M. X. Kirby, C. H. Peterson, and J. B. C. Jackson. 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas. *Science* 312:1806–1809.
- Núñez-Garro, I. M., A. Parsons, and N. D. Van Schmidt. 2025. Ornamental tree species drive the selection of nesting colony sites by Black-crowned Night-Herons (*Nycticorax nycticorax*) in an urban habitat. Report prepared for the City of Oakland, California, USA.
- Parnell, J. F., D. G. Ainley, H. Blokpoel, B. Cain, T. W. Custer, J. L. Dusi, S. Kress, J. A. Kushlan, W. E. Southern, L. E. Stenzel, and B. C. Thompson. 1988. Colonial waterbird management in North America. *Colonial Waterbirds* 11:129–169.
- Pitkin, M., and J. Wood, editors. 2011. The state of the birds, San Francisco Bay. PRBO Conservation Science and the San Francisco Bay Joint Venture, California, USA.
- Rauzon, M. J., M. L. Elliot, P. J. Capitolo, L. M. Tarjan, G. J. McChesney, J. P. Kelly, and H. R. Carter. 2019. Changes in abundance and distribution of nesting Double-crested Cormorants *Phalacrocorax auritus* in the San Francisco Bay area, 1975–2017. *Marine Ornithology* 47:127–138.
- Robinson-Nilsen, C., and J. Demers. 2010. Banding and re-sighting California Gulls in the South San Francisco Bay, 2010. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, California, USA.
- Robinson-Nilsen, C., and J. Demers. 2012. California Gull breeding surveys and hazing project, 2012. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, California, USA.
- Robinson-Nilsen, C., J. Demers, and C. Strong. 2011. Western Snowy Plover numbers, nesting success, fledging success and avian predator surveys in the San Francisco Bay, 2011. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, California, USA.
- Schwarz, M., K. LaBarbera, and J. Scullen. 2024. Western Snowy Plover and California Least Tern monitoring in the San Francisco Bay annual report 2023. Report prepared for the South Bay Salt Pond Restoration Project, California, USA.
- Shuford, W. D., and T. P. Ryan. 2000. Nesting populations of California and Ring-billed Gulls in California. *Western Birds* 31:133–164.
- Shuford, W. D., J. P. Kelly, T. E. Condeso, D. S. Cooper, K. C. Molina, and D. Jongsomjit. 2016. Distribution and abundance of colonial herons and egrets in California, 2009–2012. *Waterbirds* 39:1–24.
- St. Pierre, J., C. E. Burns, and N. Washburn. 2015. Nuisance Species Abatement Plan, 2014 annual report, Newby Island Landfill & Recyclery. Unpublished report. San Francisco Bay Bird Observatory, Milpitas, California, USA.

Strong, C. M., L. B. Spear, T. P. Ryan, and R. E. Dakin. 2004. Forster's Tern, Caspian Tern, and California Gull colonies in the San Francisco Bay: habitat use, numbers, and trends, 1982–2003. *Waterbirds* 27:411–423.

The Heron and Egret Project. 2024. ArcGIS StoryMaps.

<https://storymaps.arcgis.com/stories/b9c9cc73b84f4282bd590ed1a985ecf7>

Appendix I

Given the complex set of possibility nest detection histories, no consistent mathematical method for correcting biases for missing nests and double-counted nests is perfect. We explored a number of different methods and selected the method described here as performing best based on a combination of (1) comparison of estimated fledging rates to those in the published literature, (2) avoiding estimates of the number of fledged nests that exceeded peak single-day nest counts for that site (i.e., due to double-counting), (3) comparison of estimated number of fledged nests to the best-guess estimate from holistic assessment of the entire detection history and survey notes for a subset of sites we randomly assessed by hand. The resulting method appeared to reasonably balance over- and under-correction.

First, the total possible number of new Stage 4 nests was calculated as the sum of all nests in earlier stages at earlier visits, minus the number of nests that were in those categories in the current visit:

$$PossibleNewS_{4,t} = Max(0, S_{0,t-1} + S_{1,t-1} + S_{2,t-1} + S_{3,t-1} + S_{Unknown,t} - (S_{0,t} + S_{1,t} + S_{2,t} + S_{3,t}))$$

where S is the count of nests in each stage at visit t. Because we sought to estimate the *possible* number of new Stage 4 nests, we included Stage Unknown from the previous visit in the pool of “possible nests” but did not subtract them from the current visit (e.g., to avoid overcorrecting if Stage Unknown nests in the current visit were actually Stage 5 nests that had been Stage 4 in the previous visit).

The number of new Stage 4 nests at each visit was then capped so that it could not exceed this pool of earlier-stage nests from the previous visit that were no longer present in the current visit:

$$NewFledgedNests_t = Min(PossibleNewS_{4,t}, S_{4,t})$$

Because of lower detectability of nests in Stages 0–3, when birds are often low in the nest and incubating, Stage 5 nests were sometimes observed without any Stage 4 nests recorded during the previous visit. This indicated nests that had transitioned directly from Stages 0–3 (or Stage Unknown) to Stage 5. We therefore first calculated an alternative minimum fledgling nest count as:

$$MinimumNew_t = S_{4,t} + S_{5,t} - (S_{4,t-1} + S_{5,t-1})$$

The estimated number of fledged nests was then the larger of these two values, summed across visits:

$$TotalFledgedNests = \sum_{t=1}^T Max(NewFledgedNests_t, MinimumNew_t)$$

where T is the index of the final visit. Lastly, we calculated the total number of fledged chicks by multiplying this adjusted count of fledged nests by the average number of chicks per Stage 4 nest and summing across all visits for each species:

$$TotalFledgedChicks = \sum_{t=1}^T Max(NewFledgedNests_t, MinimumNew_t) \times \frac{ChicksS_{4,t}}{S_{4,t}}$$

If no Stage 4 chicks were recorded for a given species and visit (because of missing data or because all fledglings were derived from Stage 5 adjustments via *MinimumNew_t*), this value was set to the mean from all other visits for that species at that colony during that year.