Citizen Science-based Colonial Waterbird Monitoring at the San Francisco Bay Bird Observatory - 2012 Nesting Summary

Prepared By:

Christina Donehower, Science Programs Director
Karine Tokatlian, Biologist
San Francisco Bay Bird Observatory
524 Valley Way
Milpitas, CA 95035

Prepared For:

Cheryl Strong, Wildlife Biologist
Eric Mruz, Refuge Manager
Don Edwards San Francisco Bay National Wildlife Refuge

And

John Krause, Wildlife Biologist
Eden Landing Ecological Reserve
California Department of Fish and Game

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Program 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 is one of SFBBO's long-standing citizen science initiatives. Since 1982, the program has engaged over a hundred volunteers in waterbird nest-monitoring activities in the San Francisco Bay. Trained volunteers independently collect observational data on nesting colony status, timing of breeding, numbers of active nests observed, waterbird behavior, and evidence of nest predation or human disturbance at selected colonies each year. They also assist SFBBO staff in conducting annual walkthrough counts of all known California Gull colonies in the South Bay; these counts provide colony size estimates. This information is shared with landowners and resource agencies and contributes to the conservation and management of these species.

Introduction

Estuaries are among the most dynamic, complex, and biologically productive ecosystems in the world (Alongi 1998, Good 1999). Yet, they are also extremely vulnerable to human disturbance (Kennish 2002, Lotze et al. 2006). Large estuaries, such as the San Francisco Bay, are highly coveted places for human habitation, recreation, industry, and agriculture. Currently, over 7 million people live in the Bay Area (MTC-ABAG 2012), placing unprecedented pressures on the region's biological resources, goods, and services.

Loss of tidal wetlands has been particularly severe in the San Francisco Bay. Over the last 150 years, an estimated 90% of historic tidal marsh has been eliminated through development and/or conversion to salt evaporation ponds and agricultural fields (Goals Project 1999). Remarkably, despite these drastic changes and the continued threats of habitat loss and degradation, the Bay still retains a diverse array of fish and wildlife. For example, San Francisco Bay is recognized as a site of hemispheric importance for migratory shorebirds, a significant wintering area for waterfowl, and home to several rare marsh-dependent species (Page et al. 1999, Siegel and Bachand 2002, Stenzel et al. 2002, WHSRN 2012). The Bay also supports many colonially-nesting waterbirds.

Since 1982, SFBBO has recruited and trained volunteers annually to monitor nesting waterbirds, including herons, egrets, cormorants, gulls, and terns, in the San Francisco Bay. The Colonial Waterbird Program emphasizes community engagement and volunteerism in order to: 1) increase monitoring capacity across a large geographic area in a cost-effective manner and 2) generate public interest in protecting and restoring waterbirds and their habitats. Volunteers receive training in waterbird identification, natural history, proper "etiquette" around nesting birds, and observational study methods through a standardized protocol. They are assigned one or more colonies to monitor during the nesting season, and commit to visiting those sites at established intervals. Many of the colonies monitored by SFBBO volunteers would not otherwise be tracked. Volunteers also assist SFBBO staff in conducting walkthrough counts annually of all known California Gull colonies in the South Bay.

In this report, we summarize results from SFBBO's citizen science-based waterbird monitoring program in 2012. We also compile some nesting information provided to SFBBO by agencies monitoring other waterbird colonies in the San Francisco Bay.

Methods

Study area and focal species:

SFBBO biologists and volunteers monitored active waterbird nesting sites in the San Francisco Bay from March to August 2012. Some colonies were located on public lands, while others were on private property. Most colonies monitored were in South San Francisco Bay, but we also report on several colonies in the Central and North Bay and at inland locations of Contra Costa County. The Audubon Canyon Ranch has a similar citizen science program that targets herons and egrets in North and Central Bay locations as does PRBO Conservation Science, which centers on San Joaquin Valley locations.

SFBBO focused principally on colonies of California Gull (*Larus californicus*), Forster's Tern (*Sterna forsteri*), Caspian Tern (*Hydroprogne caspia*), California Least Tern (*S. antillarum browni*), Great Blue Heron (*Ardea herodias*), Great Egret (*A. alba*), Snowy Egret (*Egretta thula*), and Double-crested Cormorant (*Phalacrocorax auritus*). Additionally, we monitored American Avocets (*Recurvirostra americana*), Black-necked Stilts (*Himantopus mexicanus*), Black Skimmers (*Rynchops niger*), and Black-crowned Night Herons (*Nycticorax nycticorax*) only when nesting with other species of interest.

Walkthrough counts:

SFBBO biologists led one walkthrough survey of most California Gull colonies (see Table 1 for colonies) between May 11, 2012 and May 23, 2012. Trained volunteers often accompanied SFBBO staff on these surveys. Observer-teams walked systematically through the colonies, with a recorder tallying all nests present. In this report, we provide the total number of active nests (nests with eggs or chicks) encountered at each gull colony; we excluded empty nest cups from these estimates. We also refer to the number of breeding gulls in a given area, which represents the nest count multiplied by two.

Observational study:

SFBBO staff developed monitoring protocols and volunteer training curricula (see Robinson-Nilsen and Strong 2012 for details). These observational study methods have remained unchanged since the program's initiation in 1982. Volunteers were asked to visit their assigned waterbird site(s) once during each established, three-day monitoring window. In 2012, heron colonies were visited on seven occasions from March 3 to July 9, while cormorant colonies were visited on eight occasions from March 3 to August 6, and gull and tern colonies were visited on six occasions from May 5 to August 6. On each visit, volunteers used binoculars and spotting scopes to estimate the number of adult birds, nests, and chicks present. They also noted nesting behaviors, such as incubation, nest-building, and courtship displays, and any evidence of human disturbance or predation. In this report, we provide the peak number of nests observed per species for each colony monitored by SFBBO.

Agency data:

To provide a more complete picture of waterbird monitoring efforts throughout the San Francisco Bay, SFBBO has traditionally compiled and reported nesting data from other agencies in this annual summary. As of the writing of this report, SFBBO had received tern colony information from the East Bay Regional Park District (EBRPD; D. Riensche) and the U.S. Fish and Wildlife Service (USFWS; S. Euing). USFWS data represent the total number of nests counted throughout the season, whereas EBRPD data represent nests counted on single day.

Results and Discussion

Walkthrough counts:

In 2012, SFBBO documented ten active California Gull colonies in the South San Francisco Bay through intensive searches and walkthrough counts. Colonies were located at Alviso ponds A9/A10/A14, Mountain View pond A1, Mowry ponds M4/M5, Mowry pond M1/M2, Mowry pond M3, Moffett pond B2, Coyote Hills pond N3A, Coyote Hills ponds N6/N7, and the Mountain View/Palo Alto Flood Control Channel (Tables 1-2, Fig. 1). Colonies ranged in size from 61 nests at B2 to 9,164 nests at A9/A10/A14. A new colony was established on the wind fetch islands of M3. This new colony supported an estimated 1,850 gull nests and may explain why fewer gull nests were found at the nearby M1/M2 and M4/M5 colonies this season (Tables 1-2). Two other California Gull colonies outside of the South Bay, Alcatraz and Agua Vista, were also monitored (Table 1, Fig. 1).

Altogether, there were an estimated 52,172 California Gulls breeding in the South Bay in 2012, a 38% increase from 2011 (Table 2). The A9/A10/A14 colony grew from 5,978 nests in 2011 to 9,164 nests in 2012. The colony within the Palo Alto Flood Control Channel also increased considerably, from 2,239 nests in 2011 to 4,600 nests in 2012. The established colonies in the Coyote Hills complex (both the N3A/N4AB and N6/N7 colonies) supported slightly higher nest numbers than in 2011.

Over the last 30 years, SFBBO's Colonial Waterbird Program has documented an exponential increase in the number of California Gulls nesting in the San Francisco Bay, from fewer than 20 gulls in 1980 to over 52,000 gulls in 2012 (Fig. 2, see also Strong et al. 2004 and Ackerman et al. 2006). Not surprisingly, the size and location of active gull colonies have fluctuated over the study period (Table 2), probably reflecting a suite of changing environmental and demographic factors. Gulls' use of landfills and other sources of anthropogenic food in the South Bay may be a major contributing factor to such rapid growth (Ackerman et al. 2006), though the recent implementation of gull abatement programs at several area landfills appears to be reducing gull access to this food source (Robinson-Nilsen and Demers 2011) and may affect gull numbers over the long-term. The actions of the South Bay Salt Pond Restoration Project have begun (and will continue) to affect, to some extent, where nesting habitat remains available to gulls.

Currently, there is growing concern among many land managers and conservationists that the overabundance of California Gulls in the Bay will impede some goals of the South Bay Salt Pond Restoration Project, particularly, the ability of the project to support target levels of other ground-nesting waterbird populations with reduced salt pond acreage. As some gull nesting areas within salt ponds are restored to tidal action, displaced gulls may seek new nesting sites elsewhere, potentially impacting Western Snowy Plovers (*Charadrius nivosus nivosus*), Forster's Terns, or other sensitive waterbird species. California Gulls initiate nests before some other nesting waterbird species (Ackerman et al. 2009) and may exclude them from historical nesting areas (Strong et al. 2004). They are also well-documented predators of waterbird nests and chicks (Ackerman et al. 2006).

In December 2010, Alviso pond A6 was restored to tidal action. Since this site was formerly home to the largest California Gull colony in the Bay (23,108 gulls in 2010, Table 2), it provides an opportunity to study gull response/colony redistribution as a result of changing habitat conditions. However, given the timing and size of the gull colony affected, it also introduces some urgency in the need to protect rare species, such as the Western Snowy Plover, against potential gull impacts. In response, SFBBO, in partnership with the U.S. Fish and Wildlife Service, initiated intensive surveys of South Bay salt ponds

and pursued selective, nonlethal gull hazing during the gull nest initiation stage in 2011 and 2012. To date, gulls have been successfully deterred from nesting in designated ecologically sensitive areas. Ongoing monitoring, hazing, and evaluation of other actions may be required over the long-term to limit gull impacts to sensitive species.

Observational study:

In 2012, SFBBO volunteers monitored 59 waterbird colonies (Tables 1, 3, Figs. 1, 3) using observational methods. Newly discovered heron rookeries monitored by volunteers this season included those at Bunting Pond-Niles, Chesapeak-Saginaw in Redwood City, and Coyote Ranch Road. Waterbirds nested in a range of habitats, from salt ponds and levees to parks and residential areas. Colonies varied in size, and some colonies supported multiple species (Tables 1, 3).

With the exception of California Gull colonies, the nesting sites named in Tables 1 and 3 should not be viewed as a comprehensive list of all active waterbird colonies in the region, nor should the peak nest numbers observed be used for population-level trend analyses. More intensive nest-monitoring, a strategic sampling approach, and a broader geographic scope would be better-suited to such goals.

While the biased sampling scheme (toward known, occupied, and accessible sites), low frequency of colony visits, and observational methods used as part of the Colonial Waterbird Program have clear limitations, we believe that these data have many values, nonetheless. The existing program could serve as a valuable starting point for the development of a future, more comprehensive regional effort to track population sizes and trends on a larger scale. In fact, some of the data were previously incorporated into a San Francisco Bay heron and egret atlas by Kelly et al. (2006). For many sites, SFBBO possesses long-term colony profiles (see Ruus Park example, Appendix I). Some of the long-term data collected on timing of nesting/breeding phenology may be suitable for addressing questions related to climate change, though the resolution/frequency of colony visits may not be adequate to detect subtle shifts.

In the future, we may incorporate more habitat characterization elements into the protocol. For example, many heron and egret rookeries are located in urban greenspaces (e.g., parks, residential areas, playfields), and many waterbird nests are located on artificial structures, such as blinds and power towers, and in invasive or ornamental vegetation (e.g., *Eucalyptus* trees). Training citizen scientists to collect some additional information on site characteristics and nesting substrate could heighten our understanding of waterbird use of these highly modified landscapes and landscape features.

Currently, the Colonial Waterbird Program helps to identify important waterbird nesting sites and brings conservation threats, such as human disturbance, to the attention of resource managers. Due to the large geographic area to be covered (including lands under both public and private ownership), the ephemeral nature of many colonies, and the high cost of intensive monitoring, SFBBO's volunteer corps provides an important service to the community and serves as the only "eyes on-the-ground" for many colonies. Moreover, the program has the added benefits of community engagement and education, and by focusing on highly visible, charismatic waterbird species, has the potential to further generate public interest in the protection of waterbirds and their habitats.

Agency data:

Other agencies provided nesting data for two waterbird colonies (Table 4). Due to the different monitoring methods used, we advise against direct comparisons of agency nest numbers with SFBBO nest numbers.

Volunteer participation:

In 2012, 47 SFBBO volunteers contributed 409.25 volunteer hours to the Colonial Waterbird Program. If valued at a rate of $15 per hour, this amounts to $6,138.75 in donated labor. Levels of volunteer participation have remained steady in recent years, with an average of 45 volunteers contributing an average of 423 hours annually from 2009 to 2012. Many volunteers are long-term participants and supporters, highlighting the interest in this citizen science program.

Recommendations

1. Regulatory agencies, such as the U.S. Fish and Wildlife Service and California Department of Fish and Game, should work with private landowners to protect colonies on privately-owned land. In the case of wading birds, Kelly et al. (2006) urged prioritized protection for larger, more stable colonies of 20 or more nests, and especially of 100 or more nests. Since many small colonies (5-50 active nests) exist in the South Bay, and small colonies can be more vulnerable to human disturbance and abandonment than larger colonies, protection and management efforts should take these factors into consideration (Kelly et al. 2006).

2. It is unknown if the population growth of California Gulls in San Francisco Bay is due to local breeding success or recruitment from colonies outside of the Bay Area. We recommend further study of California Gull demographics. 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. Ackerman et al. (2006) indicated plans to use stable isotopes to examine marine and terrestrial inputs to California Gull diet and advocated for more direct diet studies incorporating "regurgitates, collections, and prey deliveries".

3. To our knowledge, the displaced California Gulls from the former A6 colony did not nest in any sensitive habitats in 2012 due to the intensive surveys and hazing activities conducted by SFBBO (Robinson-Nilsen and Demers 2012). We recommend continued surveys and hazing in 2013. Without these activities, gulls will likely colonize Western Snowy Plover or other sensitive waterbird nesting habitat, such as the newly-created islands at Ravenswood pond SF2.

4. Continued monitoring of South Bay waterbirds will be crucial as the South Bay Salt Pond Restoration Project completes its Phase One actions, including construction 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 citizen 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.

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Table 1. Nests observed within American Avocet (AMAV), Black-necked Stilt (BNST), California Gull (CAGU), Caspian Tern (CATE), Forster's Tern (FOTE), Least Tern (LETE), and Black Skimmer (BLSK) colonies monitored in 2012 as part of SFBBO's citizen science-based Colonial Waterbird Program in the San Francisco Bay, CA. Nest counts represent the peak number of active nests observed during the breeding season from levees or areas adjacent to colonies (observations) or the total nests found on a single walkthrough of the colony led by SFBBO staff in May (walkthrough). Dashes (-) indicate that no nesting birds were reported.

Site	Landowner/ operator	Pond/tower	AMAV	BNST	CAGU	CATE	FOTE	LETE	BLSK	Method	Map ID
Agua Vista	other	n/a	-	-	2	5	-	-	-	observations	1
Alcatraz	NPS	n/a	-	-	116	-	-	-	-	walkthrough	2
Alviso	DESFBNWR	A5	-	-	115	-	-	-	-	walkthrough	3
Alviso	DESFBNWR	A6	-	-	-	-	-	-	-	observations	4
Alviso	DESFBNWR	A7	1	-	-	-	48	-	-	observations	5
Alviso	DESFBNWR	A8	12	-	-	-	17	-	-	observations	6
Alviso	DESFBNWR	A9/A10/A14	-	-	9164	-	-	-	-	walkthrough	7
Alviso	DESFBNWR	A12	23	-	-	-	-	-	-	observations	8
Alviso	DESFBNWR	A16	-	-	-	-	-	-	-	observations	9
Belmont Slough	other	n/a	-	-	-	-	-	-	-	observations	10
Charleston Slough Island	other	n/a	-	-	-	-	21	-	-	observations	11
Coyote Hills	DESFBNWR	N2A/N3A/N4A	-	-	3624	133	-	-	-	walkthrough	12
Coyote Hills	DESFBNWR	N6/N7	-	-	3369	-	-	-	-	walkthrough	13
Dumbarton	DESFBNWR	N1/N2/N3	-	-	-	-	-	-	-	observations	14
Eden Landing	CDFG	Turk	-	-	-	-	-	-	-	observations	15
Hayward Shoreline	other	n/a	21	1	-	-	295	-	-	observations	16
Moffett	DESFBNWR	A2W	6	-	-	-	143	-	1	observations	17
Moffett	DESFBNWR	A3W	-	-	-	-	-	-	-	observations	18

Table 1 continued

Site	Landowner/ operator	Pond/tower	AMAV	BNST	CAGU	CATE	FOTE	LETE	BLSK	Method	Map ID
Moffett	DESFBNWR	B1	3	1	-	-	41	-	-	observations	19
Moffett	DESFBNWR	B2	200	-	61	-	-	-	-	walkthrough (CAGU), observations (AMAV)	20
Mountain View	DESFBNWR	A1 NW Island	1	-	-	-	12	-	-	observations	21
Mountain View	DESFBNWR	A1 SE Island	-	-	211	-	-	-	-	walkthrough	22
Mountain View - Palo Alto Flood Control Channel	other	n/a	-	-	4600	-	-	-	-	walkthrough	23
Mowry	DESFBNWR	M1/M2	-	-	885	-	-	-	-	walkthrough	24
Mowry	DESFBNWR	M3	-	-	1850	-	-	-	-	walkthrough	25
Mowry	DESFBNWR	M4/M5	-	-	2207	-	-	-	-	walkthrough	26
Mundy Marsh	other	n/a	-	-	-	-	-	-	-	observations	27
New Chicago Marsh	DESFBNWR	n/a	15	10	-	-	-	-	-	observations	28
Redwood Shores Water Treatment Plant	other	n/a	2	-	-	-	28	-	-	observations	29
TOTAL			**284**	**12**	**26204**	**138**	**605**	**0**	**1**		

Table 2. Number of breeding California Gulls by colony in the South San Francisco Bay from 1980-2012. Estimates were generated by doubling nest counts obtained from walkthrough surveys in late spring, except where otherwise noted. Dashes (-) indicate that colonies were not surveyed.

Year	Alviso A6	Newark	Alviso A9/A10/A14	Mountain View A1	Mowry M4/M5	Mowry M1/M2	Mowry M3	Moffett B2	Alameda NAS	Brooks Island	Coyote Hills N3A/N4AB	Coyote Hills N6/N7	Palo Alto Flood Control Channel	Alviso A5	Alviso A5/A7	A3W Boardwalk	South Bay Total
1980	24	-	-	0	-	-	-	0	0	0	0	-	-	-	-	-	**24**
1981	60	-	-	0	-	-	-	0	0	0	0	-	-	-	-	-	**60**
1982	412	-	434	0	-	0	-	0	0	0	0	-	-	-	-	-	**846**
1983	1342	46	-	0	-	0	-	0	0	0	0	-	-	-	-	-	**1388**
1984	2000	44	150	0	-	0	-	0	0	0	0	-	-	-	-	-	**2194**
1985	3000	554	374	0	-	0	-	0	0	0	0	-	-	-	-	-	**3928**
1986	3000	398	97	0	-	0	-	0	0	0	0	-	-	-	-	-	**3495**
1987	4000	22	100	0	-	0	-	0	0	0	0	-	-	-	-	-	**4122**
1988	4600	30	180	0	-	0	-	0	0	0	0	-	-	-	-	-	**4810**
1989	5310	0	434	0	-	0	-	0	0	0	0	-	-	-	-	-	**5744**
1990	7600	0	122	2	-	0	-	0	0	0	0	-	-	-	-	-	**7724**
1991	5250	0	0	0	-	0	-	0	0	0	0	-	-	-	-	-	**5250**
1992	5500	0	200	0	-	1294	-	0	0	0	0	-	-	-	-	-	**6994**
1993	6912	0	234	200	-	415	-	82	6	0	0	-	-	-	-	-	**7849**
1994	9000	0	300	350	-	1540	-	556	20	0	0	-	-	-	-	-	**11766**
1995	7236	0	4	74	-	2009	-	300	100	0	0	-	-	-	-	-	**9723**
1996	6558	0	1410	0	-	174	-	282	200	0	0	-	-	-	-	-	**8624**
1997	6256	0	1722	164	-	3000	-	1000	200	0	0	-	-	-	-	-	**12342**
1998	6562	0	1628	0	-	480	-	400	200	-	0	-	-	-	-	-	**9270**
1999	9380	0	2117	145	-	475	-	248	50	-	0	-	-	-	-	-	**12415**
2000	11482	0	1986	0	-	2526	-	254	80	10	0	-	-	-	-	-	**16328**

Table 2 continued

Year	Alviso A6	Newark	Alviso A9/A10/A14	Mountain View A1	Mowry M4/M5	Mowry M1/M2	Mowry M3	Moffett B2	Alameda NAS	Brooks Island	Coyote Hills N3A/N4AB	Coyote Hills N6/N7	Palo Alto Flood Control Channel	Alviso A5	Alviso A5/A7	A3W Boardwalk	South Bay Total
2001	11216	0	3056	278	-	1824	-	624	-	-	0	-	-	-	-	-	**16998**
2002	11302	0	3590	510	-	3120	-	712	-	486	0	-	-	-	-	-	**19234**
2003	13644	0	1010	862	-	4310	-	384	-	896	0	-	-	-	-	-	**20210**
2004	8600	0	1047	321	-	2233	-	219	0	270	0	-	0	-	-	-	**12420**
2005	18418	-	426	1664	-	3044	-	830	-	800	5370	-	-	-	-	-	**29752**
2006	19456[A]	0	234[A]	380	-	5068[A]	-	374	0[A]	-	7442	-	-	84	-	-	**33038**
2007	24696	-	0	92	-	7384	-	-	105	-	4384	-	206	-	-	-	**36867**
2008	26366[B]	-	0	616	5934	8224	-	-	135	-	4952	-	690	30	-	-	**46947**
2009	24190	0	0	446	3640	8842	-	8	87	1577	4944	-	1164	110	-	-	**43431**
2010	23108	0	0	428	4780	6020	-	20	54	-	6594	2506	1704	174	716	-	**46104**
2011	0	0	11956	390	6068	4164	-	112	0	-	6394	4110	4478	156	0	2	**37828**
2012	0	0	18328	422	4414	1770	3700	122	-	-	7248	6738	9200	230	0	0	**52172**

[A]Count is from a single flight over the colony and is likely conservative.
[B]USGS contributed supplemental information about this colony.

Table 3. Peak nests observed for Double-crested Cormorant (DCCO), Great Blue Heron (GBHE), Great Egret (GREG), Snowy Egret (SNEG), and Black-crowned Night Heron (BCNH) colonies monitored in 2012 as part of SFBBO's citizen science-based Colonial Waterbird Program in the San Francisco Bay, CA. Dashes (-) indicate that no nesting birds were reported.

Site	Landowner/ operator	Pond/tower	DCCO	GBHE	GREG	SNEG	BCNH	Map ID
Almaden Lake	other	n/a	-	-	11	6	4	1
Alviso	DESFBNWR	A9/A10	-	-	-	-	-	2
Alviso	DESFBNWR	A18	8	-	-	-	-	3
Bay Farm Island - Alameda	other	n/a	-	-	16	14	-	4
Bunting Ponds - Niles	other	n/a	-	2	-	-	-	5
Calaveras Reservoir	other	n/a	-	-	-	-	-	6
Chesapeak-Saginaw, Redwood City	other	n/a	-	-	1	10	18	7
Coyote Parkway Lakes	other	n/a	-	1	-	-	-	8
Coyote Ranch Road	other	n/a	-	5	-	-	-	9
Don Castro	other	n/a	-	11	-	-	-	10
Dumbarton	DESFBNWR	PG&E towers	45	-	-	-	-	11
Eden Landing	CDFG	Heron House	-	8	-	-	-	12
Grant Lake	other	n/a	-	2	-	-	-	13
Hayward Shoreline	other	n/a	-	-	-	-	-	14
Lake Chabot	other	n/a	-	1	-	-	-	15
Lake Cunningham	other	n/a	-	-	-	-	-	16
Lake Elizabeth	other	n/a	-	-	2	-	-	17
Lake Merced Mesa	other	n/a	26	3	-	-	-	18
Lake Merced - North	other	n/a	71	7	-	-	-	19
Lake Merced - South	other	n/a	28	-	-	-	-	20
Lake Merritt	other	n/a	97	-	-	-	-	21

Table 3 continued

Site	Landowner/ operator	Pond/tower	DCCO	GBHE	GREG	SNEG	BCNH	Map ID
Lakeshore Park Newark	other	n/a	-	-	-	103	36	22
Livermore VA Hospital	other	n/a	-	6	1	-	-	23
Llagas Creek, Morgan Hill	other	n/a	-	7	9	-	-	24
Moffett	DESFBNWR	Towers in A2W	16	-	-	-	-	25
Moffett	DESFBNWR	Towers in A3W	4	-	-	-	-	26
Moffett	DESFBNWR	Towers in B2	8	-	-	-	-	27
Ovation Court	other	n/a	-	22	-	-	-	28
Palace of Fine Arts	other	n/a	-	1	-	-	-	29
Palo Alto Baylands Duck Pond	other	n/a	-	-	-	1	11	30
Pescadero Marsh	other	n/a	2	11	6	-	-	31
Quarry Lakes	other	n/a	-	-	-	-	-	32
Redwood Shores	other	n/a	-	-	-	1	16	33
Ruus Park	other	n/a	-	-	26	18	-	34
Shadow Cliffs	other	n/a	22	8	4	-	-	35
Shorebird Way	other	n/a	-	-	24	8	-	36
Steinberger Slough	other	n/a	152	5	-	-	-	37
Stow Lake	other	n/a	-	4	-	-	-	38
Vasona County Park	other	n/a	-	5	-	-	-	39
Vasona Reservoir	other	n/a	-	-	-	-	-	40
TOTAL			**479**	**109**	**100**	**161**	**85**	

Table 4. Total number of nests reported for selected Forster's Tern (FOTE) and Least Tern (LETE) colonies monitored by other agencies in the San Francisco Bay, CA, 2012. Agencies included the U.S. Fish and Wildlife Service (USFWS) and the East Bay Regional Park District (EBRPD).

Site	Landowner/operator	Pond/tower	FOTE	LETE	Method
Alameda Point	other	n/a	-	382	USFWS
Hayward Shoreline	other	n/a	73[A]	189	EBRPD

[A]Nest number reflects a one-day walkthrough count conducted by EBRPD on May 29, 2012; note that this value differs greatly from the Forster's Tern nest number reported in Table 1 for Hayward Shoreline. This discrepancy is not surprising given that different survey methods were used and on different dates within the season. We advise against direct comparisons of data contained in Tables 1-3 and Table 4.

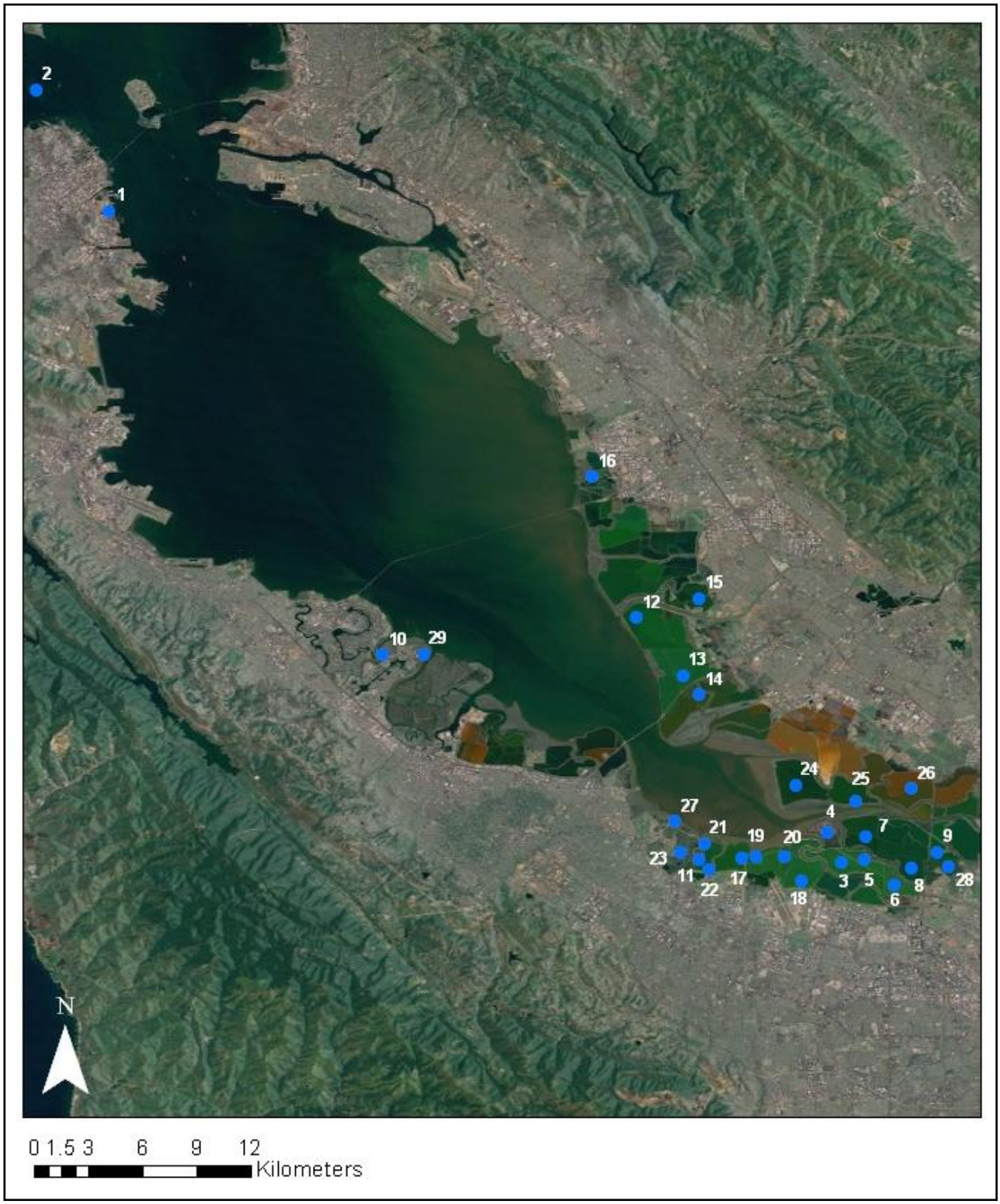


Figure 1. Locations of gull and tern colonies monitored in 2012 as part of SFBBO's citizen science-based Colonial Waterbird Program in the San Francisco Bay, CA. Labels correspond to the Map ID listed in Table 1.

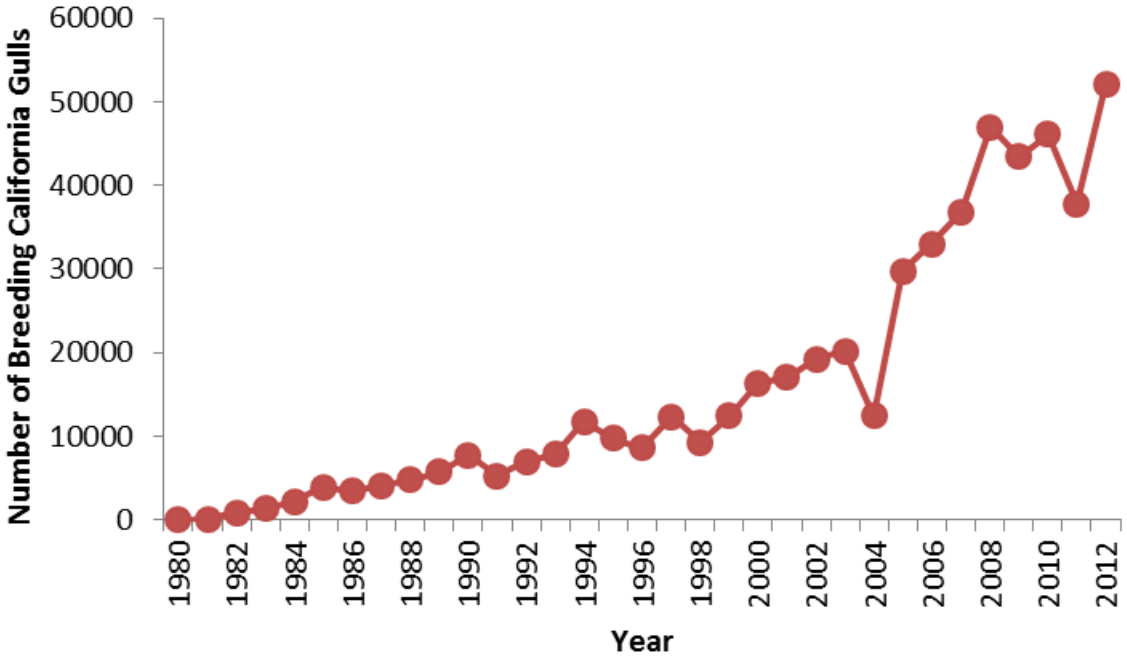


Figure 2. Estimated number of breeding California Gulls in the South San Francisco Bay, CA from 1980-2012.

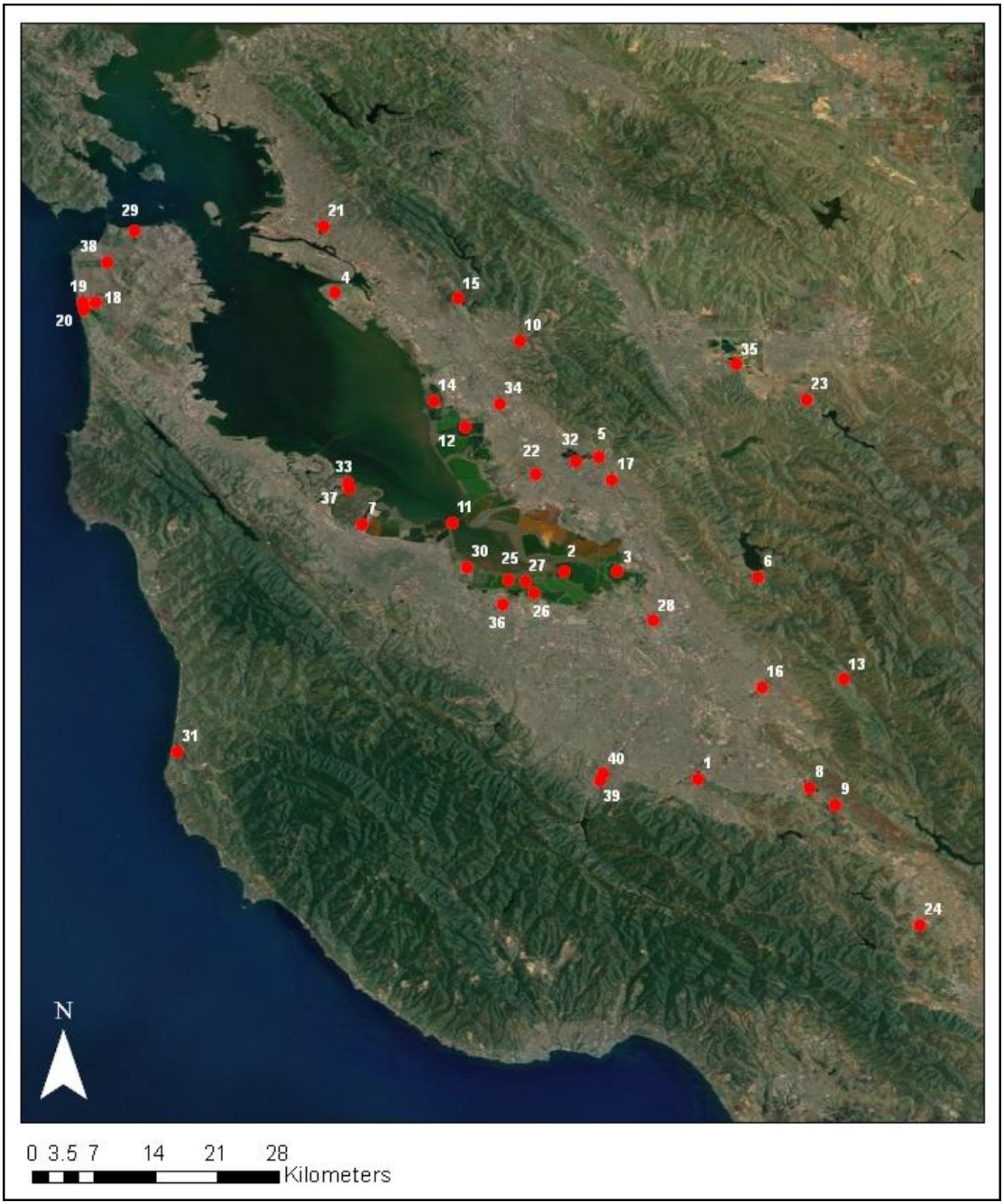


Figure 3. Locations of heron, egret, and cormorant colonies monitored in 2012 as part of SFBBO's citizen science-based Colonial Waterbird Program in the San Francisco Bay, CA. Labels correspond to the Map ID listed in Table 3.

Appendix I. Colony Profile: Ruus Park, Hayward, CA

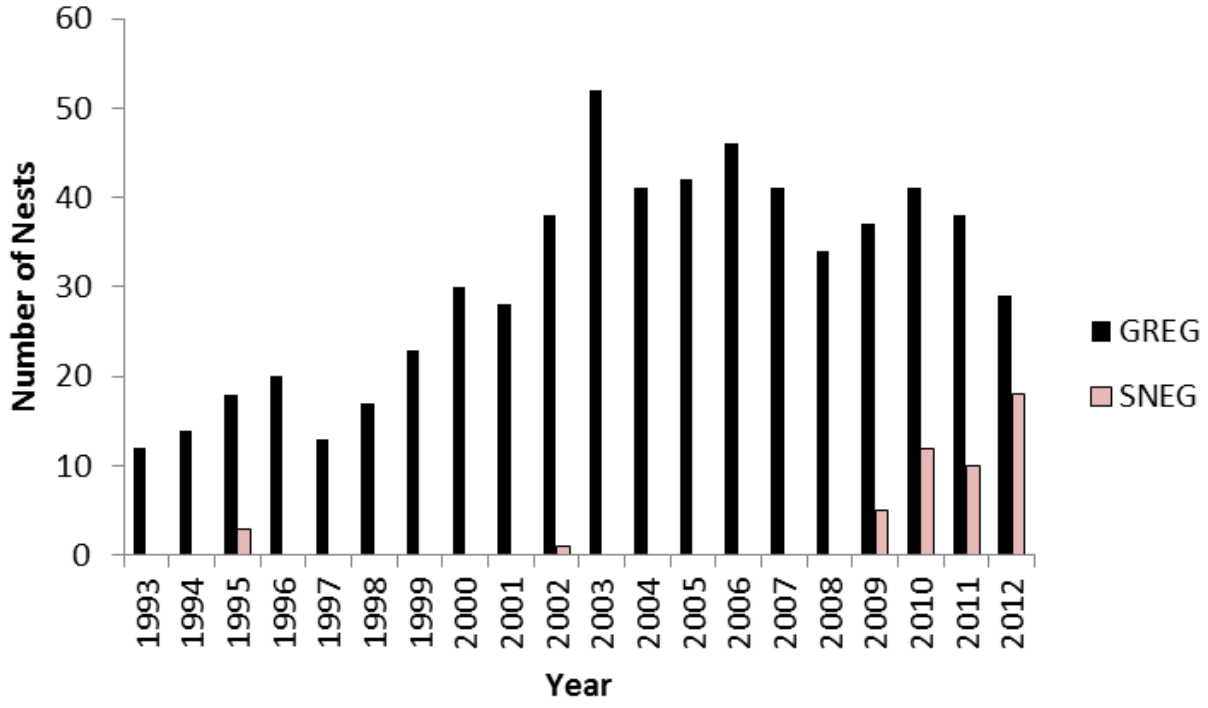
Species Monitored: Great and Snowy egrets

Dates Monitored: 1993-2012

Site Description: Ruus Park is located at the intersection of Folsom Ave and Dickens Ave in Hayward, CA. The public park is managed by the Hayward Area Recreation and Park District. It borders a densely populated residential area. Wading birds nest in several *Eucalyptus* trees onsite.

Colony Coordinates: N 37.624425, W -122.074704

Conservation Concerns: human disturbance (fireworks)



Peak number of active nests observed for Great (GREG) and Snowy (SNEG) egrets at Ruus Park, Hayward, CA from 1993-2012.

Dates of first active nests observed and first chicks observed by volunteers monitoring Great (GREG) and Snowy (SNEG) egrets at Ruus Park, Hayward, CA from 1993-2012.

Year	Species	Date first active nests observed	Date first chicks observed	No. of surveys
1993	GREG	May 16*	May 16*	3
1994	GREG	March 14*	May 1	4
1995	GREG	March 25*	May 14	8
1995	SNEG	April 10	None observed	8
1996	GREG	March 10*	May 13	5
1997	GREG	April 11*	May 12	5
1998	GREG	April 3*	May 4	5
1999	GREG	April 10*	June 5	5
2000	GREG	March 26*	May 14	6
2001	GREG	April 8*	No data	1
2002	GREG	April 7*	May 12	4
2002	SNEG	June 9	None observed	4
2003	GREG	April 4*	May 9	6
2004	GREG	March 21*	May 17	5
2005	GREG	March 7*	May 13	5
2006	GREG	April 10	May 5	5
2007	GREG	April 9*	May 19	5
2008	GREG	April 6	May 18	6
2009	GREG	April 6	May 18	8
2009	SNEG	June 22	July 13	8
2010	GREG	March 17*	May 3	7
2010	SNEG	May 3	May 19	7
2011	GREG	April 3	May 22	7
2011	SNEG	May 1	June 12	7
2012	GREG	April 8	May 6	7
2012	SNEG	May 6	June 3	7

*First visit of season