

# HERON AND EGRET MONITORING RESULTS AT MARIN ISLANDS NATIONAL WILDLIFE REFUGE: 2015 NESTING SEASON

A Report to the San Pablo Bay National Wildlife Refuge



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# **HERON AND EGRET MONITORING RESULTS AT WEST MARIN ISLAND: 2015 NESTING SEASON**

## **A Report to the San Pablo Bay National Wildlife Refuge**

### **INTRODUCTION**

Audubon Canyon Ranch (ACR) has been monitoring the number of nesting herons and egrets at Marin Islands since 1979, and the annual reproductive success of Great Egrets and Great Blue Herons there since 1993. Nests are monitored annually, during repeated visits, from viewing positions on East Marin Island and by boat. This work is part of an ongoing, regional study of heron and egret colonies in the northern San Francisco Bay area (see References Cited).

As in other years, the colony site was occupied in 2015 by nesting Great Blue Herons, Great Egrets, Snowy Egrets, and Black-crowned Night-Herons; however, all of the nesting Snowy Egrets and Black-crowned Night-Herons abandoned the site before completing the nesting cycle. Small numbers of Great Blue Herons and Great Egrets persisted to successfully fledge their young. The cause of the abandonment is unknown, but we provide some details and possible explanations below.

### **METHODS**

Detailed methods for monitoring the numbers of heron and egret nests and estimating reproductive success of Great Egrets and Great Blue Herons are described in Kelly et al. (1996, 2006, 2007). In 2015, we mapped the locations of 16 focal Great Egret nests and 5 focal Great Blue Heron nests on panoramic photographs of the nesting colony. No nests were initiated on East Marin Island in 2015. We made four visits to East Marin Island in 2015 (16 March, 9 April, 1 May, and 2 June). From viewing positions on East Marin Island, we used telescopes to monitor the nest survivorship, seasonal timing, and pre fledging brood size of numbered, focal nests. Supplemental observations were made from a mainland vantage point on Dunfries Terrace above the Loch Lomond Marina.

On 2 June, we counted the nests of all herons and egrets, gulls, and Black Oystercatchers on West Marin Island, and the nests of oystercatchers on East Marin Island. As in other years, the nests were counted from an 18-foot Boston Whaler by drifting and motoring slowly around

the islands, from an anchored position on the northeast side of West Marin Island, and from vantage points on East Marin Island. Observers were careful to maintain viewing distances that would avoid disturbance to nesting herons or egrets. No evidence of observer disturbance was detected. Viewing conditions were good.

We estimated the productivity of the Great Egret colony by multiplying the estimated number of young fledged per successful nest (mean pre fledging brood size of nests with young 5-7 weeks of age) by the estimated number of successful nests in the colony. We estimated the number of successful Great Egret nests in the colony as the number of focal nests with young that had reached the minimum fledging age of 7 weeks on or before the 2 June census, plus the number of active nests on 2 June with young that had not yet reached minimum fledging age, adjusted for stage-specific nest survivorship. This adjustment was made by multiplying the number of active nests within each nest stage by the expected (average) nest survivorship for that stage, calculated from intensively monitored nests at ACR's Picher Canyon Heronry, 1999-2005 (ACR, unpublished data). Means are reported as  $\pm$  standard error (SE).

We reported the "apparent" rate of Great Blue Heron nest survival (proportion of nests that raised at least one young to the minimum fledging age of 8 weeks) based on focal nests followed through the nesting cycle. We estimated productivity of successful Great Blue Heron nests as the pre fledging brood size (number of young) in nests with young at least 5-7 weeks of age. Overall reproductive success was calculated as the product of nest survivorship and the average number of young in successful nests.

Table 1. Number of active nests observed on West Marin Island and East Marin Island on 2 June 15.

	Number of occupied nests					Total nests
	West side	West Marin Island		East Marin Island		
		South side	Northeast side			
Great Egret	0	2	24	0		26
Snowy Egret	0	0	0 <sup>a</sup>	0		0 <sup>a</sup>
Black-crowned Night-Heron	0	0	0 <sup>a</sup>	0		0 <sup>a</sup>
Great Blue Heron	0	0	5	0		5
Western Gull	24	44	6	(not counted)		74
Black Oystercatcher	0	0	0	0 <sup>b</sup>		0 <sup>b</sup>

<sup>a</sup> Other, incomplete counts of active nests on the northeast side of West Marin Island, observed from the remote, mainland vantage point on Dunfries Terrace above the Loch Lomond Marina, estimated 26 active Snowy Egret nests on 1 April and 7 Black-crowned Night-Heron nests on 2 April; however, none of the nest attempts on the island were successful.

<sup>b</sup> One unconfirmed Black Oystercatcher "nest" was observed on East Marin Island on 1 May (see text).

## RESULTS AND DISCUSSION

As in other years, Great Egret, Great Blue Heron, Snowy Egret, and Black-crowned Night-Heron nest attempts occurred primarily on the northeast side of West Marin Island (Table 1). In 2015, no herons or egrets nested on East Marin Island. Great Blue Herons have nested on East Marin Island in only four years since 1979 (Table 2).

### Great Egret

On 2 June 2015, we counted 26 Great Egret nests, revealing the tenth year of a declining trend in nest abundance from 126 nests in 2006 and 161 nests in 2005 (Table 2). Although recent years have coincided with a period of severe drought, we do not expect dry years to lead to a decline in the abundance of Great Egrets nesting in San Francisco Bay, where the birds forage primarily in tidal marsh habitat (Kelly and Condeso 2014). However, extended effects of previous nesting disturbance by potential nest predators have apparently contributed to the continuing decline (and total nesting failure and abandonment of the site by Snowy Egrets and Black-crowned Night-Herons; see the section on Disturbance, below).

The percent of nest attempts fledging at least one young in 2015 was  $50.0 \pm 12.5\%$  (SE;  $n = 16$  focal nests), slightly (but not significantly) lower than nest survival in 2014 ( $56.0 \pm 9.9\%$ ; figure 1). The dramatically low nest survival in 2013 may have been related to the impacts of nest-predatory raccoons detected on East Marin Island (Kelly et al. 2013).

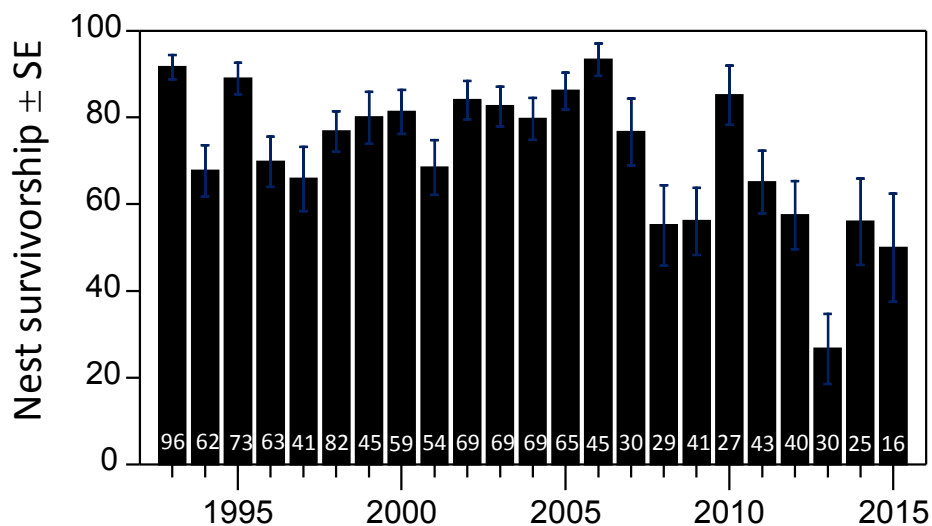


Figure 1. Annual percent survivorship  $\pm$  SE of Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

Table 2. Annual number of active heron and egret nests on West Marin Island based on early-June counts conducted by boat and from East Marin Island. Occasional nesting by Great Blue Herons on East Marin Islands is included, as indicated in the table notes.

Year	Great Egret	Snowy Egret	Black-crowned Night-Heron	Great Blue Heron
1979	58	262	98	0
1981	75	325	109	0
1982	187	500	80	0
1983	190	345	89	0
1984	139	347	54	0
1985	84	161	79	0
1986	160	126	40	0
1987	89	239	41	0
1988	77	212	35	0
1989	79	245	61	0
1990	119	300	37	1
1991	90	277	45	2
1992	189	220	30	1
1993	120	98	41	0
1994	163	8	32	2
1995	172	16	18 <sup>a</sup>	2
1996	148	36	22	3
1997	167	119	24	5
1998	155	117	53	7
1999	101	84	47	8 <sup>b</sup>
2000	134	156	50	9
2001	94 <sup>c</sup>	217	26	7 <sup>d</sup>
2002	121	204	64	7
2003	81	103	51	10
2004	83	59	29	12
2005	161	91	44 <sup>e</sup>	12
2006	126	116	41	9
2007	60	43	21	10
2008	52	132	40	6
2009	64	175	63	9 <sup>f</sup>
2010	64	102	31	8
2011	61	89	48	10
2012	53	121	26 <sup>g</sup>	8 <sup>h</sup>
2013	42	59	11	10 <sup>i</sup>
2014	36	94	26	6
2015	26	0	0	5

<sup>a</sup> 115 Black-crowned Night-Herons were present on adjacent mudflats on 17 April 1995.

<sup>b</sup> Number includes one nest on East Marin Island.

<sup>c</sup> Number of active nests during the standard early-June census window, on 5 June 2001. A count on 10 May indicated an earlier peak number of 161 active Great Egret nests.

<sup>d</sup> Number of active nests during the 5 June census, but 8 pairs nested in 2001.

<sup>e</sup> 215 Black-crowned Night-Herons were observed along the shoreline of the West Marin Island on 11 April 2005.

<sup>f</sup> Includes four Great Blue Heron nests on East Marin Island.

<sup>g</sup> Approximately 100 Black-crowned Night-Herons were observed in a fly-up from the colony on 5 April, 2012.

<sup>h</sup> Includes two Great Blue Heron nests on East Marin Island.

<sup>i</sup> Includes four Great Blue Heron nests on East Marin Island.

On 2 June, we were able to observe only one Great Egret nest that had survived long enough to raise nestlings to at least 5-7 weeks of age and was, therefore, likely to successfully fledge young. Other active nests with younger broods may have fledged additional young later in the season. The three young observed on 2 June in this single successful nest are unlikely to reflect the average productivity in successful nests in 2015. In addition, the observation of three young far exceeded the long-term average productivity and, therefore, probably overestimates the actual number of young fledged, on average, among successful nests this year (Figure 2).

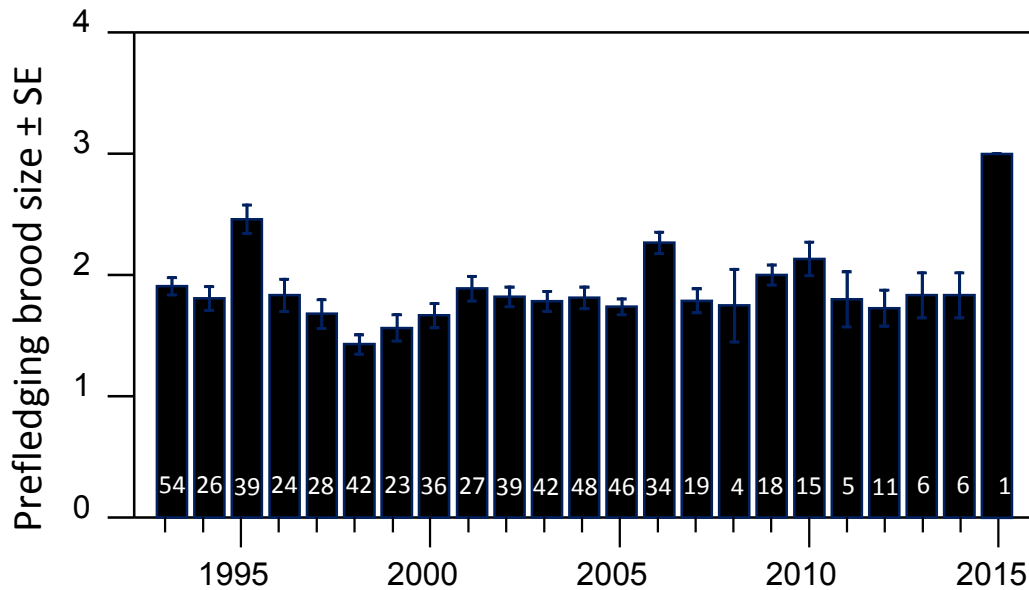


Figure 2. Mean  $\pm$  SE of annual prefledging brood size in successful Great Egret nests at West Marin Island. Numbers on the bars indicate sample size. Because of low nest survival, late nest initiations, and reduced nest abundance, only a single observation of prefledging brood size was obtained in 2015.

We estimated overall reproductive success (number of young produced per nest attempt) as prefledging brood size adjusted by focal nest survivorship. In 2015, we estimated that Great Egrets fledged  $1.5 \pm 0.38$  young per nest attempt, but as above, this estimate is strongly influenced by the availability of only a single, higher-than-expected observation of prefledging brood size (Figure 2). Therefore, this value probably overestimates of the actual productivity in successful nests in 2015 (Figure 3).

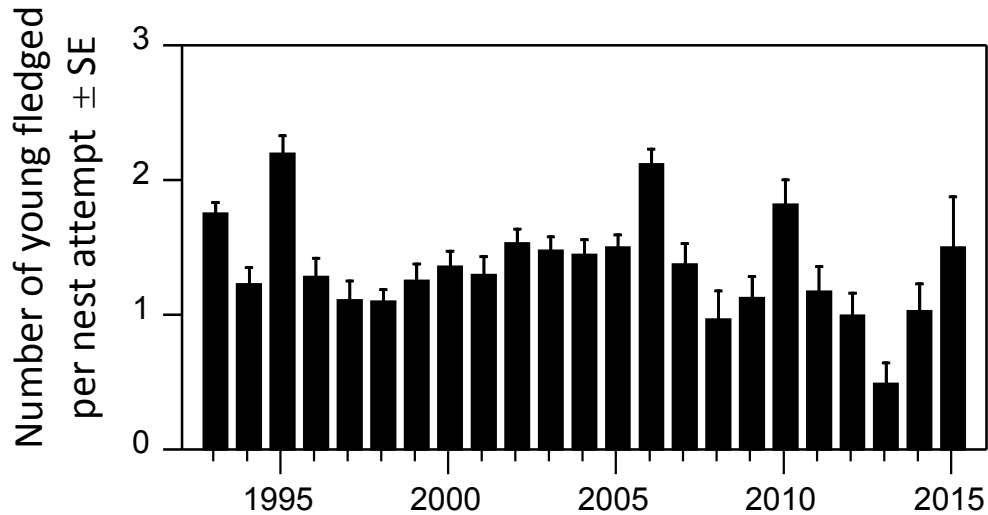


Figure 3. Overall reproductive success of Great Egrets (mean  $\pm$  SE young fledged per nest attempt) at West Marin Island, based on the prefledging brood size of successful nests adjusted for overall nest survivorship. The value for 2015 is strongly influenced by an estimated average prefledging brood size of three young—based on only one observation of a successful nest (Figure 2)—which probably overestimated the actual productivity in successful nests.

Low overall reproductive success (Figure 3) and the continuing decline in Great Egret abundance at the Marin Islands (Table 2) led to low overall production in the colony in 2015 ( $71 \pm 8$  fledged young; Figure 4). As above, even this low productivity of the colony relative to other years probably strongly overestimates the number of young produced, because it is based on only one nest—which produced more young than the expected average among all nest attempts (Figure 2).

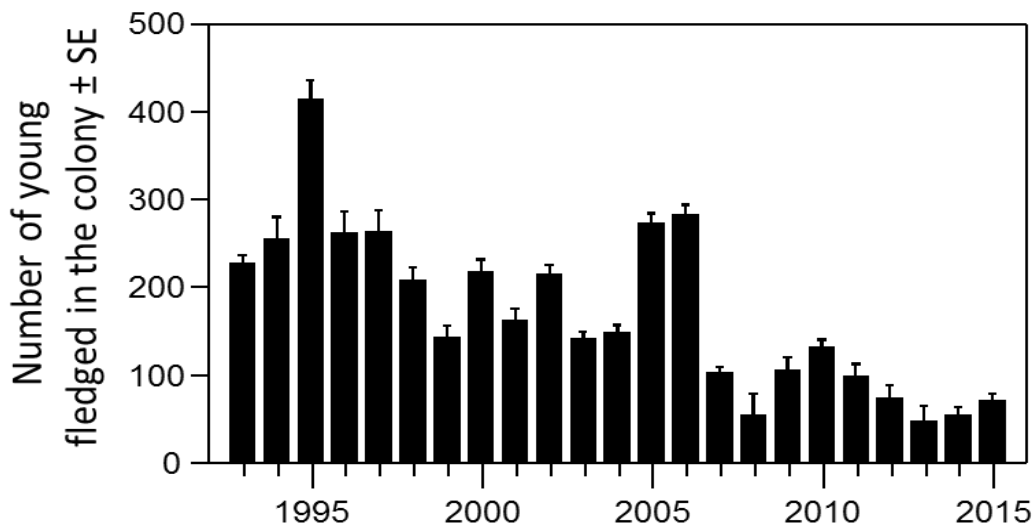


Figure 4. Annual productivity of Great Egrets (estimated number of young fledged in the colony ( $\pm$  SE) at West Marin Island.

## Great Blue Heron

We followed the fates of five Great Blue Heron nest attempts through the nesting cycle, which represented all nests detected at Marin Islands for this species in 2015. As in 2014, all five focal nests were successful (100% nest survivorship). On 2 June, four of the five nests observed contained young that had reached 5-7 weeks of age, when nestling survival rates are generally very high, providing a reasonable estimate of the number of young fledged per nest. Based on those observations, each nest attempt successfully produced two young ( $2.0 \pm 0.00$ ,  $n = 4$ ), indicating that Great Blue Heron nest success and productivity at the Marin Islands was normal.

The peak number of Great Blue Heron nests in the colony declined from nine nests in 2013 to only five nests in 2015 (on 2 June). Interestingly, we discovered a newly initiated Great Blue Heron colony on Red Rock Island, on 13 May, 2015, suggesting the local redistribution of Great Blue Heron nests in the central San Francisco Bay subregion. No Great Blue Heron nests have been observed on Red Rock in previous years (Kelly et al. 2006). The colony included five nests, two of which had reached the guardian stage, with young 2-4 weeks of age, and two had reached the postguardian stage, with young approximately 5-7 weeks of age. This suggests that the site was colonized during the normal period of nest recruitment, from late February through April.

## Snowy Egret

The number of Snowy Egrets nests on West Marin Island in 2014 (94 nests) was consistent with a partial recovery from a generally declining trend since 2009; however, during the colony-wide nest count on 2 June 2015, there were no active Snowy Egret nests on the Island (Figure 5). Earlier in 2015, Snowy Egrets initiated numerous nests attempts on West Marin Island but none of them were successful. On 1 April, in a preliminary, incomplete count of active nests from the remote, mainland vantage point on Dunfries Terrace above the Loch Lomond Marina, we estimated 26 active Snowy Egret nests on the northeast side of West Marin Island. The annual estimate of colony size reflects only the number of active nests detected on the early June survey, and excludes many nests that were established but failed before they could be counted. Therefore, our results do not directly reflect the number of nest attempts. We did not monitor the survivorship or productivity of Snowy Egret nests.



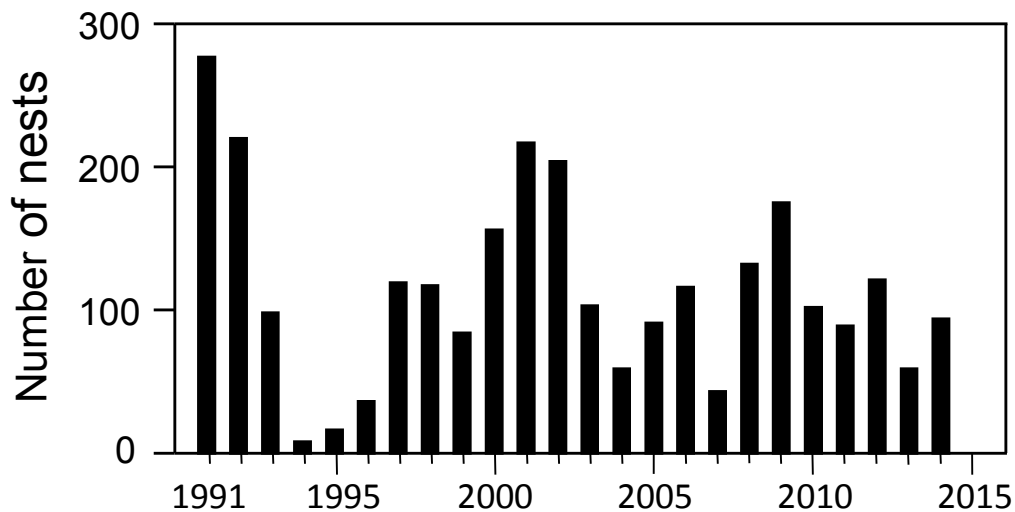


Figure 5. Annual number of Snowy Egret nests at West Marin Island estimated in early June. Active nest attempts were observe during the 2015 nesting season but, on 2 June 2015, no Snowy Egret nests were active at Marin Islands.

### Black-crowned Night-Heron

In 2014, we counted 26 active Black-crowned Night-Heron nests on west Marin Island, suggesting a slight recovery from the declining trend since 2009; however, during the colony-wide nest count on 2 June 2015, we found no active Black-crowned Night-Heron nests on the Marin Islands (Figure 6). As with Snowy Egrets, Black-crowned Night-Herons initiated a number nests attempts earlier in 2015, but none of them were successful. On 2 April, seven active Black-crowned Night-Heron nests on the northeast side of West Marin Island were observed from the remote, mainland vantage point on Dunfries Terrace above the Loch Lomond Marina. Additional nests could have been initiated earlier in the season but, as in other years, the estimated colony size in 2015 reflects only the number of active nests detected during the annual survey in early June and excludes any nests that were established but failed before this survey. Therefore, our results do not directly reflect the number of nest attempts. We did not monitor the survivorship or productivity of Black-crowned Night-Heron nests.

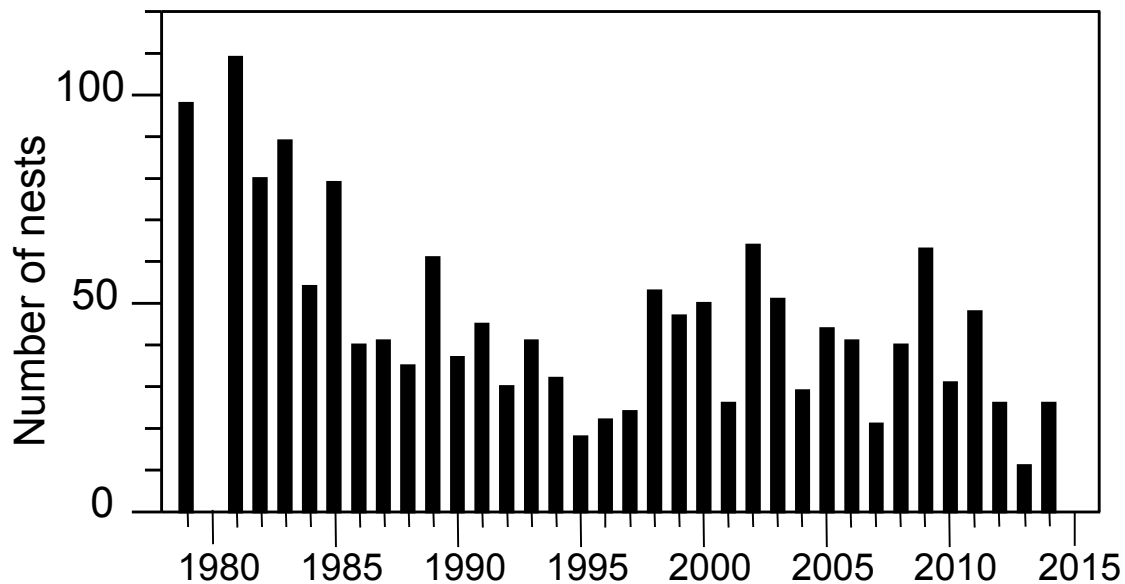


Figure 6. Number of Black-crowned Night-Heron nests counted during annual surveys of West Marin Island. See text regarding overall nest abundance. Active nest attempts were observed during the 2015 nesting season but, on 2 June 2015, no Black-crowned Night-Heron nests were active at Marin Islands.

### Disturbance by humans and nest predators

We did not observe disturbance by humans to nesting herons or egrets in 2015. However, a pair of nest-predatory ravens nested on East Marin Island and frequently spent time in the heron and egret colony on West Marin Island, as has been observed in previous years (Kelly et al. 2005). We did not quantify the extent to which nest losses resulted specifically from raven predation. Per capita nest survival among Great Egret nests was slightly—but not significantly—lower in 2015, but was similar to other recent years before and after 2013 (Figure 1). This is consistent with the previous assumption that the resident ravens, which have preyed on the colony for nearly 20 years, were not the primary cause of the unusually low nest survivorship of Great Egrets in 2013, and that the drop in nest survival in 2013 may have been caused by nest predatory raccoons (Figure 1; Kelly et al. 2005, 2014).

The nest abundances of Snowy Egrets and Black-crowned Night-Herons also dipped, temporarily, in 2013 but recovered in 2014 (Figures 5 and 6, respectively). These subsequent recoveries, along with relatively normal nest survival among Great Egrets in 2015 further suggests—but does not confirm—that the abandonment of the Marin Islands by nesting Snowy Egrets and Black-crowned Night-Herons was not a repeated instance of nest predation by either

ravens or raccoons. Nest-predatory activity by ravens could have been involved, opportunistically, if the ravens exploited the effects of other sources of failure or disturbance causing adult birds to leave their nests unattended. However, we did not monitor the behaviors of the ravens, or raven reproductive success. We did not observe any fledged raven young, although they could have been present and undetected during our visits.

The low number of 26 Great Egret nests in 2015 is not surprising even if they were not affected by the (unknown) source leading to colony-site abandonment by Snowy Egrets and Black-crowned Night-Herons, because the apparent colony-site disturbance by raccoons in 2013 would be expected to have extended effects on local nest abundances in subsequent years (Millus et al. 2013).

Intraseasonal changes in nest numbers, timing of nest initiations, and nesting distribution within Central San Francisco Bay, along with colony-site disturbances (apparently by raccoons) at the Marin Islands in 2013, suggest that the colony-site abandonments by Snowy Egrets and Black-crowned Night-Herons and the nesting declines by Great Egrets and Great Blue Herons (including 2014) may have resulted, at least in part, from very low recruitment. Thus, many birds may have perceived a high risk of nest predation at the beginning of the season and simply decided to nest elsewhere or to abandon early nest attempts before they were observed—before responding to the unknown source(s) of complete nest failure by Snowies and Black-crowns. The reduced number of Great Blue Heron nests was associated with new nests established on Red Rock, rather than nest failure at the Marin Islands; none of the Great Blue Heron nest attempts at the Marin islands failed. There were apparently no nest attempts on East Marin Island this year.

Observations at the Marin Islands in 2015 were consistent with general patterns in other declining colonies in the San Francisco Bay region observed since 1990: colony-size declines are generally related to low recruitment and or disturbance-induced nest failure/abandonment, rather than to a reduction in the productivity of successful nests (correlated declines in productivity would suggest influences related to finding food needed to provision young). However, our observations do suggest a likely increase additional nest predation or disturbance in 2015, in addition to previous evidence of disturbance by ravens and, occasionally raptors:

- On 13 May, we discovered that Red Rock Island (near the San Rafael Richmond Bridge) was recolonized by an estimated 20 Snowy Egret pairs, which have not nested at Red Rock for 15 years (since 2000). It is reasonable that those nests were established by birds fleeing the Marin Islands, where we estimated 18 pairs on 1 May (we could have missed a couple of nests this year from our vantage point on the boat).
- Red Rock also has an estimated 34 Black-crowned Night-Heron nests this year (up from 23 last year).

- Red Rock was also colonized by five Great Blue Heron pairs (the first recorded Great Blue Heron nests at that site). In 2014, there were only six active Great Blue Heron nests on West Marin Island in early June, but there were also five Great Blue Heron nest failures and one renesting attempt. It is possible that the five pairs that failed on West Marin Island in 2014 simply relocated to Red Rock in 2015. Given these changes, the combined number of Great Blue Heron nests in the immediate vicinity of the Marin Islands remained at 10 pairs in 2015.
- Of possible—but unknown—significance: We talked to a few people at the Loch Lomond Marina during the nesting season, and they reported observing regular river otter (*Lontra canadensis*) activity in the marina. Apparently, very few waterbirds that are normally present in the marina (e.g., Western Grebes, Mallards) were observed. Kevin Wolfe, from the Loch Lomond Bait Shop, reported that he saw a river otter kill a Mallard. River otters are uncommon-but-documented nest predators in nesting colonies of gulls, terns, cormorants, and other seabirds, and they have been observed in egret colonies in Florida (Verbeek and Morgan 1978, Hayward et al. 1975, Frederick and Collopy 1989). In addition to taking adult waterbirds, river otters are known to eat eggs and chicks. They are aggressive wetland predators that eat mostly fish—but their diet includes a substantial, well-documented, portion of avian prey. River otters are also quite terrestrial and could easily climb into the nesting colony on West Marin Island to raid the nests. Because Snowy Egrets and Black-crowned Night-herons nests are often on or near the ground, in or under the very low, scattered shrubs, they might provide periodically available prey for otters. Observations are needed to substantiate the likelihood of nesting disturbance or predation by river otters, but visits into heronries by otters have been documented and otters have been suspected predators of nesting herons and egrets (Frederick and Collopy 1989, Blus et al. 1997).
- On 1 May, many of the Black-crowned Night-Heron nests on West Marin Island were occupied by large chicks; some were even beginning to wander away from their nests. It might be possible for the Refuge to find evidence of colony disturbance or predation, such as prey remains, tracks, or scat that could confirm the presence of river otters.
- Based on our observations of heronries across the San Francisco Bay region since 1990 (see References), It seems unlikely that a human disturbance (event) would cause this kind of complete abandonment by Snowies and Black-crowneds without a similar response by Great Egrets and Great Blue Herons.

- Other possible sources of colony-site disturbance at the Marin Islands include Bald Eagles, which nest in the Marin Watershed and have targeted heronries in West Marin and elsewhere in the San Francisco Bay area. Bald Eagles are well-known heronry specialists, primarily in Great Blue Heron colonies (Vennesland and Butler 2004). Keith Fraser at the Loch Lomond Bait Shop reported that Bald Eagles have been seen in the area, although not in the heronry. Nonetheless, disturbance by Bald Eagle might have contributed or caused Snowy Egrets and Black-crowned Night-Herons to abandon their nests.
- Such predator-driven disturbance patterns are uncommon at individual colony sites, but occur regularly among heronries in the San Francisco Bay area. Periodic disturbance to nesting colonies account for the frequent—sometimes dramatic—intraregional shifts in nesting distribution that we have seen over the last few decades (Kelly et al 2007).
- River otters are not uncommon in the vicinity of the Marin Islands (Megan Isadore, River Otter Ecology Project, personal communication: Figure 7).



Figure 7. Recent river otter sightings (magenta stars) since 2012 recorded by the River Otter Ecology Project ([www.riverotterecology.org/maps-of-bay-area-sightings.html](http://www.riverotterecology.org/maps-of-bay-area-sightings.html)) suggest the vulnerability of the Marin Islands heronry to nesting disturbance or predation by river otters:

### Black Oystercatcher

We surveyed the full shoreline of both islands for Black Oystercatchers, on each of three trips this season. On 1 May, we saw one apparently occupied oystercatcher, but unconfirmed “nest” on the south side of West Marin Island. This was the only direct evidence of nesting that we have seen this season. We also observed up to 4 unconfirmed “pairs” of oystercatchers during our visits. Therefore, in 2014, we did not confirm any oystercatcher nests and did not see any oystercatcher chicks (Table 1).

### Other bird species

We opportunistically observed the presence of other bird species, on or within 200 feet of the Marin Islands, while monitoring the heron and egret colony (Table 3).

Table 3. Bird species observed on or within 200 ft. of the Marin Islands.

Species name	16 March	7 April	1 May	2 June
Canada Goose		X	X	X
Mallard	X	X	X	
Greater Scaup		X		
Surf Scoter			X	X
Bufflehead	X			
Harlequin Duck			X	
Common Goldeneye	X	X		
Eared Grebe	X			
Horned Grebe	X			
Western Grebe	X	X		X
Clark’s Grebe	X		X	X
Double-crested Cormorant	X	X	X	X
Pelagic Cormorant		X		
Brown Pelican			X	
American White Pelican				X
Great Blue Heron	X	X	X	X
Great Egret		X	X	X
Snowy Egret		X	X	
Black-crowned Night-Heron		X	X	
Turkey Vulture	X			X
Red-tailed Hawk		X		
Osprey		X	X	X
Peregrine Falcon				X
American Coot	X	X	X	
Black Oystercatcher	X	X	X	X
Spotted Sandpiper	X	X	X	

Western Gull	X	X	X	X
Mourning Dove	X	X	X	
Western Gull	X	X	X	
California Gull			X	X
Anna's Hummingbird		X	X	
Allen's Hummingbird		X		
Black Phoebe		X	X	X
Ruby-crowned Kinglet	X			
Bewick's Wren		X		
Chestnut-backed Chickadee		X		
Common Raven	X	X	X	X
Tree Swallow	X	X		X
Cliff Swallow				
Bushtit		X		X
Chestnut-backed Chickadee		X	X	
Song Sparrow	X	X	X	X
American Goldfinch			X	
House Finch	X	X	X	X

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