

HERON AND EGRET MONITORING RESULTS AT MARIN ISLANDS NATIONAL WILDLIFE REFUGE: 2014 NESTING SEASON

A Report to the San Pablo Bay National Wildlife Refuge



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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).

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 2014, we mapped the locations of 25 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 2014. Because of seasonally late nest initiations, and a relatively early decline in the number of active nests, we made only three visits to East Marin Island in 2014 (7 April, 1 May, and 6 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 nests. Supplemental observations were made from a mainland vantage point on Dunfries Terrace above the Loch Lomond Marina.

On 6 June, we counted the nests of all herons and egrets, gulls, and Black Oystercatchers, on West Marin Island, and the nests of herons and 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 expected 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 6 June census, plus the number of active nests on 3 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 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 based on pre fledging brood size in nests with young at least 5-7 weeks of age. Overall nest 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 6 June 2013.

	Number of occupied nests				Total nests
	West side	South side	Northeast side	East Marin Island	
Great Egret	0	0	36	0	36
Snowy Egret	0	0	94	0	94
Black-crowned Night-Heron	1	2	23	0	26
Great Blue Heron	0	1	5	0	6
Western Gull	14	26	2	(not counted)	42
Black Oystercatcher	0	0 ^a	0	0 ^a	0 ^a

^aOn 6 June, we observed an adult oystercatcher lying down on an apparent nest site on the south side of West Marin Island, but we could not confirm a nest attempt. A separate pair of adult Black Oystercatchers were also observed on 6 June, near the landing wharf on East Marin Island.

RESULTS AND DISCUSSION

As in other years, Great Egrets, Great Blue Herons, Snowy Egrets, and Black-crowned Night-Herons nested primarily on the northeast side of West Marin Island (Table 1). In 2014,

Great Blue Herons did not nest on East Marin Island. Great Blue Herons have nested on East Marin Island in only four years since 1979 (Table 2).

Great Egret

On 6 June 2014, we counted 36 Great Egret nests, revealing the eighth consecutive year of low nest abundance after a substantial decline 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 apparent nesting disturbance that occurred in 2013 may have contributed to the continuing decline (see the section on Disturbance, below).

The percent of nest attempts fledging at least one young in 2014 was $56.0 \pm 9.9\%$ (SE; $n = 25$ focal nests), revealing a recovery from the dramatically low rate of nest survival in 2013, which was the lowest rate recorded since we began monitoring survivorship in 1993 (Figure 1).

We estimated that 1.8 ± 0.17 young were produced per successful nest, based on a small sample of $n = 6$ successful nests with clearly observed broods at 5-7 weeks of age. This estimate was the same as the estimate in 2013 and similar to other years, indicating that the number of young fledged from successful nests was approximately normal (Figure 2).

We estimated overall reproductive success (number of young produced per nest attempt) as pre-fledging brood size adjusted by focal nest survivorship. In 2014, Great Egrets fledged 1.02 ± 0.21 young per nest attempt, reflecting primarily the recovery from the dramatically low rate of nest survival in 2013 (Figures 1-3).

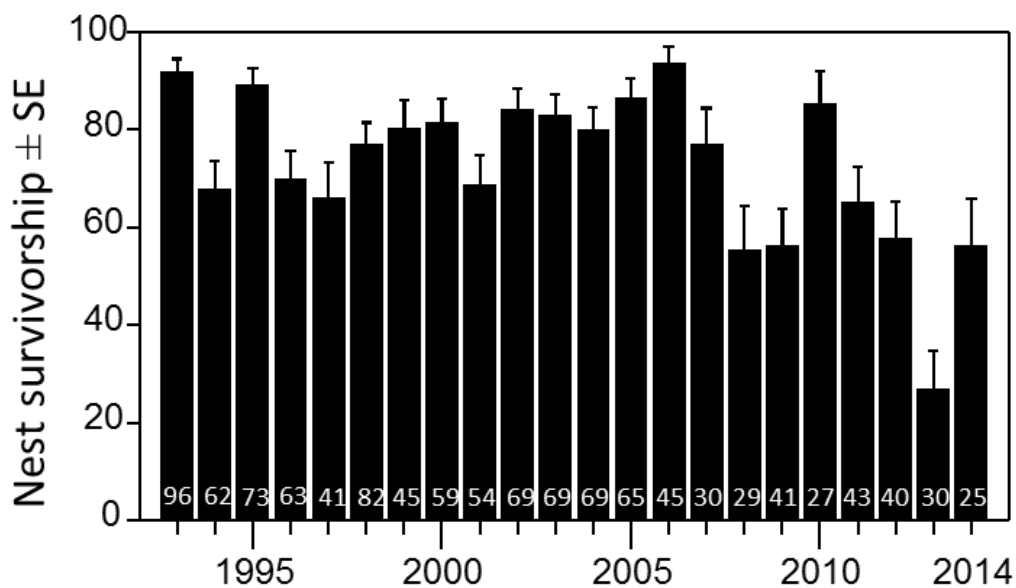


Figure 1. Annual percent survivorship \pm SE of Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

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 ^a	2
1996	148	36	22	3
1997	167	119	24	5
1998	155	117	53	7
1999	101	84	47	8 ^b
2000	134	156	50	9
2001	94 ^c	217	26	7 ^d
2002	121	204	64	7
2003	81	103	51	10
2004	83	59	29	12
2005	161	91	44 ^e	12
2006	126	116	41	9
2007	60	43	21	10
2008	52	132	40	6
2009	64	175	63	9 ^f
2010	64	102	31	8
2011	61	89	48	10
2012	53	121	26 ^g	8 ^h
2013	42	59	11	10 ⁱ
2014	36	94	26	6

^a 115 Black-crowned Night-Herons were present on adjacent mudflats on 17 April 1995.

^b Number includes one nest on East Marin Island.

^c 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.

^d Number of active nests during the 5 June census, but 8 pairs nested in 2001.

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

^f Includes four Great Blue Heron nests on East Marin Island.

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

^h Includes two Great Blue Heron nests on East Marin Island.

ⁱ Includes four Great Blue Heron nests on East Marin Island.

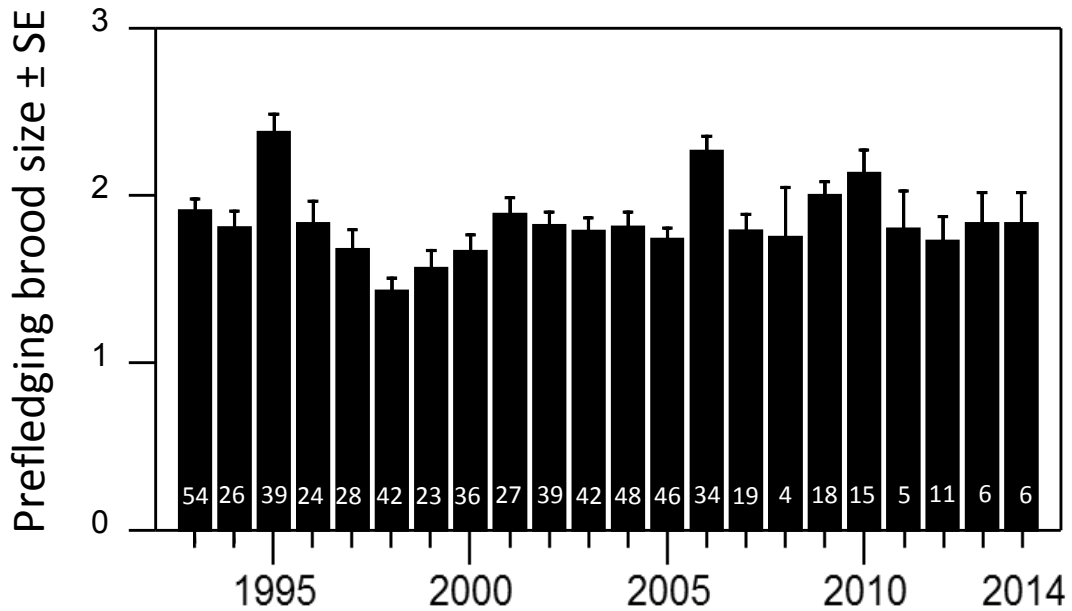


Figure 2. Mean \pm SE of annual prefledging brood size in successful Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

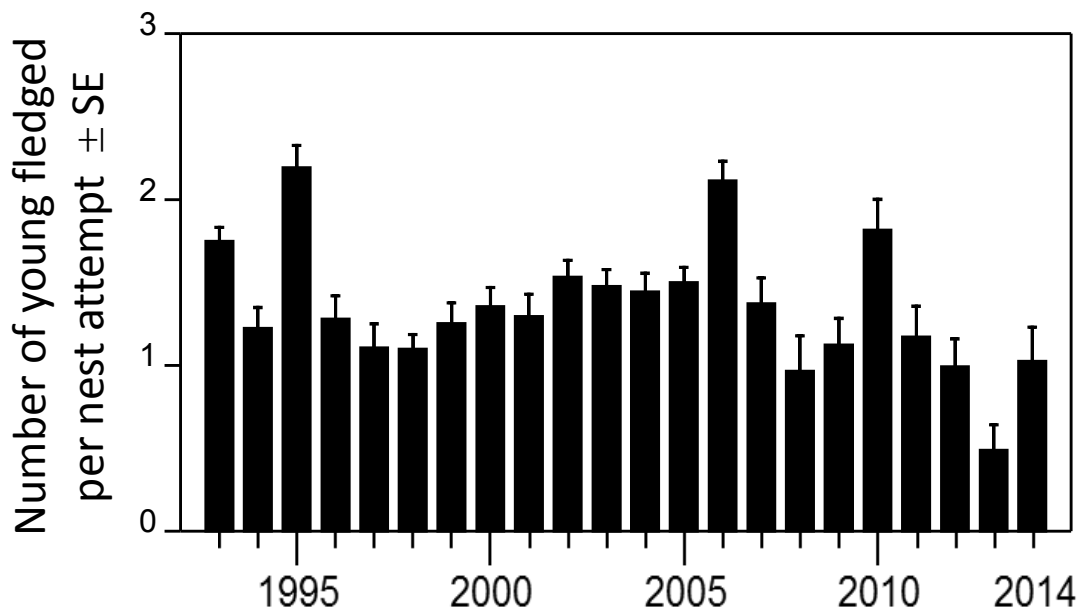


Figure 3. Overall reproductive success of Great Egrets (mean \pm SE young fledged per nest attempt) at West Marin Island, based on the prefledging brood size of successful nests adjusted for overall nest survivorship.

Low overall reproductive success (Figure 3), combined with the continuing low abundance of Great Egrets nesting at Marin Islands (Table 2), led to low total production in the colony in 2014 (54 ± 10 fledged young). This outcome is consistent with a continuing long-term decline in colony productivity since the mid-1990s (Figure 4).

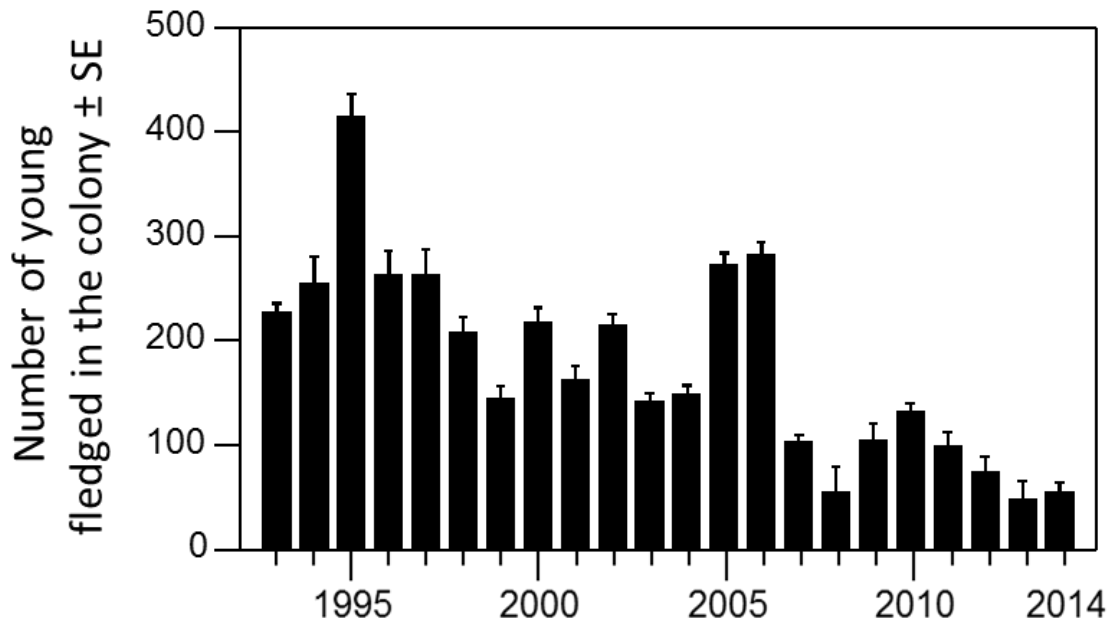


Figure 4. Annual productivity of Great Egrets (estimated number of young fledged in the colony (\pm SE) at West Marin Island.

Snowy Egret

The number of Snowy Egrets nests on West Marin Island in early June 2014 (94 nests) was consistent with a partial recovery from a generally declining trend since 2009 (Figure 5). The substantial annual variation in Snowy Egret nest abundance (Figure 5) may partly reflect the difficulty of detecting nests in inconspicuous locations. In addition, our results reflect only the number of active nests detected on the early June survey and may have overlooked nests that were established but failed before they could be counted. Therefore, our results do not directly reflect the number of breeding pairs. In addition, differences in the extent or timing of nest failure among years, relative to our early-June surveys, could influence our estimates of Snowy Egret nest abundance. We did not monitor the survivorship or productivity of Snowy Egret nests.

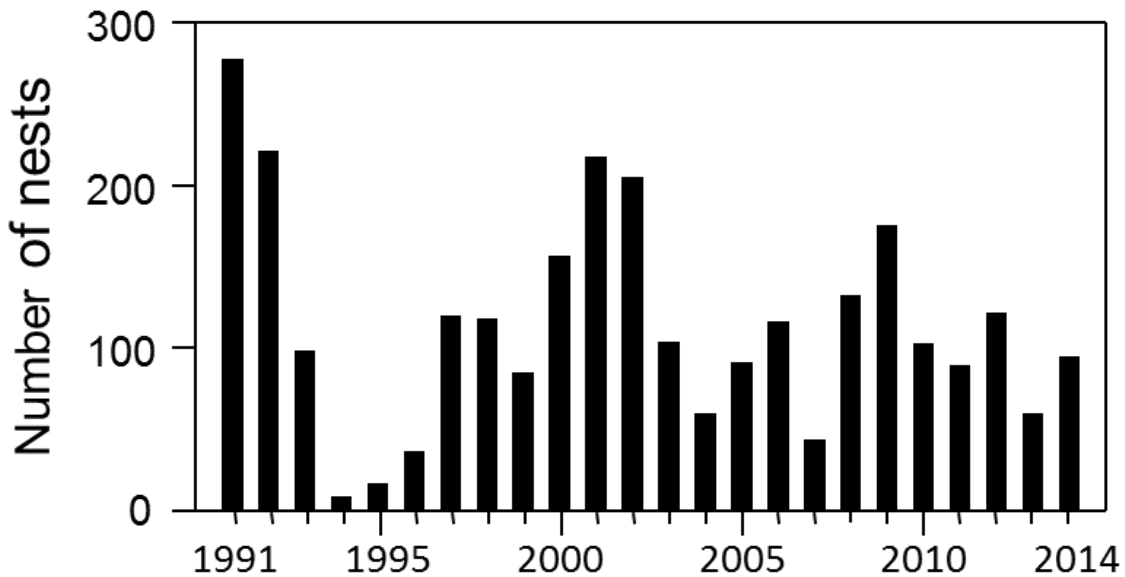


Figure 5. Annual number of Snowy Egret nests at West Marin Island estimated in early June.

Great Blue Heron

No Great Blue Heron nests were initiated on East Marin Island in 2014, even though eight nests were initiated there last year, of which six were successful (Kelly et al. 2013). We followed the fates of five nest attempts through the nesting cycle. All of the five focal nests were successful (100% nest survivorship). The six Great Blue Heron nests observed on 6 June (including the five focal nests) contained young that had reached the age of 5-7 weeks of age, when nestling survival rates are generally very high, providing reasonable estimates of the number of young fledged. Based on those observations, an average of 2.3 ± 0.33 ($n = 6$) young were produced per successful nest. In general, Great Blue Heron nest success and per capita productivity at the Marin Islands were approximately normal. However, the peak number of Great Blue Heron nests declined from nine nests in 2013 to only six nests in 2014, observed on 6 June.

Black-crowned Night-Heron

We counted 26 active Black-crowned Night-Heron nests on 6 June, 2013. This suggests a slight recovery from the declining trend since 2009 (Figure 6). However, the estimated number of Black-crowned Night-Heron nests at West Marin Island fluctuates substantially among years, with no evidence of a long-term trend over the last 20-25 years (Figure 6). It is important to

recognize that the annual variation in our results over the course of this study may include considerable sampling error associated with conducting the counts from remote positions by boat. Because night-herons often conceal their nests in dense vegetation, our estimates provide only a rough index of trends in colony size.

Ground-based nest counts conducted on West Marin Island in 1990 and 1991 (R. Hothem, pers. communication) indicated that counts conducted by boat underestimate the actual number of night-heron nests by a factor of approximately 5.4. The magnitude of this bias is consistent with large numbers of adult night-herons observed occasionally along the shoreline, possibly in response to disturbance events (Table 2). Comparisons with counts made from aerial photographs, as well as ground-based counts, substantiate the value of non-intrusive counts conducted by boat for long-term monitoring, as a rough index of trends in nest abundance. Adjusting the boat-based count by a factor of 5.4 suggests that as many as 140 Black-crowned Night-Heron nests may have been established on the Island in 2014.

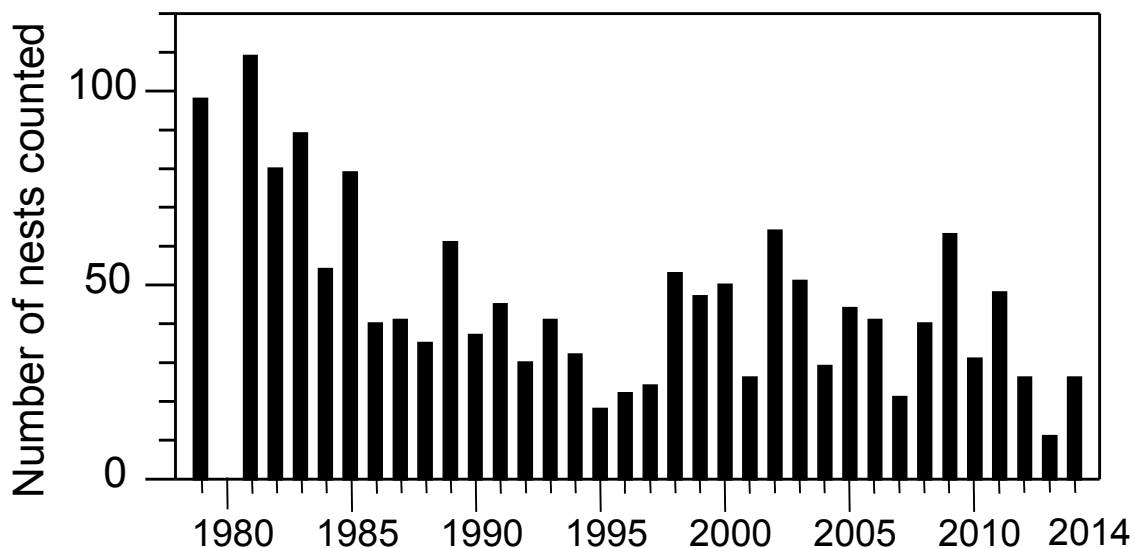


Figure 6. Number of Black-crowned Night-Heron nests counted during annual surveys of West Marin Island. See text regarding overall nest abundance.

Disturbance by humans and nest predators

As in other years, a pair of ravens nested on East Marin Island and frequently spent time in the heron and egret colony on West Marin Island (Kelly et al. 2005). We observed nest disturbance by the resident ravens resulting in behavioral responses by nesting herons and egrets, suggesting that raven predation may have been a key cause of nest failure. However, we did not quantify the extent to which nest losses resulted specifically from raven predation.

Per capita nest survival among Great Egret nests in 2014 was similar to other years (Figure 1), with a recovery from the record low nest survival in 2013. This suggests that the resident (nesting) ravens, which have preyed on the colony for nearly 20 years (Kelly et al. 2005), were not the primary cause of low nest success among Great Egrets in 2013. Nest predatory activity by ravens could have increased, opportunistically, if the ravens exploited the effects of other sources of failure, or disturbance causing adult birds to leave their nests unattended, but we did not monitor the behaviors of the ravens. We did not measure raven reproductive success and we did not observe any fledged raven young, although they could have been present and undetected during our visits.

A likely, but unconfirmed, explanation for the high nest-failure among Great Egret nests in 2013 may be the presence on East Marin Island of nest-predatory raccoons, which might easily swim the short distance to the heronry. Camera traps established in 2013 to monitor the incidence of human intruders, indicated that an adult raccoon and two offspring were on East Marin Island during some or part of the 2013 nesting season. The absence of continuing evidence of raccoons in 2014 is consistent with the apparent recovery of normal nest survival in Great Egrets (Figure 1). The presence of raccoons may have also impacted the nesting Black-crowned Night-Herons or Snowy Egrets—nest abundance in both species declined in 2013 then recovered in 2014. We do not know if nest success in Snowy Egrets or night-herons showed a pattern similar to their changes in nest abundance because we do not monitor their nest success. On each of our visits during the 2014 nesting season, we searched East Marin Island for evidence of continuing raccoon presence, but we found no evidence. This suggests that the raccoons were no longer there during the 2014 nesting season. The record low number of 36 Great Egret nests in 2014 is not surprising, because colony-site disturbances—such as the possible nest predation and disturbance by one or more raccoons in 2013—generally lead to extended effects on local heron and egret nest abundances in subsequent years (Millus et al. 2013).

On 1 May, two curious intruders on kayaks landed on West Marin Island, causing a huge fly-up of the nesting herons, egrets, and gulls. We yelled across to them from East Marin Island, telling them to back down, but they did not show any intention to leave the island. We yelled to them a second time and they departed. The two intruders then paddled over to us and were very contrite. We informed them that landing on the islands was not permitted without authorization from the Refuge. We also talked to them about the protected status of the Islands and the sensitivity of the nesting birds.

Other species

On 1 May, we observed a pair of adult Black Oystercatchers on the south side of West Marin Island, and we determined that there were at least six—maybe eight—oystercatchers on

East and West Marin islands (combined), but we could not confirm nesting. On 6 June, we observed an adult oystercatcher lying down on an apparent nest site on the south side of West Marin Island, but we could not confirm a nest attempt. A separate pair of adult oystercatchers was seen on East Marin Island on 6 June, on the beach near the landing wharf. Therefore, in 2014, we did not confirm any oystercatcher nests and did not see any oystercatcher chicks or fledglings (Table 1).

Bird species observed (opportunistically, while monitoring the heron and egret colony) on or within 200 feet of the Marin Islands are listed in Table 3. In contrast to the previous five years, we did not observe an adult Harlequin Duck in the waters and shorelines of the Marin Islands.

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

Species name	7 April	1 May	6 June
Canada Goose	X	X	X
Mallard	X	X	X
American Wigeon	X		
Greater Scaup	X		
Surf Scoter	X	X	X
Bufflehead	X		
Red-breasted Merganser		X	
Western Grebe	X	X	X
Clark's Grebe	X	X	X
Double-crested Cormorant	X	X	X
Great Blue Heron	X	X	
Great Egret	X	X	
Snowy Egret	X	X	
Black-crowned Night-Heron	X	X	
Turkey Vulture			X
American Coot	X		
Black Oystercatcher	X	X	X
Spotted Sandpiper	X	X	
Western Gull	X	X	
Mourning Dove	X	X	X
Anna's Hummingbird	X	X	X
Black Phoebe	X		X
Common Raven		X	X
Tree Swallow			X
Cliff Swallow		X	
Bushtit		X	X
Chestnut-backed Chickadee			X
Song Sparrow	X	X	X
Fox Sparrow	X		
Dark-eyed Junco	X		
Golden-crowned Sparrow	X		
House Finch	X	X	X

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