

**HERON AND EGRET MONITORING RESULTS
AT MARIN ISLANDS NATIONAL WILDLIFE REFUGE:
2016 NESTING SEASON**

A Report to the San Pablo Bay National Wildlife Refuge



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INTRODUCTION

In 2015, as in other years, Great Blue Herons, Great Egrets, Snowy Egrets, and Black-crowned Night-Herons nested on West Marin Island (none on East Marin Island); however, all of the nesting Snowy Egrets and Black-crowned Night-Herons abandoned the site before completing the nesting cycle and, by 2 June 2015, only five Great Blue Heron nests and 26 Great Egret nests remained active (Kelly et al. 2015). The cause of the 2015 abandonments is unknown. In 2016, we found no evidence of successful nesting by herons or egrets on West Marin Island. However, seven Great Blue Heron nests were established on East Marin Island and a few of those nests were apparently successful in fledging young. In this report, we present our detailed observations of heron and egret nesting activity on the Marin Islands in 2016.

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, 2006a, 2007a). We made four visits to East Marin Island in 2016 (7 March, 4 April, 2 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, focal nests on West Marin Island (randomly selected subsets of observable nests) followed from early in the incubation period. 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 searched carefully for oystercatcher nests 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 mapped the locations of 11 focal Great Egret nests and four (unconfirmed) focal Great Blue Heron nests on West Marin Island, on panoramic photographs of the nesting colony. We also tracked the fates of 7 Great Blue Heron nests on East Marin Island. Nest survival was measured as “apparent” nest survival based on the proportion of nests that raised at least one young to the minimum fledging age of seven or eight weeks, respectively, for Great Egrets and Great Blue Herons. In 2016, all Great Egret nest attempts failed. Great Blue Heron nest survival was based on the results from both East Marin and West Marin islands, but the only nests determined to be successful were on East Marin Island.

We normally estimate the productivity Great Egret and Great Blue Heron nests as the pre-fledging brood size in successful nests with young at least 5-7 weeks of age (Kelly et al. 2007a). Because all Great Egret nest attempts failed in 2016, nest productivity was zero (no young were fledged). It was impossible to clearly observe the contents of Great Blue Heron nests on East Marin Island without risk of disturbance to the nesting herons; therefore, we could not estimate the productivity of successful Great Blue Heron nests.

Because of the widespread nest failure in 2016, overall reproductive success was zero for Great Egrets, Snowy Egrets, and Black-crowned Night-Herons (product of average nest survivorship [zero] and average number of young in successful nests; Kelly et al. 2007a). We could not determine the number of young in the successful nests on East Marin Island; therefore, we could not calculate overall reproductive success for Great Blue Herons.

RESULTS AND DISCUSSION

In 2016, all nest attempts by herons and egrets on West Marin Island failed, although few Great Blue Heron nests on East Marin Island were apparently successful in fledging young (species accounts below; Table 1). Great Blue Herons have nested on East Marin Island in only five years since 1979 (1999, 2009, 2012, 2013, and 2016; Table 2).

Great Egret

On 6 June, there were no nesting Great Egrets on the Marin Islands, revealing the first recorded complete colony failure by this species on the Marin Islands (since at least 1979; Table 2).

Table 1. Number of active nests observed on West Marin Island and East Marin Island on 6 June 2016.

	Number of occupied nests				
	West Marin Island			East Marin Island	Total nests
	West side	South side	Northeast side		
Great Egret	0	0	0	0	0
Snowy Egret	0	0	0	0	0
Black-crowned Night-Heron	0	0	0	0	0
Great Blue Heron	0	0	0	1	1
Western Gull	0	53	1	(not counted)	54
Black Oystercatcher	0	0	1 ^a	0	1 ^a

^aApparent but unconfirmed nest site: a pair of oystercatchers on the south side of West Marin Island, one adult standing next to one that was lying down on a possible nest site.

On 4 April, we observed 11 active Great Egret nests on West Marin Island but, by 2 May, only three remained active, with adults on two additional nest sites exhibiting “stretch” displays suggesting courtship without evidence of a pair bond. Because the intraseasonal timing of these nest failures may have been too late for viable second nest attempts, we cannot confirm that this represents a colony-site abandonment unless Great Egrets choose not to nest on the Marin Islands in 2017. Behavioral patterns of this species indicate that even a few returning pairs could stimulate the recruitment of additional pairs and, therefore, could be important in sustaining nesting activity without complete abandonment of the colony site.

On 2 May, we also observed one Great Egret nest on East Marin Island--the first Great Egret nest recorded on East Marin Island (since at least 1979). This nest failed prior to 6 June, apparently during the incubation period. Nest predation was suggested by a depredated Great Egret egg shell found beneath the nest, which was pierced from the side in the manner typical of predation by Common Raven.

By 6 June, there were no active Great Egret nests on either of the Marin Islands. None of the nest attempts by Great Egrets on the Marin Islands successfully fledged young in 2016. Thus, in 2016, Great Egret colony size declined to zero in June (after a peak of approximately 11 nests on 4 April); nest survival, number of young fledged per nest, and overall productivity of the colony were zero in 2016 (Figures 1-4).

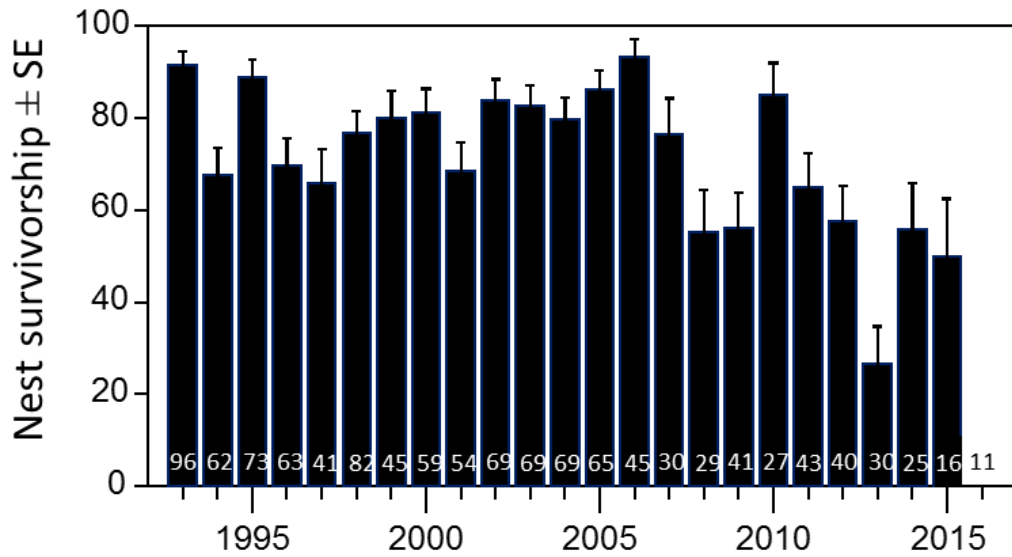


Figure 1. Annual percent survivorship \pm SE of Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

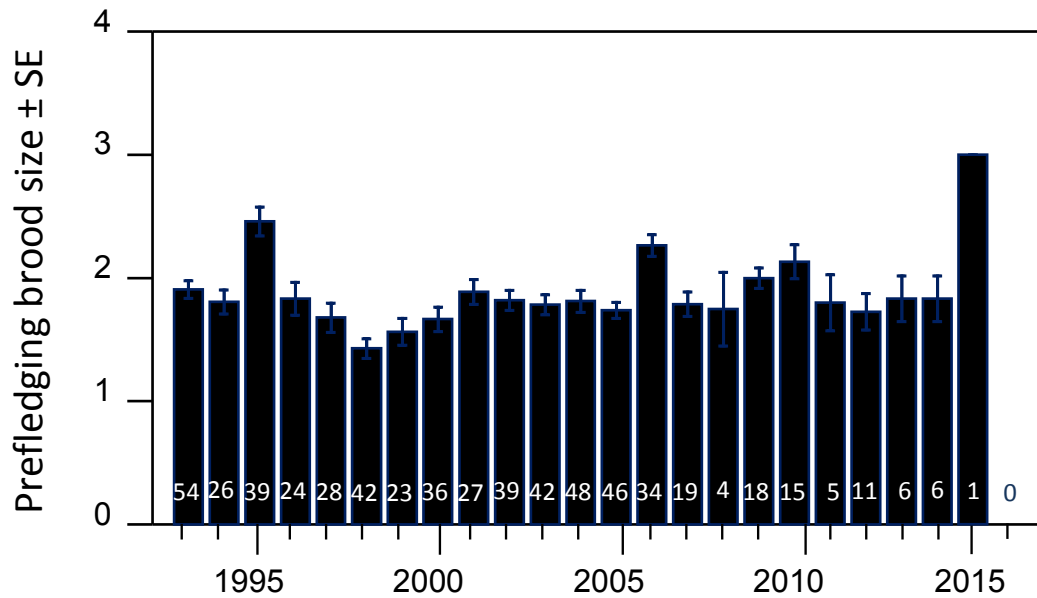


Figure 2. Mean \pm SE of annual prefledging brood size in successful Great Egret nests at West Marin Island. Numbers on the bars indicate the number of nests sampled.

Table 2. Annual number of active heron and egret nests on East and West Marin Islands based on early-June counts conducted by boat and from East Marin Island.

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
2015	26	0	0	5
2016	0	0	0	1 ^j

^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 2001 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.

^j The only active Great Blue Heron nest on 6 June was on East Marin Island.

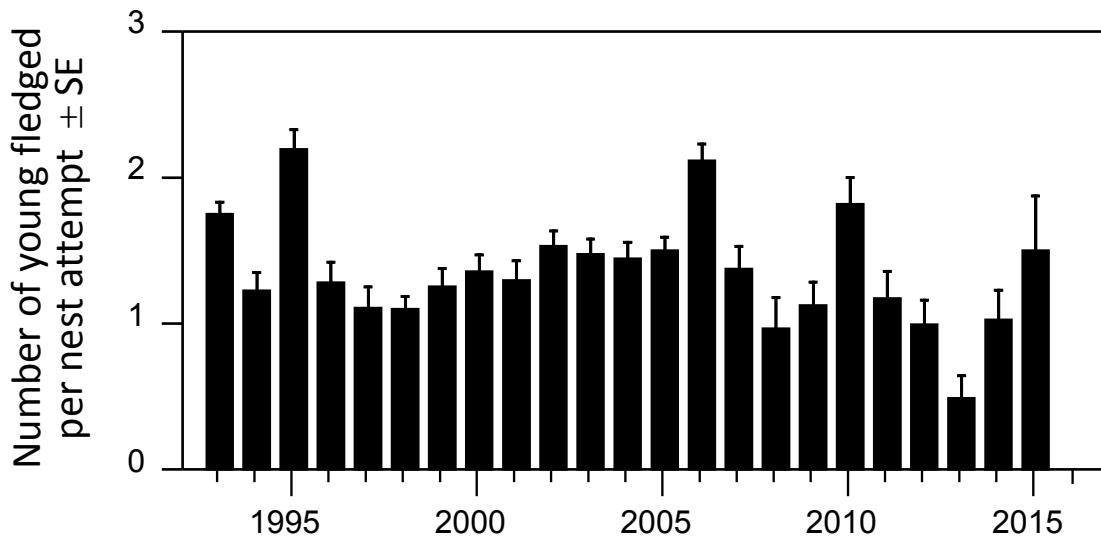


Figure 3. Overall reproductive success of Great Egrets (mean \pm SE young fledged per nest attempt) at West Marin Island, based on the pre fledging brood size of successful nests adjusted for overall nest survivorship. The value for 2015 probably overestimated the actual productivity in successful nests because it was based on observation of only one successful nest, with a pre fledging brood size of three young; Figure 2.

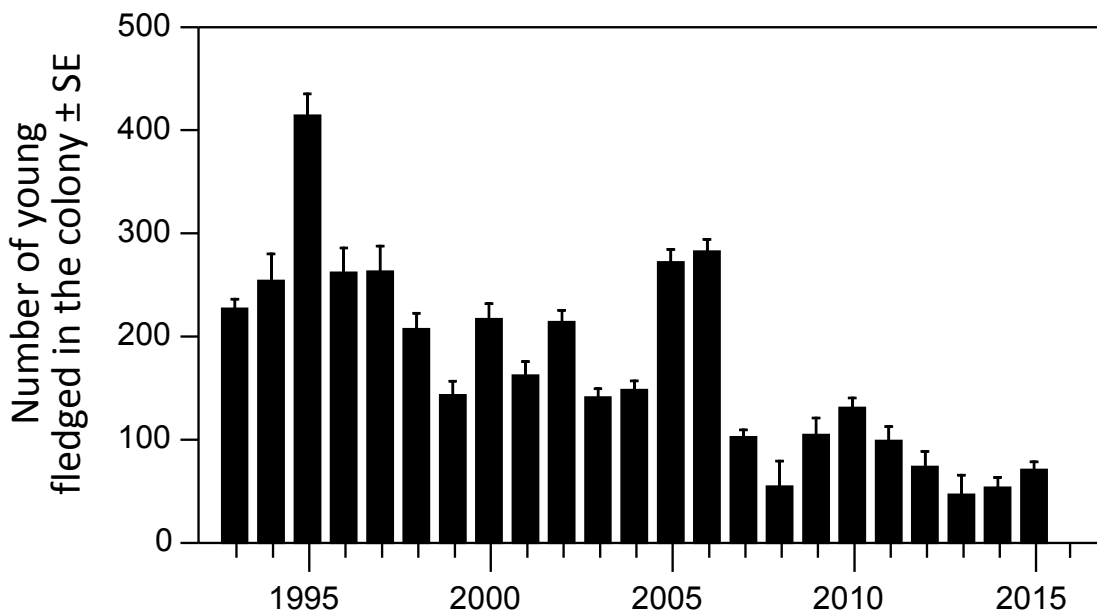


Figure 4. Annual productivity of Great Egrets (estimated number of young fledged in the colony \pm SE) at West Marin Island.

Great Blue Heron

Great Blue Herons initiated six nest attempts on West Marin Island. We found no evidence that any of those nests successfully produced young. Three of the nests that were empty on 6 June could have previously fledged young.

On East Marin Island, we counted seven Great Blue Heron nests. All but one of those nests were empty on 6 June (Table 2), but we estimated that four of the nests on East Marin Island were successful (fledged at least one young).

Therefore, overall nest success by Great Blue Herons on both islands was between $31 \pm 0.13\%$ and $54 \pm 0.14\%$, because the fates of three nests were unknown. It was impossible to clearly observe the contents of Great Blue Heron nests on East Marin Island without risk of disturbance to the nesting herons; therefore, we did not estimate the productivity of the nests (number of young likely to fledge).

Snowy Egret and Black-crowned Night-Heron

Last year (2015), small numbers of Snowy Egrets and Black-crowned Night-Herons established nests on West Marin Island, but all of the nest attempts failed. In 2016, a small number of individuals of each of these two species were observed visiting West Marin Island, but we found no active Snowy Egret or Black-crowned Night-Heron nests. Therefore, we determined that Snowy Egrets and Black-crowned Night-Herons abandoned the West Marin Island colony site in 2016.

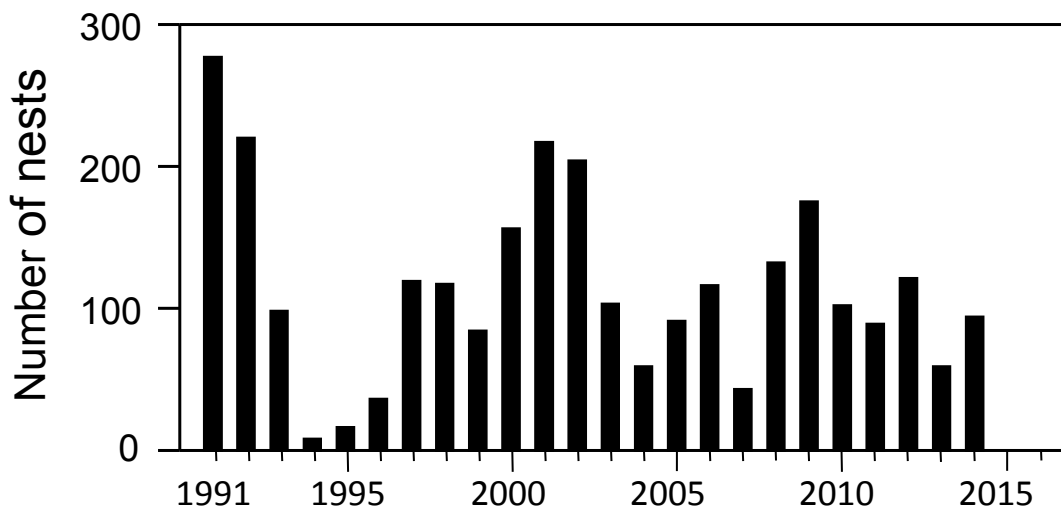


Figure 5. Annual number of Snowy Egret nests at West Marin Island estimated in early June. Active nest attempts were observed during the 2015 nesting season but, on 2 June 2015, no Snowy Egret nests were active at Marin Islands. In 2016, no nesting attempts were observed.

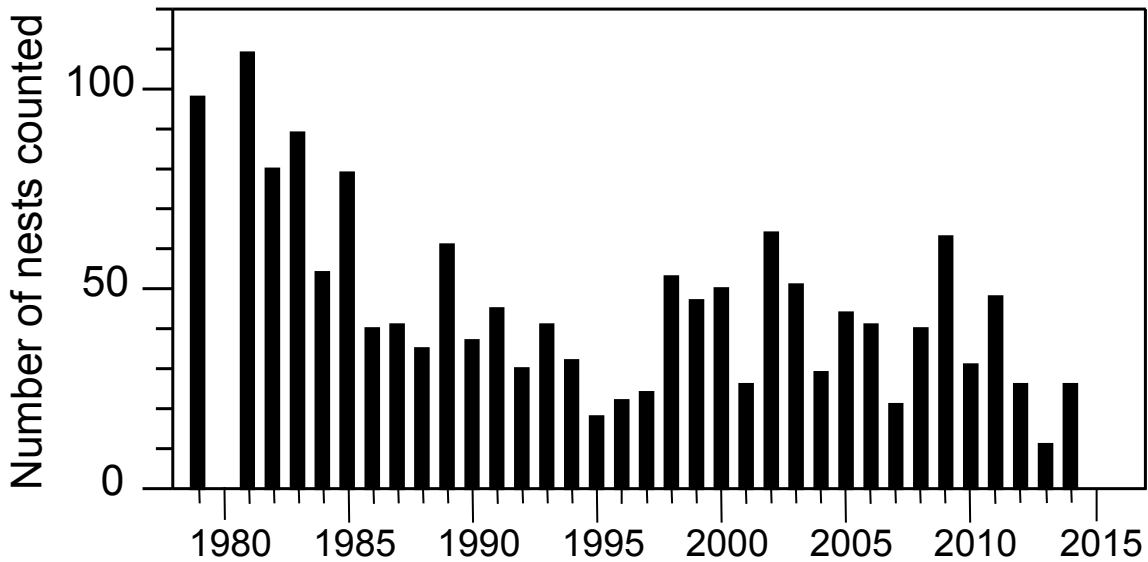


Figure 6. Annual number of Black-crowned Night-Heron nests counted during early-June surveys of West Marin Island. Active nest attempts were observed during the 2015 nesting season but, on 2 June 2015, no Black-crowned Night-Heron nests were active at Marin Islands. In 2016, no nesting attempts were observed.

Disturbance by humans and nest predators

Given that the herons and egrets nesting on the Marin Islands have tolerated the presence of—and occasional, opportunistic nest predation by—territorial, nesting ravens for more than 20 years (Kelly et al. 2005), we do not believe that disturbance by resident ravens was the primary cause of the widespread nest failure and abandonment observed in 2016. We confirmed that a pair of Common Ravens nested on East Marin Island in 2016, but no ravens were observed on our final visit, on 6 June.

We did not observe disturbance by humans or potential nest predators 2016. We observed scat on the wharf at East Marin Island that appeared to be raccoon scat, composed primarily of invertebrate exoskeletons. Reasonable speculation suggests that the nest failures could have resulted from disturbance by potential nest predators, such as Bald Eagles (*Haliaeetus leucocephalus*), river otters (*Lontra canadensis*), or raccoons (*Procyon lotor*)—all known to be in the vicinity of the Islands during the nesting season (see discussion in annual reports by Kelly et al. 2014 and 2015). However, we found no evidence to confirm or reject these possibilities.

The decisions by herons or egrets to nest on the Marin Islands are of course, completely up to the birds. Accordingly, we advise against attempts to lure them back using artificial means such as decoys. If an underlying threat of nest disturbance or predation persists—which may have led

to the nest failure and abandonment in 2015 and 2016—future decisions by the birds to nest elsewhere might be adaptive, allowing them to avoid further disturbance.

There is no way to predict if any herons or egrets will return to nest on the Marin Islands in 2017. However, efforts to reduce the possible impacts of potential nest predators or human intrusion might interact with the natural tendency of these species to return to traditional colony sites, such as the Marin Islands, increasing the chance of recolonization in spite of previous disturbance (Kelly 2014).

Black Oystercatcher

Several Black Oystercatchers were observed flying in the vicinity of both islands on all visits. We surveyed the entire shoreline of both islands for oystercatcher nests during each of four trips this season. On 6 June, we saw one occupied but unconfirmed oystercatcher “nest” on the south side of West Marin Island. At this site, one adult was seen standing next to a second adult that was lying down on an apparent nest site, but we could not confirm nesting.

Other bird species

While monitoring the heron and egret colonies at the Marin Islands, we opportunistically observed the presence of other bird species, on or within 200 feet of the Marin Islands (Table 3).

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

Species name	7 March	4 April	1 May	6 June
Canada Goose	X	X	X	
Mallard		X	X	X
Gadwall			X	X
Greater Scaup	X	X		X
Surf Scoter	X	X	X	X
Bufflehead	X	X		
Harlequin Duck		X		
Common Goldeneye	X			
Ruddy Duck		X		
Eared Grebe			X	
Double-crested Cormorant	X	X		X
Great Blue Heron	X	X	X	X
Great Egret	X	X	X	
Snowy Egret		X	X	
Black-crowned Night-Heron		X		
Turkey Vulture		X		
Osprey		X		X
American Coot		X		
Black Oystercatcher	X	X	X	X
Least Sandpiper		X		
Spotted Sandpiper		X	X	
Western Gull				X
Mourning Dove		X		X
Western Gull	X	X		
Mew Gull	X			
Anna's Hummingbird		X		
Allen's Hummingbird			X	
Black Phoebe	X	X	X	
Bewick's Wren	X		X	X
Red-breasted Nuthatch	X			
Common Raven	X	X	X	
American Crow				X
Tree Swallow		X	X	X
Song Sparrow	X	X	X	X
Golden-crowned Sparrow	X			
Lesser Goldfinch				X
House Finch		X	X	X

REFERENCES CITED

- Kelly, J. P. 2014. An analysis of the potential for recolonization of Picher Canyon by Great Egrets: Effects of Temporal Scale and Human Activity. ACR Technical Report 1967-1-7 © May 2014, Audubon Canyon Ranch Cypress Grove Research Center P. O. Box 808, Marshall, CA 94940
- Kelly, J. P., and N. Nur. 2015a. Wildlife—heron and egret nest density and nest survival indicators. Technical summary and appendix, in State of the San Francisco Estuary 2015: Status and Trends Update on 33 Indicators of Ecosystem Health, San Francisco Estuary Partnership. [www.sfestuary.org/about-the-estuary/soter/]
- Kelly, J. P., and N. Nur. 2015b. Processes—heron and egret brood size indicator. Technical summary and appendix, in State of the San Francisco Estuary 2015: Status and Trends Update on 33 Indicators of Ecosystem Health, San Francisco Estuary Partnership. [www.sfestuary.org/about-the-estuary/soter/]
- Kelly, J.P. and T. E. Condeso. 2014. Rainfall Effects on Heron and Egret Nest Abundance in the San Francisco Bay Area. *Wetlands*: 1-11.
- Kelly, J. P., K. L. Etienne, and J. E. Roth. 2005. Factors influencing the nest predatory behaviors of Common Ravens in heronries. *Condor* 107: 402-415.
- Kelly, J. P., K. Etienne, C. 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.
- Kelly, J. P., K. L. Etienne, C. Strong, M. L. Parkes, and M. McCaustland. 2006. Annotated atlas and implications for the conservation of heron and egret nesting colonies in the San Francisco Bay area. Audubon Canyon Ranch, Stinson Beach, CA 94940. [Online: www.egret.org/atlas.html].
- Kelly, J. P., H. M. Pratt, and P. L. Greene. 1993. The distribution, reproductive success, and habitat characteristics of heron and egret breeding colonies in the San Francisco Bay area. *Colonial Waterbirds* 16: 18-27.
- Kelly, J. P., D. Stralberg, K. Etienne, and M. McCaustland. 2008a. Landscape influences on the quality of heron and egret colony sites. *Wetlands* 28: 257-275.
- Millus, S.A., J.P. Kelly, and T.E. Condeso. 2013. Effects of disturbance on subregional heron and egret nesting abundance. Poster presentation, State of the Estuary Conference, October 29-30, 2013. Oakland, CA. [www.egret.org/sites/default/files/scientific_contributions/soe_poster_millusetal_final.pdf]

Annual reports

- | | |
|---|---|
| <p>Kelly, J. P., B. Fischer, and H. M. Pratt. 1994. 1993 heron and egret monitoring results at West Marin Island. Reports to the San Francisco Bay National Wildlife Refuge.</p> <p>Kelly, J. P., B. Fischer, and H. M. Pratt. 1995. 1994 heron and egret monitoring results at West Marin Island. Report to the San Francisco Bay National Wildlife Refuge.</p> <p>Kelly, J. P., B. Fischer, and H. M. Pratt. 1996. 1995 heron and egret monitoring results at West Marin Island. Report to the San Francisco Bay National Wildlife Refuge.</p> <p>Kelly, J. P., B. Fischer, and H. M. Pratt. 1997. 1996 heron and egret monitoring results at West Marin Island. Report to the San Francisco Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 1998. 1997 heron and egret monitoring results at West Marin Island. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 1999. 1998 heron and egret monitoring results at West Marin Island. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 2000. 1999 heron and egret monitoring results at West Marin Island. Report to the San Pablo Bay National Wildlife Refuge.</p> | <p>Kelly, J. P., and B. Fischer. 2001. Heron and egret monitoring results at West Marin Island: 2000 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 2002. Heron and egret monitoring results at West Marin Island: 2001 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 2003. Heron and egret monitoring results at West Marin Island: 2002 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 2004. Heron and egret monitoring results at West Marin Island: 2003 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., and B. Fischer. 2004b. Heron and egret monitoring results at West Marin Island: 2004 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., B. Fischer, and M. McCaustland. 2006b. Heron and egret monitoring results at West Marin Island: 2005 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> <p>Kelly, J. P., B. Fischer, and M. McCaustland. 2007b. Heron and egret monitoring results at West Marin Island: 2006 nesting season. Report to the San Pablo Bay National Wildlife Refuge.</p> |
|---|---|

- Kelly, J. P., B. Fischer, and M. McCaustland. 2008b. Heron and egret monitoring results at West Marin Island: 2007 nesting season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J. P., B. Fischer, and T.E. Condeso. 2009a. Heron and egret monitoring results at West Marin Island: 2008 nesting season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J. P., B. Fischer, and T. E. Condeso. 2009b. Heron and egret monitoring results at West Marin Island: 2009 nesting season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J. P., B. Fischer, and T.E. Condeso. 2011a. Heron and egret monitoring results at West Marin Island: 2010 nesting season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J. P., B. Fischer, and T.E. Condeso. 2011b. Heron and egret monitoring results at West Marin Island: 2011 nesting season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J.P., B. Fischer, and T.E. Condeso. 2012. Heron and Egret Monitoring Results at Marin Islands National Wildlife Refuge: 2012 Nesting Season. Report to the San Pablo Bay National wildlife Refuge.
- Kelly, J. P., S.A. Millus, B. Fischer, and T. E. Condeso. 2013. Heron and Egret Monitoring Results at Marin Islands National Wildlife Refuge: 2013 Nesting Season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J. P., S.A. Millus, B. Fischer, and T. E. Condeso. 2014. Heron and Egret Monitoring Results at Marin Islands National Wildlife Refuge: 2014 Nesting Season. Report to the San Pablo Bay National Wildlife Refuge.
- Kelly, J. P., B. Fischer, S.A. Millus, and T. E. Condeso. 2015. Heron and Egret Monitoring Results at Marin Islands National Wildlife Refuge: 2015 Nesting Season. Report to the San Pablo Bay National Wildlife Refuge.