HERON AND EGRET MONITORING RESULTS AT MARIN ISLANDS NATIONAL WILDLIFE REFUGE: 2013 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 (Kelly et al. 1993, 2006, 2007, 2008a).

METHODS

Methods for monitoring the numbers of heron and egret nests and estimating reproductive success of Great Egrets and Great Blue Herons are identical each year and are described in detail in Kelly et al. (1996, 2006, 2007). In 2013, we mapped the locations of 30 focal Great Egret nests and 12 focal Great Blue Heron nests on panoramic photographs of the nesting colony. We made five visits to East Marin Island (11 March [observations by boat only], 8 April, 3 May, 3 June, and 17 June). From viewing positions on East Marin Island, we used telescopes to monitor the nest survivorship, seasonal timing, and prefledging brood size of numbered nests. Supplemental observations were made from a mainland vantage point on Dunfries Terrace above the Loch Lomond Marina.

On 3 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 prefledging 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 3 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 ± 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 prefledging 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.

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 2012, Great Blue Herons once again established nests on East Marin Island. Documented nesting by Great Blue Herons on East Marin Island has occurred in four years since 1979; one nest in 1999, four nests in 2009, two nests in 2012 (Table 2), and four nests in 2013.

Table 1. Number of active nests observed on West Marin Island and East Marin Island on 3 June 2013.

	Number of occupied nests				
	West Marin Island			East Marin	Total
	West side	South side	Northeast side	Island	nests
Great Egret	0	0	42	0	42
Snowy Egret	0	0	59	0	59
Black-crowned Night-Heron	0	0	11	0	11
Great Blue Heron	0	0	6 [a]	3 [a]	9 [a]
Western Gull	9	48	2	(not counted)	59
Black Oystercatcher	0 [b]	0 [b]	0 [b]	1 [b]	1 [b]

[a] The seasonal peak number of Great Blue Heron nests was 10 (7 on West Marin island and 3 on East Marin Island) , on 3 May 2013.
[b] Three adult Black-crowned Oystercatchers were observed on West Marin Island and 6 on East Marin Island on 17 June.

Great Egret

On 3 June 2013, we counted 42 Great Egret nests, revealing the seventh consecutive year of low nest abundance after a substantial decline from 126 nests in 2006 and 161 nests in 2005 (Table 2). The percent of nest attempts fledging at least one young in 2013 was only 26.7± 8.1% (SE; *n* = 30 focal nests), revealing a dramatically low rate of nest survival, which was substantially lower than the two other lowest records for nest survivorship (2008 and 2009) 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 suggests 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 prefledging brood size adjusted by focal nest survivorship. In 2013, Great Egrets fledged 0.49 ± 0.16 young per nest attempt—a dramatic overall decline in reproductive success relative to previous years. The poor reproductive success in 2013 resulted primarily from the low rate of nest survivorship (number of nests fledging at least one young; Figures 1-3).

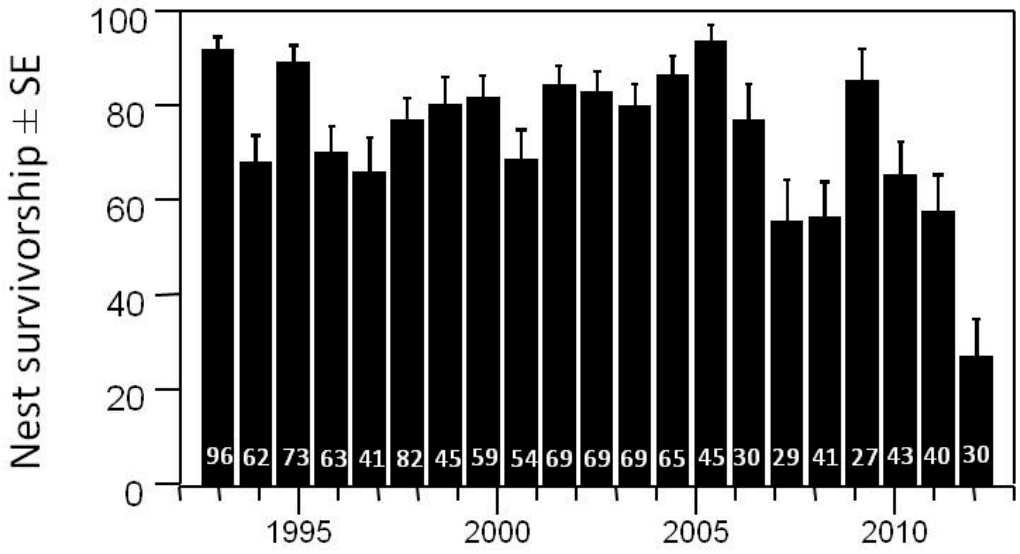

Figure 1. Annual percent survivorship ± SE of Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

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]

[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.

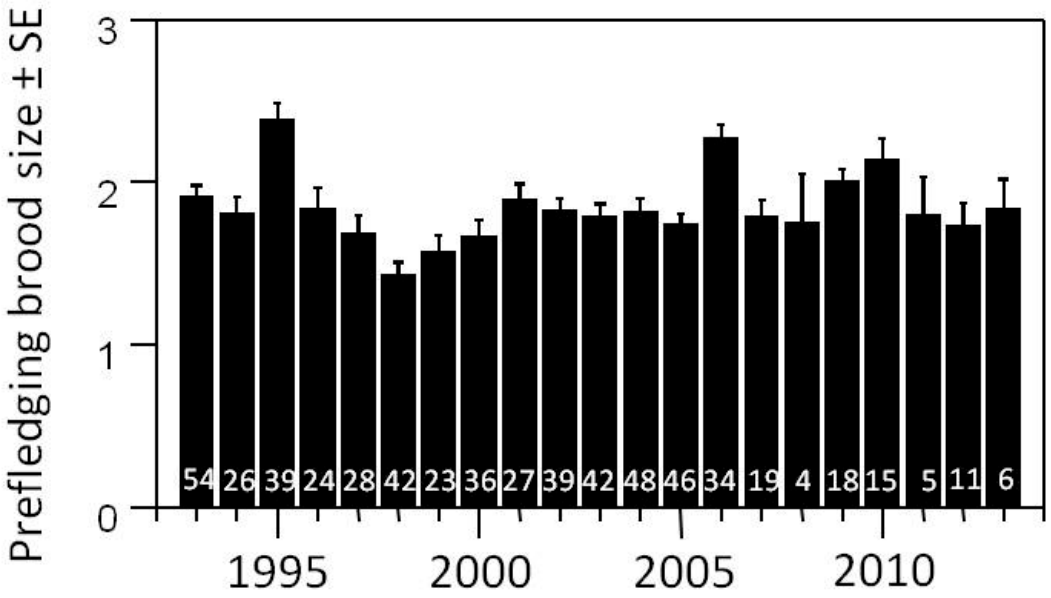

Figure 2. Mean ± SE of annual prefledging brood size in successful Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

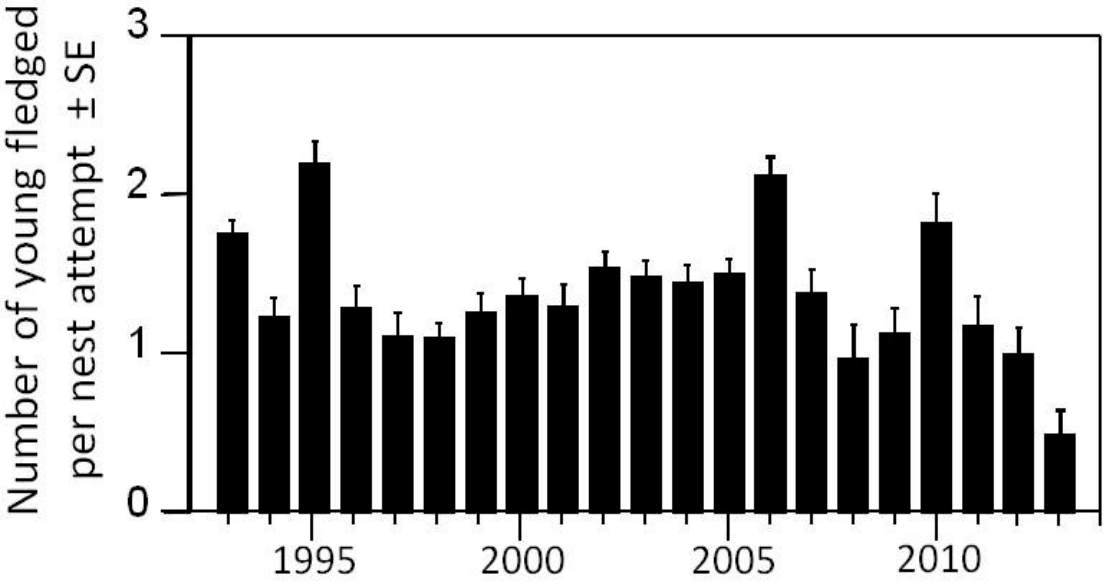

Figure 3. Overall reproductive success of Great Egrets (mean ± SE young fledged per nest attempt) at West Marin Island, based on the prefledging brood size of successful nests adjusted for overall nest survivorship.

The low overall reproductive success in 2013 (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 and a continuing long-term decline in colony productivity since the mid-1990s (47 ± 19 fledged young in 2013; Figure 4).

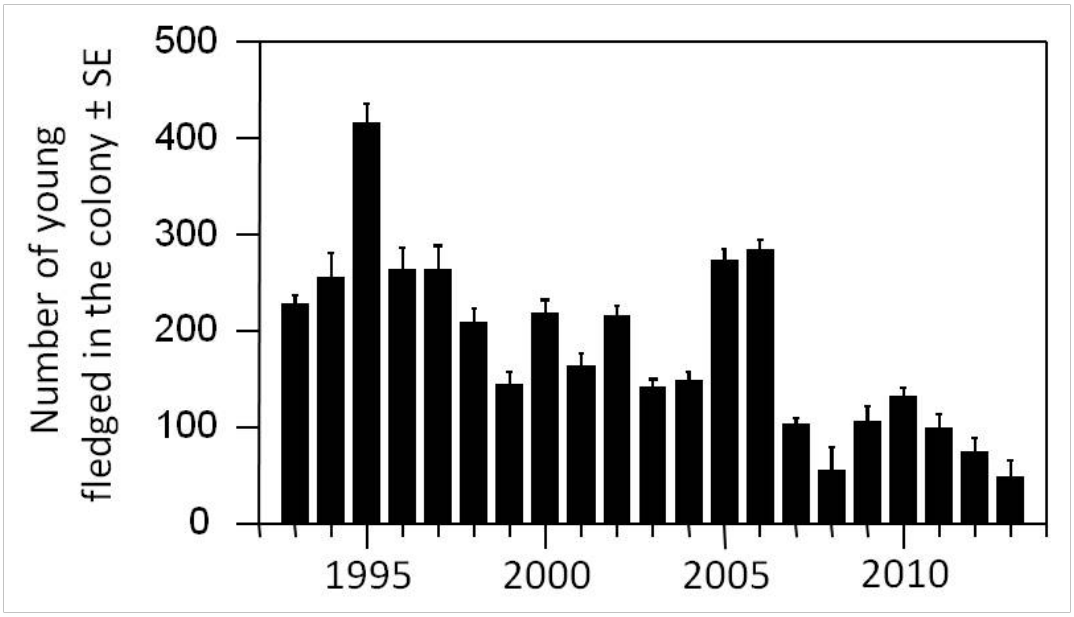

Figure 4. Annual productivity of Great Egrets (estimated number of young fledged in the colony ± SE) at West Marin Island.

Snowy Egret

The number of Snowy Egrets nests on West Marin Island in early June 2013 (59 nests) was consistent with a general 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.

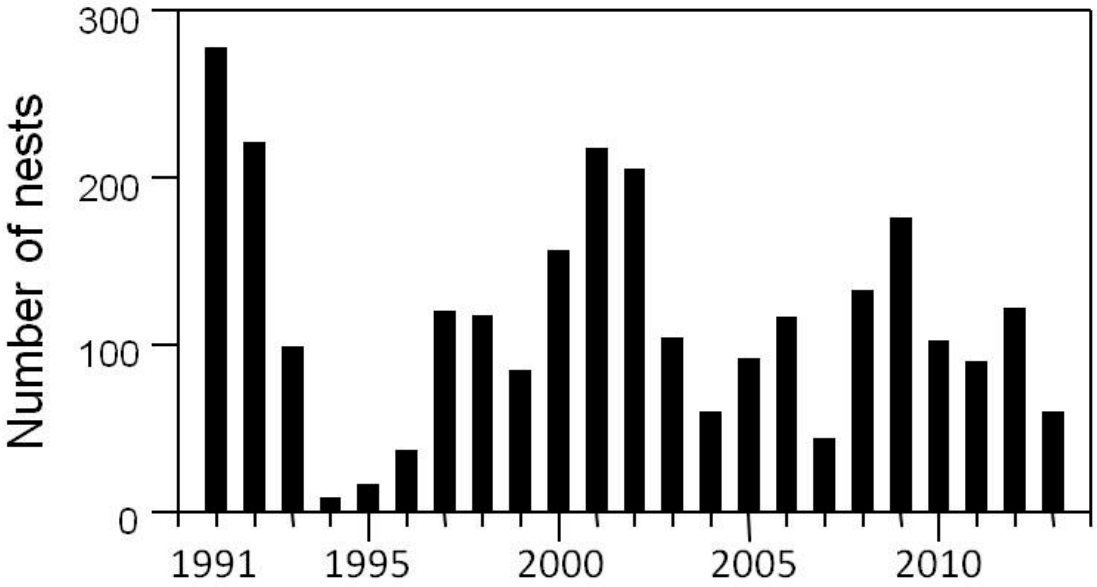

Figure 5. Annual number of Snowy Egret nests at West Marin Island estimated in early June.

Great Blue Heron

The peak number of active Great Blue Heron nests in 2013 was ten, observed on 3 and 17 June (Table 2). Eight Great Blue Heron nests were initiated on West Marin Island and four on East Marin Island. We followed the fates of all 12 nest attempts. Six of the eight nests on West Marin Island were successful, with two nests raising one young each to minimum fledging age (8 weeks), three nests fledging two young each, and one nest fledging three young. All four nests on East Marin Island were successful, with one nest fledging one young and two nests fledging two young each; the number of young fledged from the fourth nest could not be determined. Great Blue Heron reproductive success at the Marin Islands was approximately normal, with 83.3 ± 1.16% nest survivorship (*n* = 12 focal nests) and an average of 1.8 ± 0.22 (*n* = 9) young produced per successful nest.

Black-crowned Night-Heron

We counted 11 active Black-crowned Night-Heron nests on 3 June, 2013. This result revealed a continuing declining trend since 2009, consistent with the decline in the number of nesting Snowy Egrets (Figures 5 and 6). The estimated number of Black-crowned Night-Heron

nests at West Marin Island fluctuates substantially among years, but the number of night-heron nests observed in early June of 2013 was the lowest recorded since 1979. In contrast to the decline in nest abundance over the last few years, there has been no evidence of a long-term trend over the last 20-25 years (Figure 6). It is important to recognize that the substantial 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, roughly, that as many as 50 Black-crowned Night-Heron nests may have been established on the island in 2013.

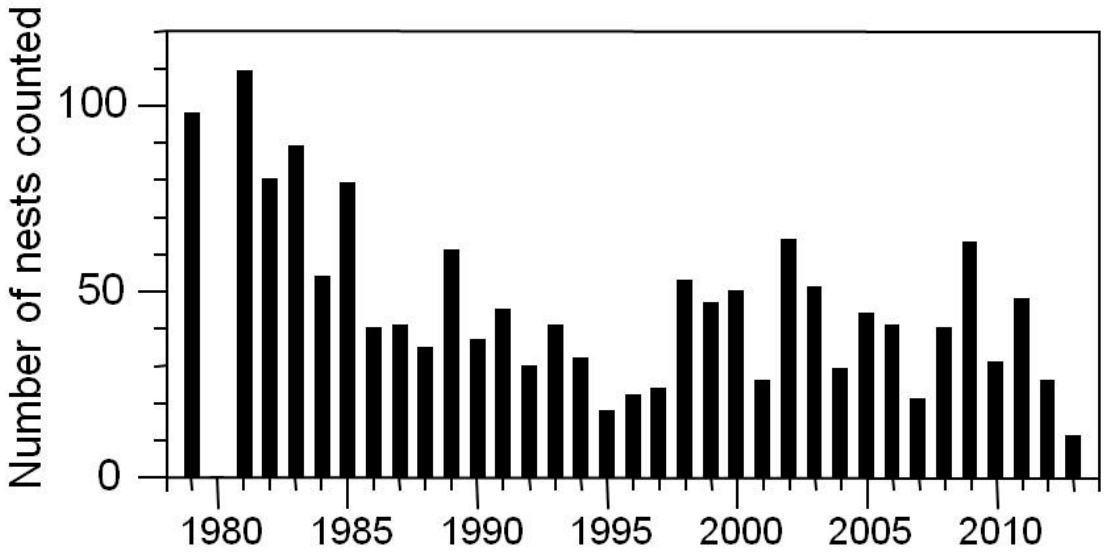

Figure 6. Number of Black-crowned Night-Heron nests counted during annual surveys of West Marin Island. See text regarding overall nest abundance.

Common Raven

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 birds and evidence of likely raven predation on at least one Great Egret chick; it is likely that nest predation by ravens was a key cause of nest failure in the heronry, but we did not quantify the extent to which nest losses resulted specifically from raven predation. Nest mortality among Great Egret nests was far greater than in most other years (Figure 1), suggesting considerable raven predation. However, other sources of disturbance could have been involved—and potentially followed by opportunistic nest predation by ravens. The observed failure rate among Great Blue Heron nests (16.7 ± 1.16% (*n* = 12) did not differ significantly from expected rates in the San Francisco Bay area (Kelly et al. 2007). Rates of nest mortality and nest predation in other heron or egret species were not measured. We did not measure raven reproductive success and we did not observe any fledged raven young, although they could have been present but undetected during our visits.

Other species

On 17 June, we observed one Black Oystercatcher nest on East Marin Island (east end of south shore), six adult oystercatchers on East Marin Island, and 3 adult oystercatchers on West Marin Island (Table 1). As in the previous five years, an adult male Harlequin Duck occupied the waters and shorelines of the Marin Islands through the nesting season. Bird species observed on or within 200 feet of the Marin Islands are listed in Table 3.

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

Species name	8 April	3 May	3 June	17 June
Canada Goose	X	X	X	X
Gadwall		X	X	
Mallard	X	X	X	X
Greater Scaup	X			
Surf Scoter			X	X
Harlequin Duck		X	X	X
Western Grebe	X	X	X	X
Clark's Grebe	X	X	X	X
Brandt's Cormorant		X		
Double-crested Cormorant	X	X	X	X
American White Pelican			X	

Great Blue Heron	X	X	X	X
Great Egret	X	X	X	X
Snowy Egret	X	X	X	X
Black-crowned Night-Heron	X	X	X	X
Turkey Vulture		X	X	X
Osprey		X	X	X
American Coot	X			
Black Oystercatcher	X	X	X	X
Spotted Sandpiper		X		
Western Gull	X	X	X	X
Glaucous-winged Gull		X		
Caspian Tern		X		
Eurasian Collared-Dove		X		
Mourning Dove		X	X	
Anna's Hummingbird			X	
Selasphorous spp. (hummingbird)		X		
Black Phoebe			X	X
Common Raven	X	X	X	X
Tree Swallow		X	X	
Bushtit		X		
Wilson's Warbler		X		
Song Sparrow		X	X	
House Finch	X	X	X	X
Purple Finch				X
American Goldfinch		X	X	X

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