

HERON AND EGRET MONITORING RESULTS AT WEST MARIN ISLAND: 2008 NESTING SEASON

A Report to the San Pablo Bay National Wildlife Refuge



John P. Kelly^a, Binny Fischer, and T. Emiko Condeso
Cypress Grove Research Center, Audubon Canyon Ranch
P. O. Box 808, Marshall, CA 94940
^akellyjp@egret.org



ACR Technical Report 90-3-20
© February 2009, Audubon Canyon Ranch
Cypress Grove Research Center
P. O. Box 808, Marshall, CA 94940

HERON AND EGRET MONITORING RESULTS AT WEST MARIN ISLAND: 2008 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 on West Marin Island since 1979 and the annual reproductive success of Great Egrets and Great Blue Herons since 1993 (Kelly et al. 1994-1997, Kelly and Fischer 1998-2004, Kelly et al. 2006-2008). Nests are monitored during repeated visits each year, from viewing positions on East Marin Island and by boat. This work is part of a regional study of heron and egret colonies in the northern San Francisco Bay area (Kelly et al. 1993, 2006, Kelly et al. 2007).

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. Methods are summarized here and described in detail in Kelly et al. (1996, 2006, 2007). In 2008, we mapped the locations of 29 focal Great Egret nests and 6 Great Blue Heron nests on panoramic photographs of the nesting colony. We used telescopes to monitor the nest survivorship, seasonal timing, and pre fledging brood size of numbered nests, during five visits to East Marin Island (7 March, 14 April, 28 April, 2 June, and 18 June). Supplemental (approximately weekly) observations were made from a mainland vantage point on Dunfries Terrace above the Loch Lomond Marina, although focal nests were not monitored from this location.

On 2 June, we counted nests of all bird species nesting on all sides of West Marin Island. As in other years, we counted nests from an 18-foot Boston Whaler by drifting and motoring slowly around the Island and by counting nests from an anchored position on the northeast side of the Island. Finally, we landed on East Marin Island and rechecked the initial estimates for the number of Great Blue Heron nests. 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 focal nests) by the number of successful nests. We estimated nest survivorship as the proportion of focal nests determined to be successful (nestlings at least 5-7 weeks old) on the last visit (18 June), adjusted by the expected survivorship of nests that had not yet reached 5-7 wks of age, based on nesting stage, (determined from intensively monitored nests at ACR's Picher Canyon Heronry, 1999-2005; Kelly, unpublished data). Means are reported as \pm standard error (SE).

We also measured the directions of arrival and departure flights, during a 2-hr observation period, from 11:20 to 13:20 on 2 June 2008. Flightline results from 2004, 2005, 2006 and 2007 are reported in Kelly et al. (2007b). As in previous years, observers were stationed on East Marin Island and in a boat on the north side of West Marin Island. Observers partitioned the recording of flights between viewing positions to monitor arrivals and departures in all directions around West Marin Island, communicating with radios to clarify the flight bearings when necessary. We used compasses and maps marked with the angles of distant landmarks relative to true north to record the angular trajectories of all arrival and departure flights during the 2-hr observation period, although a few flights were missed.

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). No herons or egrets nested on East Marin Island.

Table 1. Number of active nests observed on West Marin Island on 2 June 2008.

	Number of occupied nests			Total nests
	West side	South side	Northeast side	
Great Egret	0	7	45	52
Snowy Egret	2	1	129	132
Black-crowned Night-Heron	3	4	33	40
Great Blue Heron	0	0	6	6
Western Gull	23	38	10	71
Black Oystercatcher	1 ^a	1 ^b	0	2 ^c

^a Nest site indicated by a pair of adults with two chicks.

^b Nest observed with two eggs; two adults were observed near the nest.

^c The first record of Black Oystercatcher nesting on East Marin Islands was confirmed by a third nest site, indicated by a nest with two eggs and a pair of adults near the nest on the south side of East Marin Island.

Great Egret

On 2 June 2008, we counted 52 Great Egret nests, indicating a continuation of the reduced nest abundance observed in 2007 when the presence of only 60 nests revealed a substantial decline from 126 nests in 2006 and 161 nests in 2005. In addition, Great Egret nest abundance in 2008 was the lowest on record for the colony site (Table 2). Nest survivorship (percent of focal nests fledging at least one young) in 2008 was the lowest we have recorded since 1993 ($55 \pm 6\%$, std. error; $n = 29$ focal nests). In 2007, nest survivorship was considerably higher ($77 \pm 6\%$; $n = 30$). In contrast, nest survivorship was unusually high in 2006 ($93 \pm 3\%$, $n = 45$; Figure 1).

We were unable to obtain a precise estimate of mean pre fledging brood size for Great Egrets in 2008, because of the combined effects of low nest abundance, seasonally late nesting, and limited visibility of nests. Based on only 4 clearly observed broods, pre fledging brood size averaged 1.75 ± 0.25 young per successful nest ($n = 4$), the number of young produced in successful nests was comparable to most recent years, with the exception of unusually high productivity in 2006 (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 2008 Great Egrets fledged 0.97 ± 0.18 young per nest attempt, revealing a substantial decline in overall reproductive success (Figure 3), which resulted primarily from low nest survivorship (Figure 1).

The substantial decline in nest abundance of Great Egrets, combined with relatively low overall reproductive performance, led to an estimate of only 34 ± 24 fledged young in 2008, although this estimate is associated with a relatively large margin of uncertainty (95% confidence is approximately ± 2 standard errors; Figure 4). The productivity of the colony was the lowest measured since we began the monitoring program in 1993 (Figure 4).

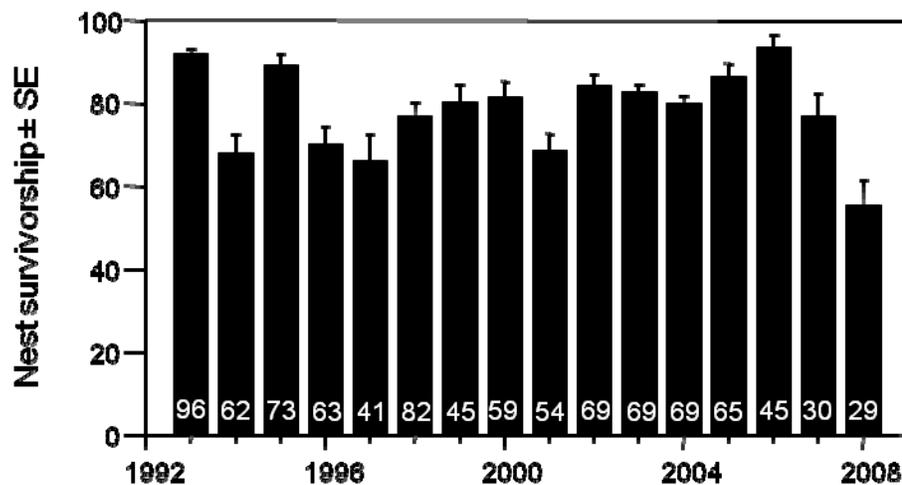


Figure 1. Annual percent survivorship \pm SE of Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

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.

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

^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.

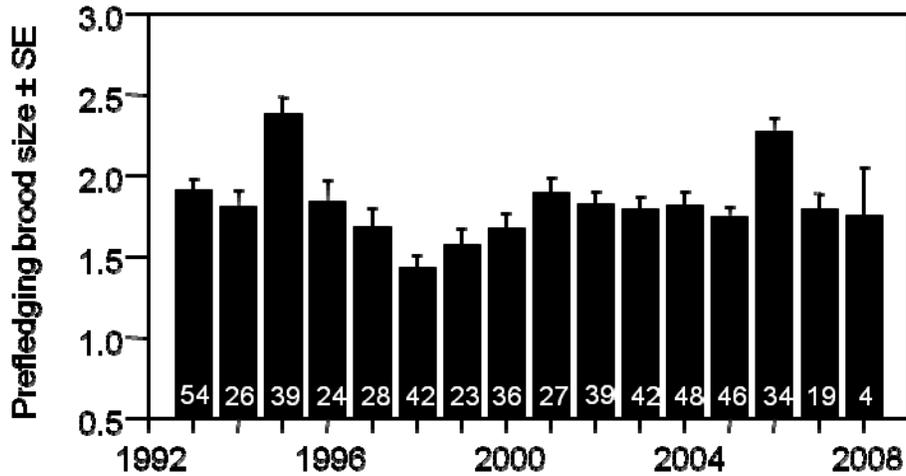


Figure 2. Mean \pm SE of annual prefledging brood size in successful Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

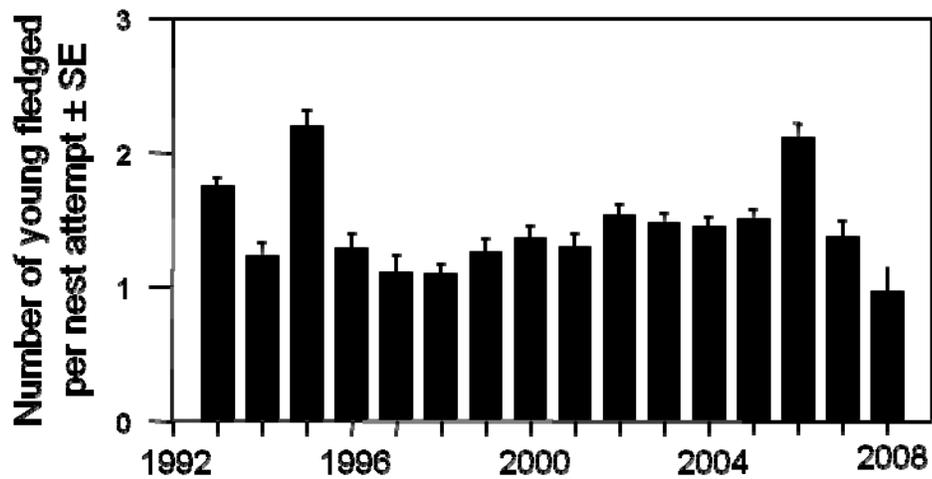


Figure 3. Overall reproductive success of Great Egrets (mean \pm SE young fledged per nest attempt) at West Marin Island, based on the prefledging brood size of successful nests adjusted for overall nest survivorship.

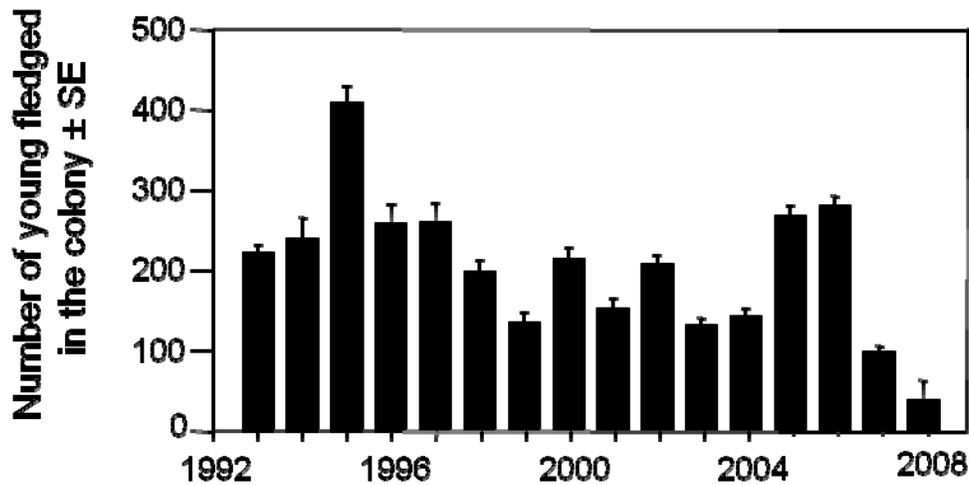


Figure 4. Annual productivity of Great Egrets (estimated number of young fledged in the colony \pm SE) at West Marin Island.

Snowy Egret

The number of Snowy Egrets nests on West Marin Island increased sharply in 2008. We counted 132 nests in 2008, compared to only 43 in 2007 and surpassing nest numbers in other years (Table 2, Figure 4). The extremely low nest counts in 1994-1996 were associated with repeated disturbance by a Red-tailed Hawk (Kelly et al. 1995, Kelly and Fischer 1998). The decline from 2001-2004 was related to habitat degradation (loss of shrub cover) on the north side of the island and disturbance by predatory Common Ravens (Kelly and Fischer 2004; Table 2). The increase in nest abundance in 2008 might reflect (1) recovery of previously diminished shrub cover needed to provide protection from predatory ravens, (2) immigration of nesting adults from other colony sites, and or (3) recruitment of first-time breeders. The region-wide increase in the number of nesting Snowy Egrets in 2008 was primarily a result of the increase in nesting at West Marin Island (Figure 5, top). The increase in Snowy Egret nesting abundance in 2008 moderated the declining trend in the northern San Francisco Bay region since 2002 but is insufficient to indicate a trend of increasing nest numbers in the region (Figure 5, top).

In addition, the percent of nesting Snowy Egrets in the northern San Francisco Bay area that nested on West Marin Island increased from approximately 20% in 2007 to 40% in 2008

(Figure 5, bottom). The proportion of nesting on West Marin Island in 2008 (40%) is close to the average proportion observed since 1997, suggesting that the regional importance of Marin Islands to nesting Snowy Egrets has returned to relatively normal levels. In 1991-1992, approximately 90% of the known Snowy Egrets in region nested on the Island, followed by unusually low numbers in 1994-1995 (Figure 5, bottom).

We emphasize that considerable annual variation in nest abundance is apparent (Figures 5 and 6) and our results reflect only the number of active nests detected on observation days. Therefore, our results do not directly reflect the number of breeding pairs. Estimated changes in regional breeding abundance and the number of Snowy Egrets nesting at West Marin Island could be influenced by differences in the extent or timing of nest failure among colony sites or years, relative to our observation dates. We did not monitor nest survivorship or productivity of Snowy Egrets.

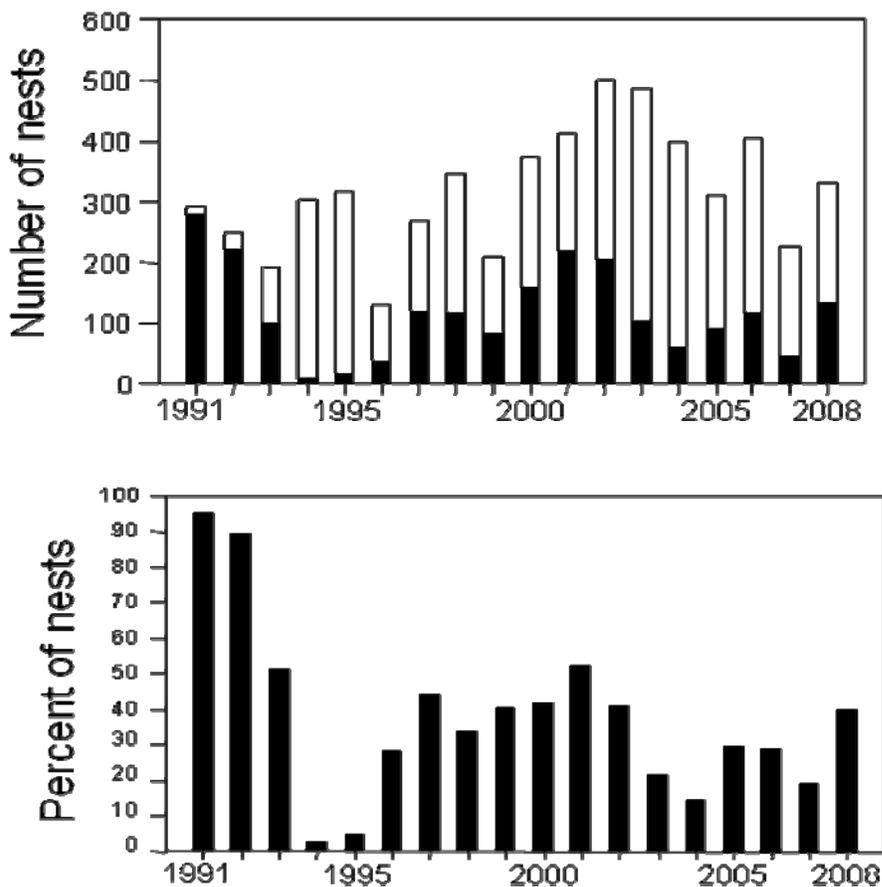


Figure 5. Annual number of Snowy Egret nests (top graph) at West Marin Island (solid bars) and at other colony known colony sites in the northern San Francisco Bay area (open bars), and the associated regional percent of nests that occur at West Marin island (bottom graph).

Great Blue Heron

The peak number of Great Blue Heron nests declined from 10 nests in 2007 to six nests in 2008 (Table 2). Preliminary observations from several other colony sites in the northern San Francisco Bay region revealed similar declines in nest abundance. We observed eight different nest sites occupied by Great Blue Herons, but two of them did not apparently result in nest initiations (pair bonds). Two of the six nest initiations subsequently failed to fledge any young. Fledging success, based on prefledging brood sizes, could be estimated for two of the four successful nests: one nest produced one young and one nest produced two young.

Black-crowned Night-Heron

The estimated number of active Black-crowned Night-Heron nests on 2 June was 40, about twice as many as observed in 2007 and similar to the estimated nest abundance in 2005 and 2006 (Table 2). However, these estimates have shown considerable variation over the course of this study. This variation probably reflects 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) indicate 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 a total of 216 Black-crowned Night-Heron nests in 2008. Boat-based counts of Black-crowned Night-Heron nests suggest that the apparent declining trend from 2002 to 2007 may have leveled off, reflecting dynamic but fairly stable use of West Marin Island since the mid-1980s (Figure 7).

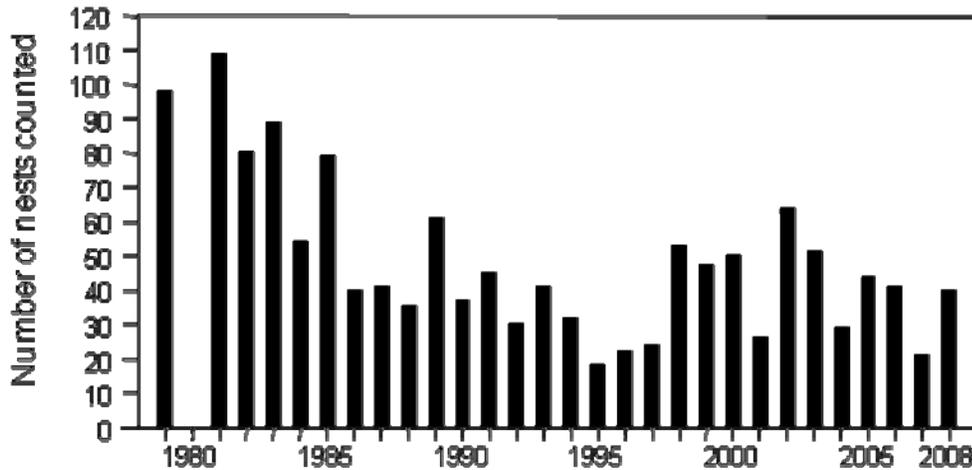


Figure 7. Number of Black-crowned Night-Heron nests counted during annual surveys of West Marin Island. See text regarding overall nest abundance.

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. Nest predation by ravens was apparent in the heronry, but we did not quantify the extent to which nest losses resulted from predation by ravens. However, unusually low Great Egret nest survivorship of $55 \pm 6\%$ (see above) suggested that raven predation may have accounted for up to 45% nest mortality (Kelly et al. 2005). Rates of nest mortality and nest predation in other species are unknown. Observations of adult ravens and their fledged young on 2 June indicated that the resident ravens produced three young.

Other Species

On 2 June, we observed evidence of two Black Oystercatcher nests on West Marin Island, one with two eggs and two nearby adults and one with two chicks attended by two adults. In addition, on 2 June 2008, we recorded the first record of Black Oystercatcher nesting on East Marin Island. This third nest site was indicated by two adult oystercatchers near a nest with two eggs, along the southwest shore of East Marin Island near the passage between the islands. An adult male Harlequin Duck occupied the waters and shorelines of the Marin Islands on 7 March, 14 April, 28 April, 2 June, and 18 June.

Flightlines

As in previous years (Kelly et al. 2007b), we quantified the angles of arrival and departure flights from the heronry. Results from a 2-h flightline survey on 2 June 2008 indicated differences in the use of surrounding feeding areas by Great Egrets and Snowy in 2007, with a total of 50 Great Egret flights (84 in 2007) and 30 Snowy Egret flights (136 in

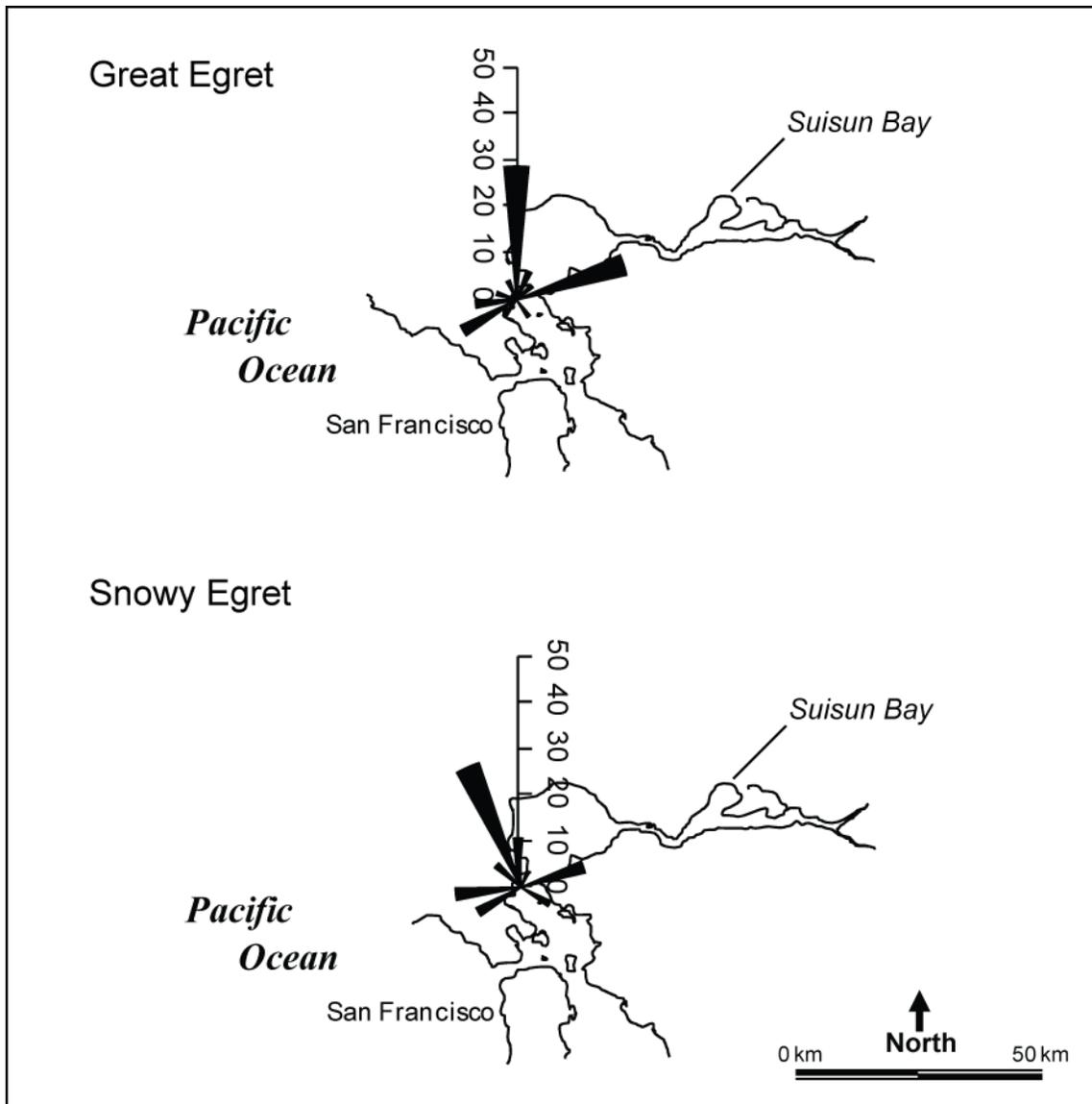


Figure 8. Angular distribution of arrival and departure flights (pooled) of Great Egrets ($n = 50$) and Snowy Egrets ($n = 30$) at West Marin Island, by percent of flights among 16 compass sectors. Flights were observed from 11:20 to 13:20 on 2 June 2008, over a tide range of 3.4 – 4.4 ft above MLLW (rising, based on NOAA tide predictions for Point Orient, 4.3 km west of Marin Islands).

2007). Great Egrets and Snowy Egrets both focused approximately 30% of their foraging flights in northerly directions, toward the Petaluma Marsh and the western shore of San Pablo Bay, although we do not know their actual destinations. This northward orientation is consistent with observations at other tide levels in previous years (Kelly et al. 2007b). Great Egrets exhibited a secondary concentration of flights in the direction of Suisun Bay (Figure 8). In previous years over a range of tidal conditions, flights to and from the direction of Suisun Bay were observed for both species (Kelly et al. 2007b). Little movement was directed to and from the Marin County shoreline south of Marin Islands or southward toward the southern or central portions of San Francisco Bay. We emphasize that these flightlines represent foraging patterns only during one observation period and might differ considerably on other days or tides.

ACKNOWLEDGEMENTS

We thank Philip Greene, and Christine Rothenbach for valuable assistance in the field.. Giselle Downard of the San Pablo Bay National Wildlife Refuge was extremely helpful in coordinating access to the Marin Islands. We thank the Loch Lomond Marina in San Rafael for generously providing use of their boat launching facility.

REFERENCES CITED

- 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., and B. Fischer. 1998-2004. 1997-2004 heron and egret monitoring results at West Marin Island. Annual Reports to the San Pablo Bay National Wildlife Refuge.

Kelly, J. P., B. Fischer, and M. McCaustland. 2006-2008. 2005-2007 heron and egret monitoring results at West Marin Island. Annual reports to the San Pablo Bay National Wildlife Refuge.

Kelly, J. P., B. Fischer, and H. M. Pratt. 1994-1997. 1993-1996 heron and egret monitoring results at West Marin Island. Annual reports to the San Francisco Bay National Wildlife Refuge.

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(1): 18-27.