

HERON AND EGRET MONITORING RESULTS AT WEST MARIN ISLAND: 2010 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 on West Marin Island since 1979 and the annual reproductive success of Great Egrets and Great Blue Herons since 1993 (see REFERENCES CITED). Each year, nests are monitored during repeated visits, 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, 2007, 2008b).

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 described in detail in Kelly et al. (1996, 2006, 2007). In 2010, we mapped the locations of 27 focal Great Egret nests and 4 focal 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 four visits to East Marin Island (23 March, 13 April, 30 April, 1 June). Supplemental (approximately weekly) observations were made from a mainland vantage point on Dunfries Terrace above the Loch Lomond Marina.

On 1 June, we counted nests of all bird species nesting on West Marin Island—no herons or egrets nested on East Marin Island in 2010. As in other years, we counted nests from an 18-foot Boston Whaler by drifting and motoring slowly around the islands, from an anchored position on the northeast side of the 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 and 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 focal nests with young 5-7 weeks of age) by the estimated number of successful nests in the colony. The number of successful nests in the colony was estimated as the number of nests on the 1 June

census with young that had reached the minimum fledging age of 7 weeks, plus the number of nests that had not reached 7 weeks of age adjusted by the expected stage-specific survivorship of nests. This adjustment involved multiplying overall focal nest survivorship by the expected proportion of overall survivorship at each stage, calculated from intensively monitored nests at ACR's Picher Canyon Heronry, 1999-2005 (Kelly, unpublished data). Means are reported as \pm standard error (SE). For Great Blue Herons, we reported the apparent survival rate based on focal nests and productivity based on prefledging brood sizes in nests with young at least 5-7 weeks of age.

We also measured the directions of arrival and departure flights of all herons and egrets (primarily Snowy Egrets and Great Egrets), during a 2-hr observation period, from 13:15 to 15:15 on 1 June 2010, over a range of moderate tide levels approximately 2.2– 4.2 ft above MLLW. Additional flightline results are included in previous reports. 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, 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 arrival and departure flights.

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 1 June 2010.

| | Number of occupied nests | | | Total nests |
|---------------------------|--------------------------|------------|----------------|----------------|
| | West side | South side | Northeast side | |
| Great Egret | 0 21 | 43 | 64 | |
| Snowy Egret | 2 | 1 | 99 | 102 |
| Black-crowned Night-Heron | 2 | 4 25 | 31 | |
| Great Blue Heron | 0 0 8 | | | 8 |
| Western Gull | 19 14 | | 2 35 | |
| Black Oystercatcher | 0 | 1 | 0 | 1 ^a |

^a at least five adult oystercatchers were observed in the vicinity of the Islands.

Great Egret

On 1 June 2010, we counted 64 Great Egret nests, indicating four years of low nest abundance after a substantial decline from 126 nests in 2006 and 161 nests in 2005 (Table 2). Nest survivorship (percent of focal nests fledging at least one young) in 2010 was $85 \pm 5\%$, (std. error; $n = 27$ focal nests), suggesting a sharp increase in nests survival relative to 2008 and 2009 (Figure 1).

Based on 15 clearly observed broods, 2.13 ± 0.13 young were produced per successful nest ($n = 15$). This was slightly greater than in 2009 (2.0 ± 0 , $n = 18$) and also greater than in most other years (Figure 2).

We estimated overall reproductive success (number of young produced per nest attempt) as prefledging brood size adjusted by focal nest survivorship. IN 2010, Great Egrets fledged 1.82 young per nest attempt, suggesting a strong increase in overall reproductive success relative to recent years and also higher reproductive success than in most other years of study (Figure 3). This relatively high rate of success resulted primarily from an increase in nest survivorship (Figure 1), augmented by a slight increase in the number of young fledged from successful nests (Figure 2).

Despite relatively high reproductive success (Figure 3), the continuing low abundance of Great Egrets nests (Table 2) led to relatively modest production for the colony relative to most other years (131 ± 9 fledged young in 2010; Figure 4). However, more young were produced in the colony in 2010 than to the previous few years (Figure 4).

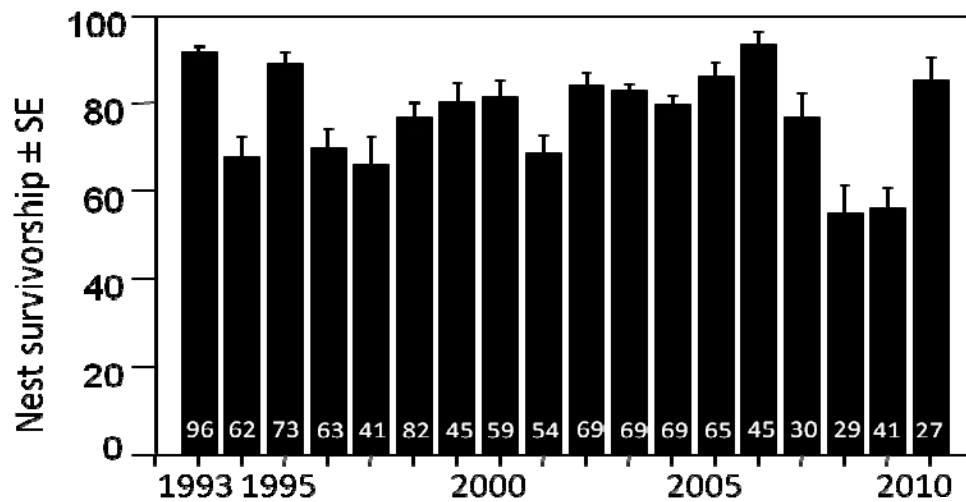


Figure 1. Annual percent survivorship \pm SE of Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

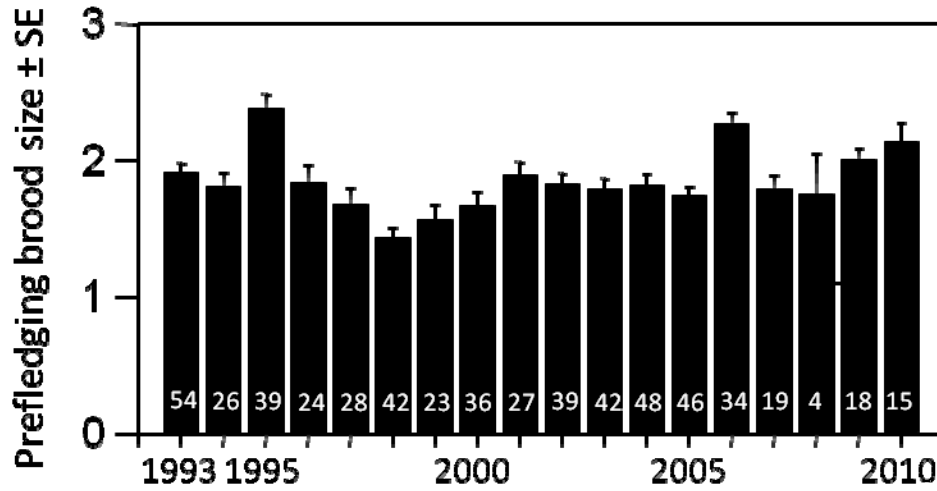


Figure 2. Mean \pm SE of annual prefledging brood size in successful Great Egret nests at West Marin Island. Numbers on the bars indicate sample size.

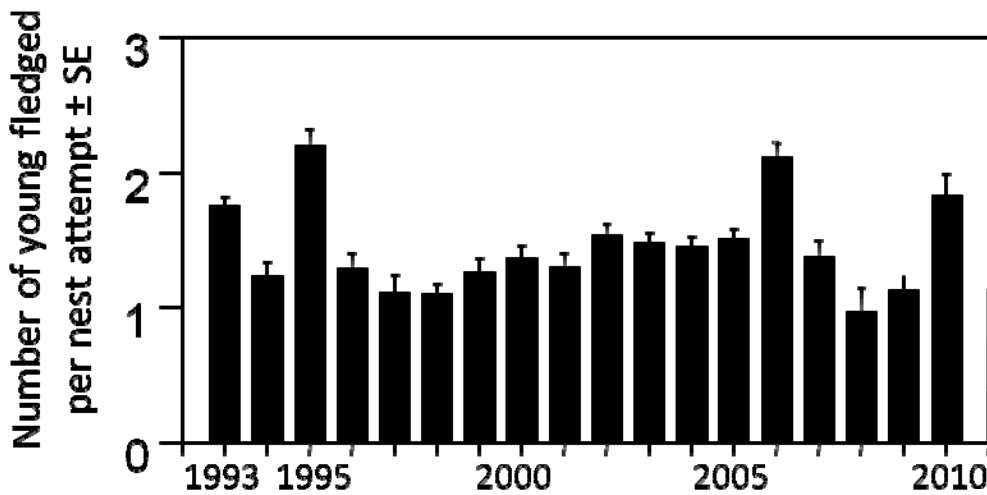


Figure 3. Overall reproductive success of Great Egrets (mean \pm SE young fledged per nest attempt) at West Marin Island, based on the prefledging brood size of successful nests adjusted for overall nest survivorship.

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 |
| 200 | 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 |

^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.

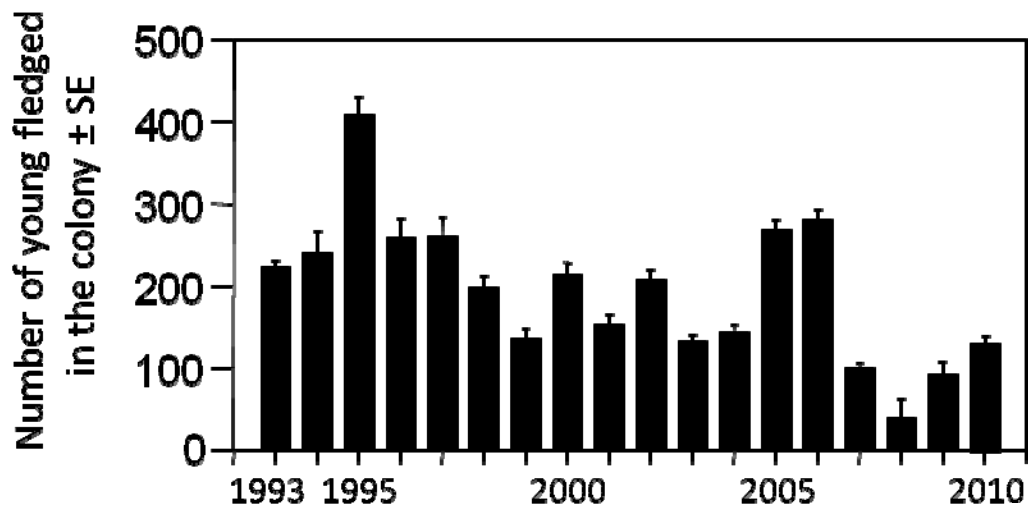


Figure 4. Annual productivity of Great Egrets (estimated number of young fledged in the colony \pm SE) at West Marin Island.

Snowy Egret

The number of Snowy Egrets nests on West Marin Island in early June 2010 (102 nests) declined by 42% compared to 2009 (175 nests), ending a three-year span of increasing nest abundance. The decline in the number of nesting Snowy Egrets at the Marin Islands in 2010 was slightly greater than the estimated regionwide decline, suggesting that loss of nest abundance at the Marin Islands was offset partially by a relative increase elsewhere in the region (Figure 5, top).

The estimated percent of nesting Snowy Egrets in the northern San Francisco Bay area that nested on West Marin Island decreased from 48% in 2009 to 38% in 2010 (Figure 5, bottom). In 1991-1992, approximately 90% of the known Snowy Egrets in region nested on the Island, followed by unusually low numbers in 1994-1995, apparently related to repeated disturbance by a juvenile Red-tailed Hawk (Kelly et al. 1995, Kelly and Fischer 1996), and a second decline in use in 2001-2004, apparently related to loss of shrub cover on the north side of the island and disturbance by predatory Common Ravens (Kelly and Fischer 2004b; Figure 5, bottom).

We emphasize that considerable annual variation in Snowy Egret nest abundance is apparent (Figures 5 top) and may partly reflect difficulty in detecting nests at inconspicuous locations. In addition, our results reflect only the number of active nests detected on

observation days 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, annual regional variation in nest numbers and differences between regional abundance and the number of Snowy Egret nests 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.

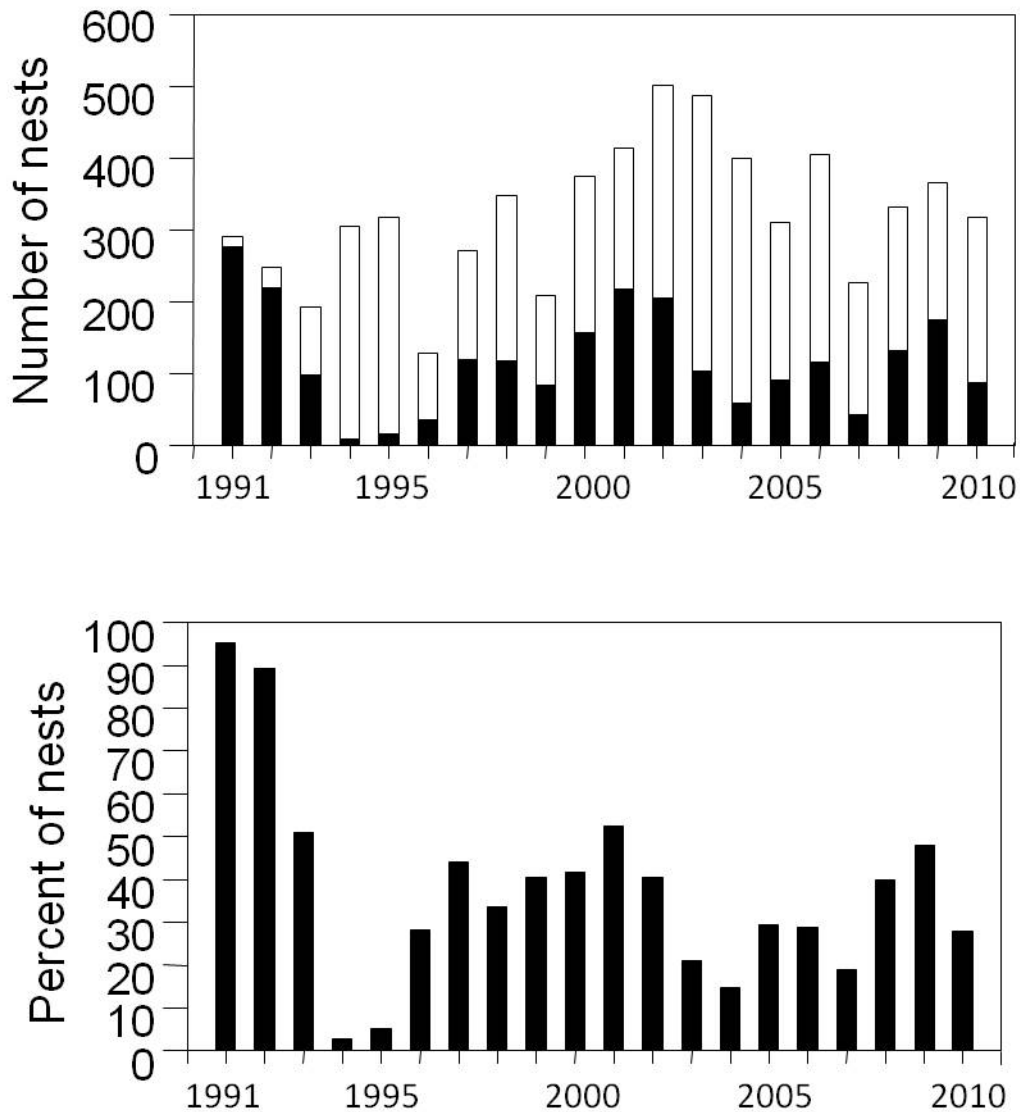


Figure 5. Annual number of Snowy Egret nests (top graph) at West Marin Island (solid bars) and at other colony known colony sites in the northern San Francisco Bay area (open bars), and the associated regional percent of nests that occurred at West Marin island (bottom graph).

Great Blue Heron

The peak number of active Great Blue Heron nests in 2010 was eight, observed on 1 June (Table 2). All eight nests were on West Marin Island. We followed the fates of four focal nests and all of them successfully raised at least one young to minimum fledging age (8 weeks). The number of young produced in successful nests could be estimated for only two of the nests, one of which produced two young and one produced one young.

Black-crowned Night-Heron

The estimated number of active Black-crowned Night-Heron nests on 1 June, 2010, was 31, suggesting approximately half the nesting abundance estimated in 2009 (63; Table 2). Boat-based counts of Black-crowned Night-Heron nests suggest that numbers have fluctuated considerably among years, but the absence of an overall trend suggests dynamic but generally stable use of the West Marin Island over the last 20 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) 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 that as many as 167 Black-crowned Night-Heron nests could have been established in 2010.

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). Nest disturbance by the resident ravens was observed, resulting in behavioral responses by nesting birds, but we did not quantify the extent to which nest losses resulted from predation by ravens. However, nest

mortality among focal Great Egret and Great Blue Heron nests was low. Rates of nest mortality and nest predation in other heron or egret species are unknown. No fledgling ravens were observed on 1 June, but four ravens occupied the colony simultaneously on 3 July, suggesting that the resident pair fledged at least two young.

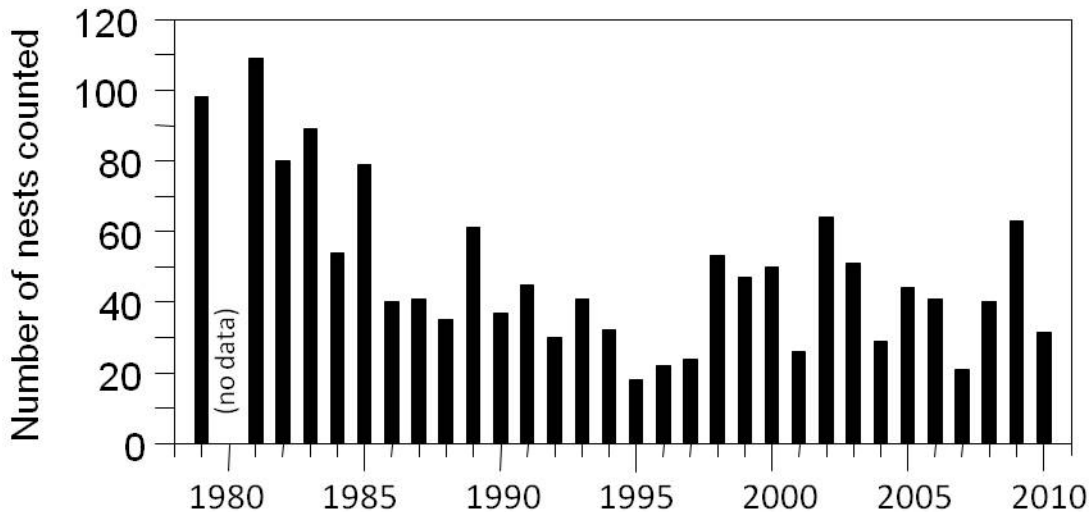


Figure 6. Number of Black-crowned Night-Heron nests counted during annual surveys of West Marin Island. See text regarding overall nest abundance.

Other Species

On 1 June, we observed a Black Oystercatcher nest with two adults and two chicks on the south side of West Marin Island. There were also at least five other adult oystercatchers in the vicinity of the Marin Islands, suggesting, as in recent years, the presence of additional nesting pairs. As in 2008 and 2009, an adult male Harlequin Duck occupied the waters and shorelines of the Marin Islands through the nesting season.

Flightlines

As in previous years (Kelly et al. 2010), we quantified the angles of arrival and departure flights from the heronry. In 2010, we observed many fewer arriving or departing birds, with a total of 38 Great Egret flights (50 in 2008, 58 in 2009) and 10 Snowy Egret flights (30 in 2008, 49 in 2009). Approximately half of the observed Great Egret flights were arriving from or

departing to the area north of West Marin Island, and about half were oriented to or from southeast Figure 7). Snowy Egret flights were more concentrated to the southeast than were those of Great Egrets (40% of observed flights). The remaining Snowy Egret flights were in variable directions, with approximately 20 percent of the total flights to the north and a small

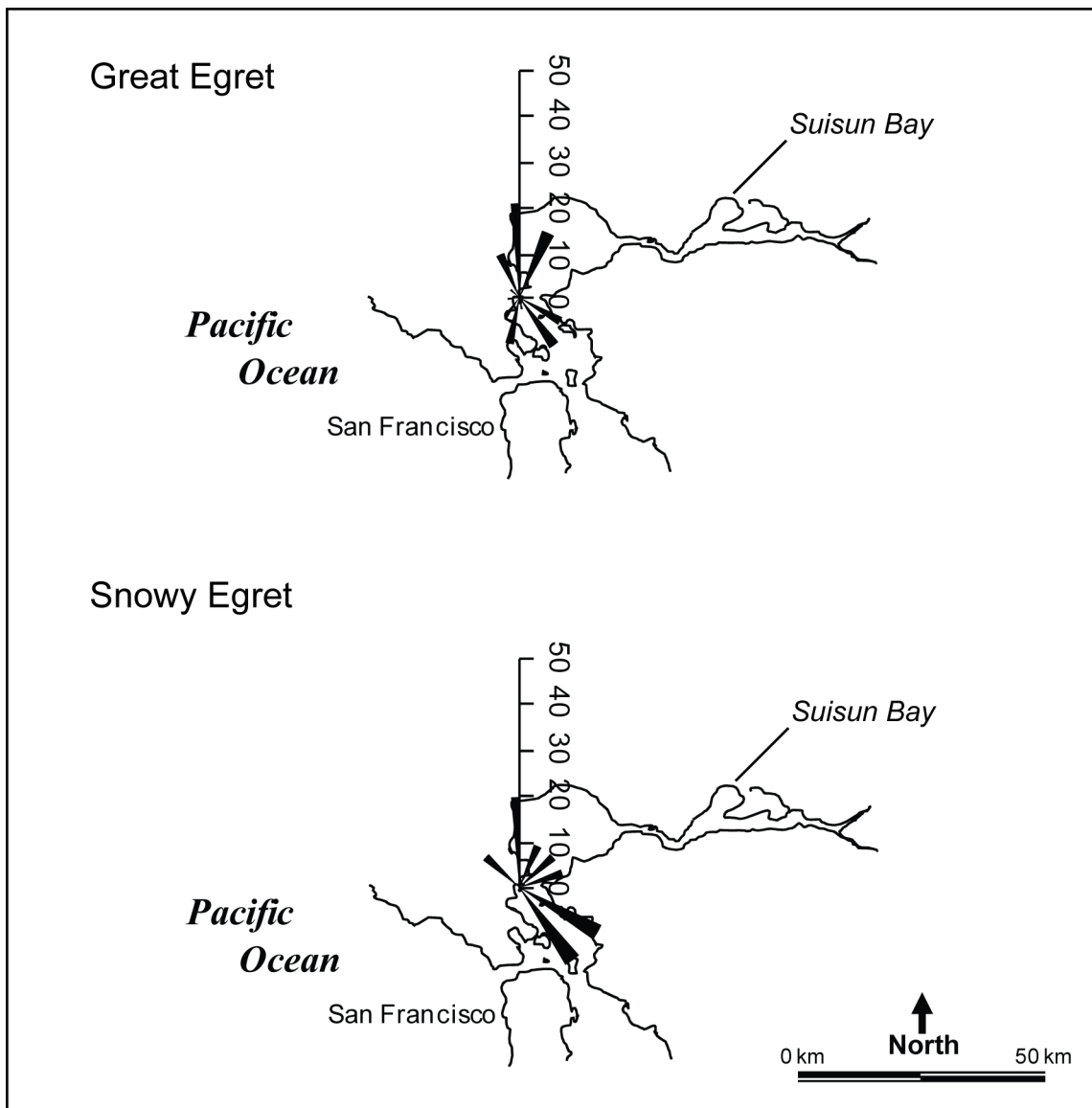


Figure 7. Angular distribution of arrival and departure flights (pooled) of Great Egrets ($n = 38$) and Snowy Egrets ($n = 10$) at West Marin Island, by percent of flights among 16 compass sectors. Flights were observed from 13:15 to 15:15 on 1 June 2010, over a tide range of approximately 2.2– 4.2 ft above MLLW (rising, based on NOAA tide predictions for Point Orient, 4.3 km west of Marin Islands).

proportion to the northwest and northeast. Small sample sizes for both species, Snow Egrets in particular, make it difficult to identify a trend in the direction of flights in 2010.

Northerly flights are likely to correspond to feeding areas in the Petaluma Marsh, the western shore of San Pablo Bay, and Suisun Bay and are consistent with observations made at other tide levels in previous years (Kelly et al. 2010; Figure 7). Birds making southerly flights may be heading toward foraging grounds on the Marin County shoreline south of Marin Islands and the southern or central portions of San Francisco Bay. We emphasize that these flightlines represent foraging patterns observed during a single period and might differ considerably from flights observed on other days or tides.

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