Long-term Studies of Seabirds on Año Nuevo Island and Mainland, 2003

Final Report to the Monterey Bay National Marine Sanctuary –
Sanctuary Integrated Monitoring Network








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Executive Summary

The year 2003 represents the 11th year of monitoring seabirds on Año Nuevo Island (ANI). Rhinoceros Auklet, Brandt's Cormorant, and Western Gull populations increased from 2002 to 2003, to the highest levels yet recorded for ANI. Reproductive success, however, has been variable. Rhinoceros Auklets banded as chicks in nest boxes earlier in our project are now recruiting into the ANI breeding population, providing novel information on age-at-first-breeding, immigration and recruitment rates for this species worldwide. Auklet diet reveals a shift from an anchovy-based diet in the 1990s to rockfish-based diet in recent years, corresponding to a shift in ocean climate in 1998-1999. We continue to provide scientific advice to the California Department of Fish and Game (CDFG) on how to manage fisheries from an ecosystem perspective. Most recently, we reviewed the draft Market Squid Fishery Management Plan and provided recommendations to protect squid as one of the primary prey resources for marine birds and mammals in the MBNMS. Future monitoring should include analyses of food habits of other seabirds of the MBNMS.

Introduction

Several new seabird colonies have been established in the last decade in central coastal California. Año Nuevo Island (ANI) is the largest and most diverse seabird breeding colony in the Monterey Bay National Marine Sanctuary (MBNMS), hosting breeding populations of Rhinoceros Auklets (*Cerorhinca monocerata*), Cassin's Auklets (*Ptychoramphus aleuticus*), Brandt's Cormorants (*Phalacrocorax penicillatus*), Pelagic Cormorants (*P. pelagicus*), Western Gulls (*Larus occidentalis*), Pigeon Guillemots (*Cepphus columba*) and Black Oystercatchers (*Haematopus bachmani*). Additionally, ANI is an important roosting site for Heerman's Gulls (*Larus heermani*) and the endangered Brown Pelican (*Pelicanus occidentalis*). Other species that have occurred on ANI include state-listed Ashy Storm-Petrels (*Oceanodromo homochroa*) and Fork-tailed Storm-Petrels (*O. furcata*).

There are several threats to marine bird populations of the MBNMS. Environmental variability (e.g., climate change) and a variety of human factors (e.g., bycatch and indirect effects from commercial fisheries, oil and pesticide pollution) affect seabird populations in this region. We have initiated what we hope will be long-term (i.e., multi-decadal) studies of breeding seabird population dynamics, demography and prey use in the MBNMS, with an emphasis on ANI. Such information will provide valuable insights into changes of these upper-trophic level predators in central California and help marine wildlife managers develop appropriate conservation strategies.

Results and Discussion

<u>Population dynamics</u>

Rhinoceros Auklets totaled approximately 270 breeding birds in 2003 (**Figure 1**). Brandt's Cormorant and Western Gull populations on the island numbered ~ 1740 and ~2370 birds, respectively (**Figure 2**). Population growth for these species in 2003 was likely due to the recruitment of many young born in 1999, which was an extremely productive year.

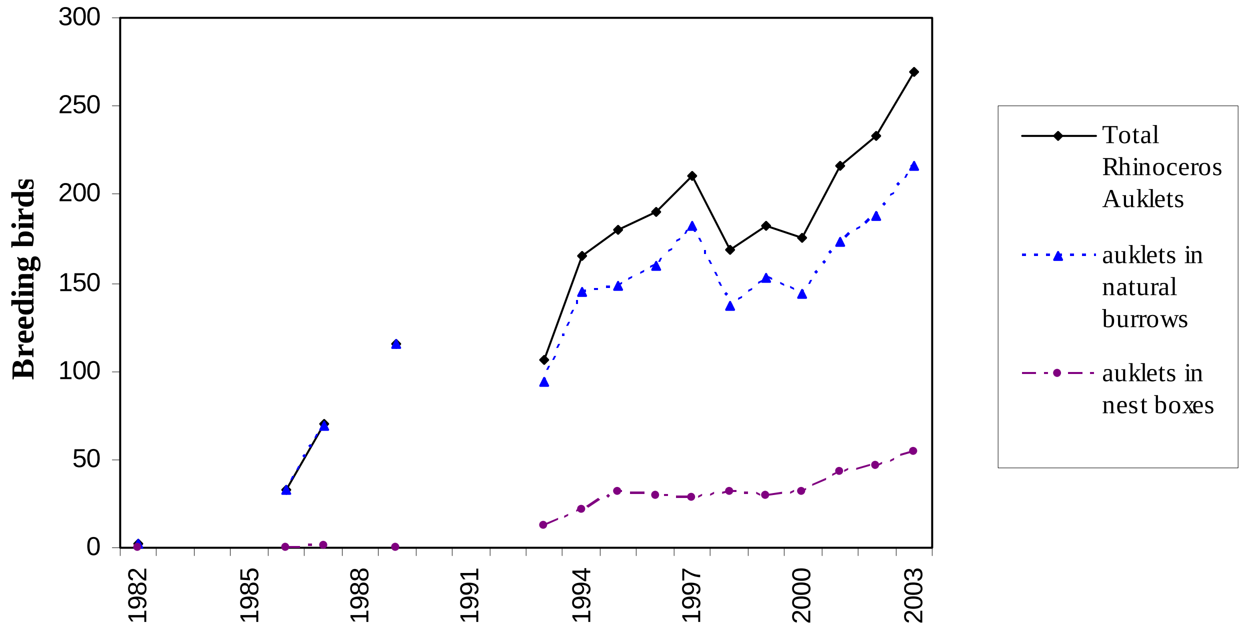

Figure 1. Population dynamics of Rhinoceros Auklets on Año Nuevo Island over 21 years, 1982-2003. Data in 1982 from LeValley and Evens (1982), 1986-1987 from Lewis and Tyler (1987), and 1989 from Carter et al. (1992), all adjusted with PRBO burrow occupancy correction factor.

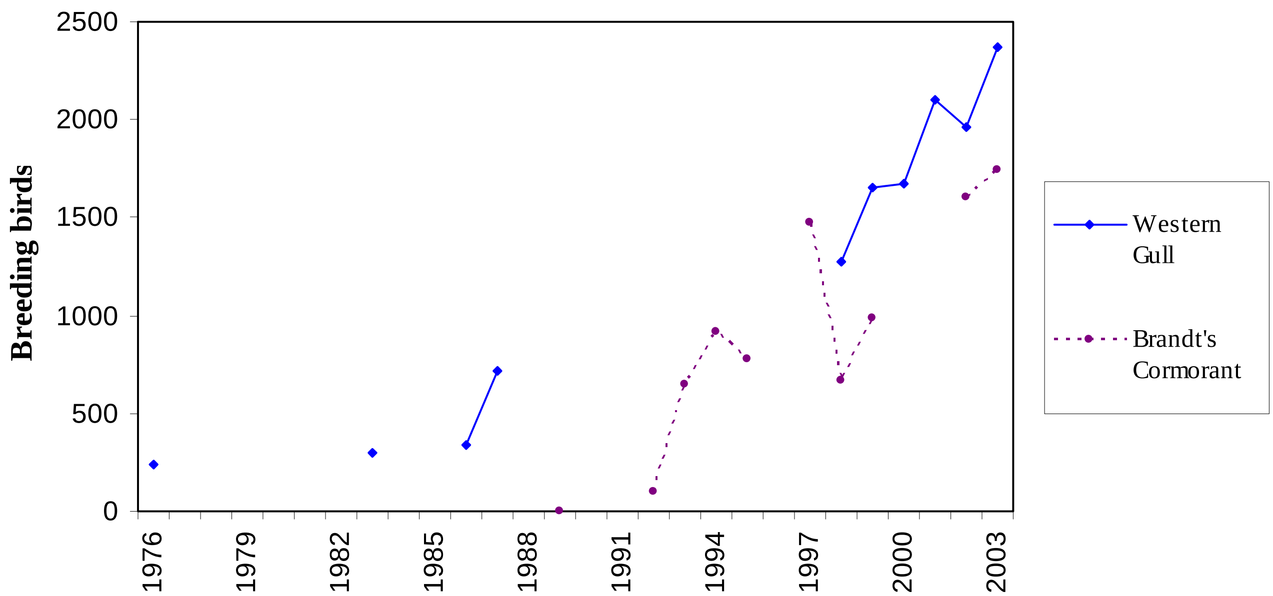

Figure 2. Population dynamics of Western Gulls and Brandt's Cormorants on Año Nuevo Island, 1976-2003. Western Gull data in 1976 from Briggs' survey in Sowls et al. 1980, 1983 and 1987-1987 from A. Huntley/ pers. comm. in Lewis and Tyler (1987). Brandt's Cormorant data in 1989 from Carter et al. (1992). Cormorant nests in 1992-1999 were counted from aerial photographs courtesy of M. Lowry (NMFS/NOAA).

As in 2002, there were 90 breeding Pelagic Cormorants in 2003 on ANI (**Figure 3**). Pelagic Cormorants also nest on cliffs near Año Nuevo Point. This mainland population decreased from an estimated 40 – 105 nests in 1970 (Sowls et al. 1980, Lewis and Tyler 1987) to 10 nests in 2000, but is now increasing, having reached 28 nests in 2003. The Pigeon Guillemot population on ANI remained fairly stable at ~ 36 birds, as did the new Cassin's Auklet population at ~ 28 birds. There were ~ 20 Black Oystercatchers breeding on ANI in 2003.

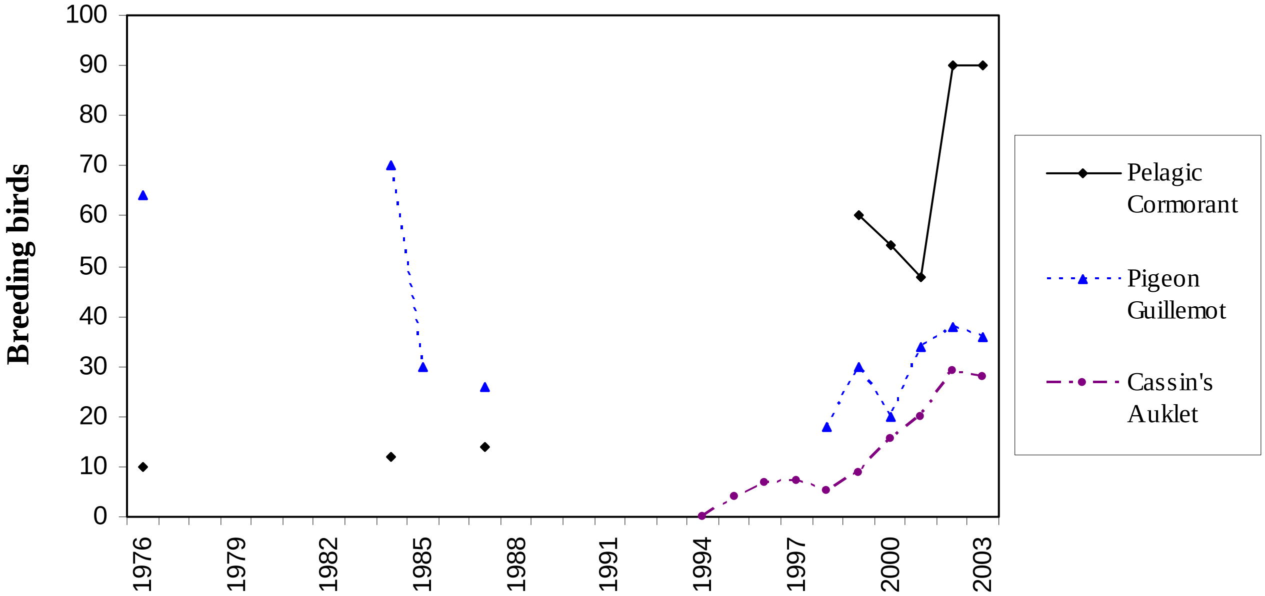

Figure 3. Population dynamics of Pelagic Cormorants, Pigeon Guillemots and Cassin's Auklets on Año Nuevo Island, 1976-2003. Pelagic Cormorant data in 1976 from Briggs' survey in Sowls et al. (1980), 1984 from A. Huntley pers. comm. in Lewis and Tyler (1987), and 1987 from Lewis and Tyler (1987). Pigeon Guillemot data in 1976 from Briggs' survey in Sowls et al. (1980), 1984-1985 from A. Huntley, pers. comm. in Lewis & Tyler (1987), and 1987 from Lewis & Tyler (1987).

Marine bird species that use ANI for a roost site include Heerman's Gulls and Brown Pelicans. One Heerman's Gull pair bred on ANI between 1994–1996. The Heerman's Gull population breeds almost entirely on Rasa Island in the Gulf of California (Harrison 1983). One adult was observed at the historic nest site on ANI from April till June in 2003, but did not breed. Groups of roosting Heerman's Gulls were present on ANI between June and August, with a maximum of 47 adults and 1 juvenile in late July.

In 2003, a maximum of 436 Brown Pelicans were observed roosting on ANI on 21 April. Brown Pelicans breed off southern California and Baja California. This peak number was 50-90% lower than many previous years of our study, and occurred very early in the season. This could be an indication of early failed breeding attempts at colonies in southern California and Baja.

Reproductive Success

Productivity (chicks fledged per pair) in 2003 was lower than in 2002 for all species except Pelagic Cormorants breeding on the mainland. Overall productivity of Rhinoceros Auklets was low in 2003 at 0.55 chicks per pair (s.d. 0.50, n = 126; **Figure 4**).

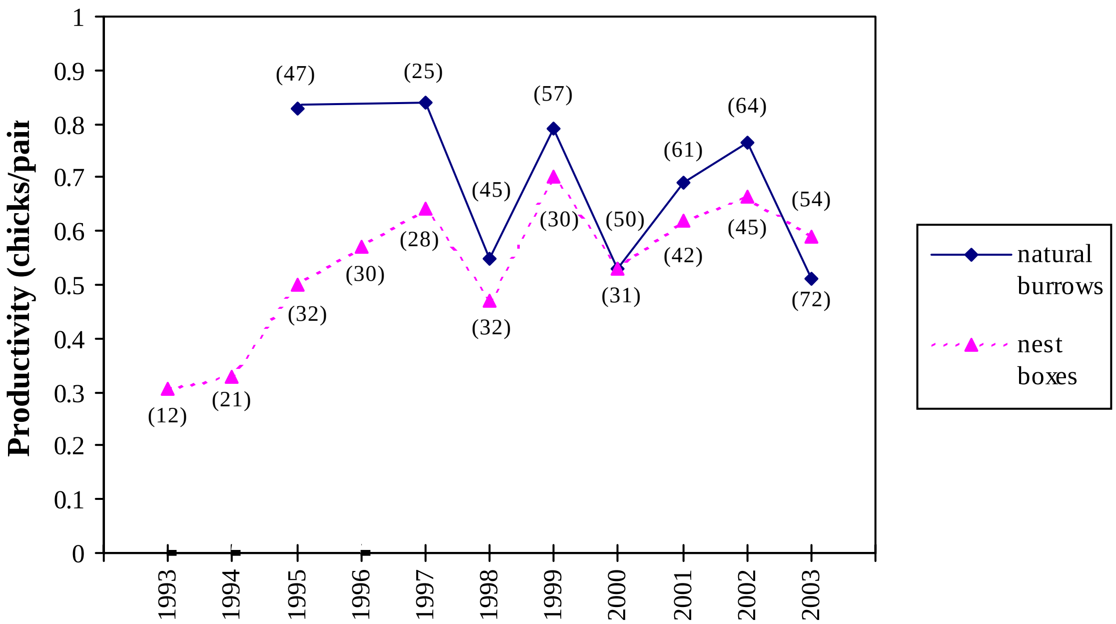

Figure 4. Reproductive performance of Rhinoceros Auklets on Año Nuevo Island, 1999-2003. Rhinoceros Auklets lay one-egg clutches. Data reflect first attempts only; egg re-lays after the first clutch was lost were excluded. Low productivity in nest boxes in early years of our study likely reflects the recruitment of young, inexperienced birds into the boxes; once population age structure evened out between natural burrows and boxes, productivity in boxes became more representative of the whole population.

Brandt's Cormorant productivity was also low at 0.57 chicks/pair (s.d. 0.95, n = 53; **Figure 5**). Black Oystercatchers experienced complete breeding failure (n = 5), influenced by Common Raven disturbance and possible predation. Pelagic Cormorant reproductive success on ANI was low at 1.07 chicks/pair (s.d. 1.01, n = 43) and somewhat higher on the mainland (1.31 ± 0.97, n = 26). This is in contrast to 2002, when mainland productivity was extremely low (0.14 ± 0.35, n = 22), likely influenced by Common Ravens. Pigeon Guillemot productivity was also low, at 0.64 chicks per pair (s.d. 0.50, n = 11; **Figure 6**). Cassin's Auklet productivity was 0.67 chicks/pair (s.d. 0.50, n = 9), while Western Gulls fledged 1.06 chicks per pair (s.d. 0.98, n = 31; **Figure 6**).

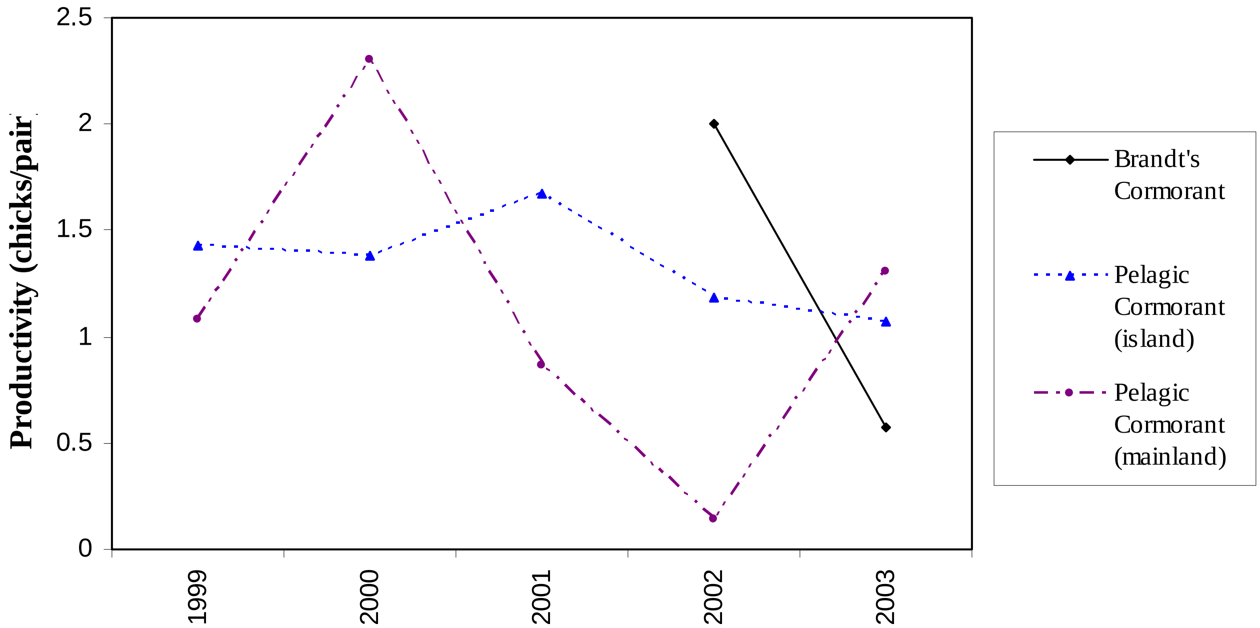

Figure 5. Reproductive performance of Brandt's and Pelagic Cormorants on Año Nuevo Island, 1999-2003. Cormorants can lay five-egg clutches. Data reflect first attempts only; egg re-lays after the first clutch was lost were excluded.

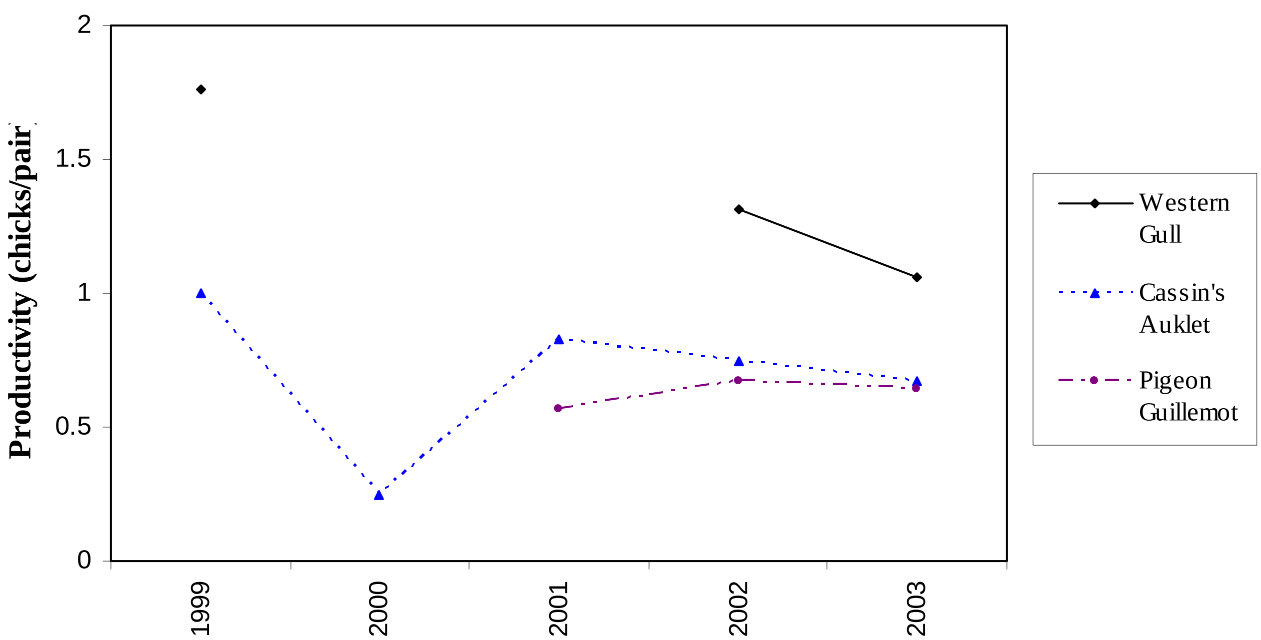

Figure 6. Reproductive performance of Cassin's Auklets, Pigeon Guillemots and Western Gulls on Año Nuevo Island, 1999-2003. Cassin's Auklets lay one-egg clutches, but have been known to raise two broods in some years (double-brooding). Pigeon Guillemots can lay two eggs/clutch, and Western Gulls can lay three eggs/clutch. Data reflect first attempts only; egg re-lays after the first clutch was lost were excluded. For Cassin's Auklets, however, double-broods were included.

Environmental variability and predator pressure influence reproductive performance. We are currently working on a publication evaluating seabird productivity on ANI in relation to ocean climate and prey resources. ANI seabirds experience predation by Common Ravens (*Corvus corax*) and Peregrine Falcons (*Falco peregrinus*). Common Ravens were seen during every visit to ANI in 2003 (n=24 visits, 48 observations of ravens); raven nesting was documented on a mainland cliff near the Pelagic Cormorant colony. Raven activity has increased every year since 1998 when they were first seen on ANI. In 2003, ravens were seen harassing Black Oystercatchers on 19 occasions and Pelagic Cormorants on 3 occasions. Peregrine Falcon predation on Rhinoceros Auklets has been documented since 1993; in some years ~10% of the population is killed by falcons. We are currently modeling effects of predation on auklet survival at ANI and other colonies.

<u>Auklet Juvenile Recruitment</u>

We monitored Rhinoceros nest boxes in 2003 to investigate recruitment of young birds into the breeding population. This year marks the seventh year that auklets originally reared on ANI have returned to their natal colony. To date, 39 auklets banded as chicks have been recaptured as adults. A total of 17 have reproduced in nest boxes, including one born on Southeast Farallon Island, 90 km to the north. The return of Rhinoceros Auklet chicks born in nest boxes demonstrates success of our nest box program.

Rhinoceros Auklet age at first breeding ranged from 3 to 7 years of age (**Figure 7**). As more banded juveniles recruit into the breeding population, we will investigate rates of juvenile/subadult survival. These estimates of age at first breeding, immigration and recruitment are the first for this species worldwide, and will form the basis for modeling the health and viability of this and other Rhinoceros Auklet populations in the future.

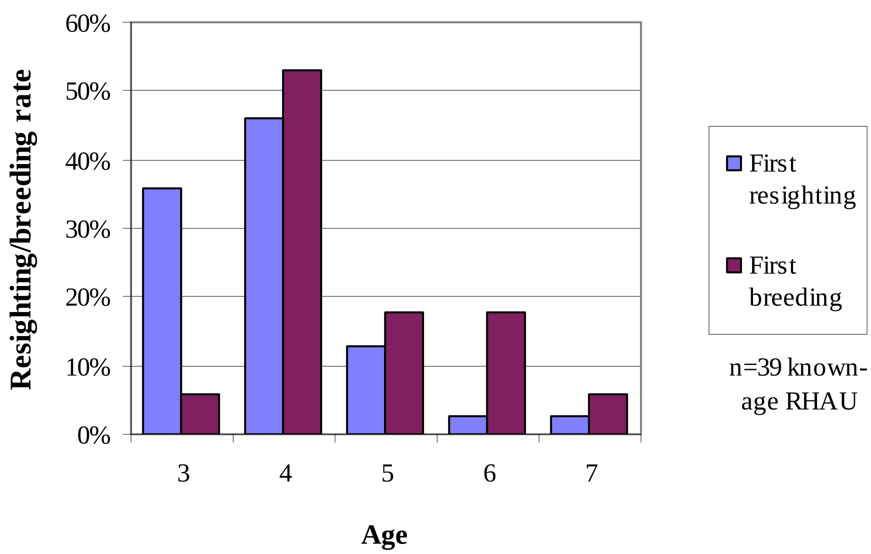

Figure 7. Age at first resighting and first breeding for juvenile Rhinoceros Auklets on Año Nuevo Island, 1997-2003.

Marine Bird Diet

We collected and archived diet samples Rhinoceros Auklets, Pelagic Cormorants, and Brandt's Cormorants in 2003, adding to our long-term databases of marine bird food habits.

Rhinoceros Auklet diet on ANI reveals a shift from an anchovy-based diet in the 1990s to a juvenile rockfish-based diet in recent years (**Figure 8**). This change corresponds with a theorized climate regime shift of 1998-1999 (Peterson and Schwing 2003). However, during the weak El Niño event of 2003, the main prey species rockfish (*Sebastes* spp.) and anchovy (*Engraulis mordax*) were likely not available, forcing auklets to switch to other prey as observed in previous warm-water years. In 2003, auklets found a pulse of lipid-rich juvenile chinook salmon (*Oncorhynchus tshawytscha*) in late June, but also fed on lipid-poor Pacific saury (*Cololabis saira*) for much of the summer.

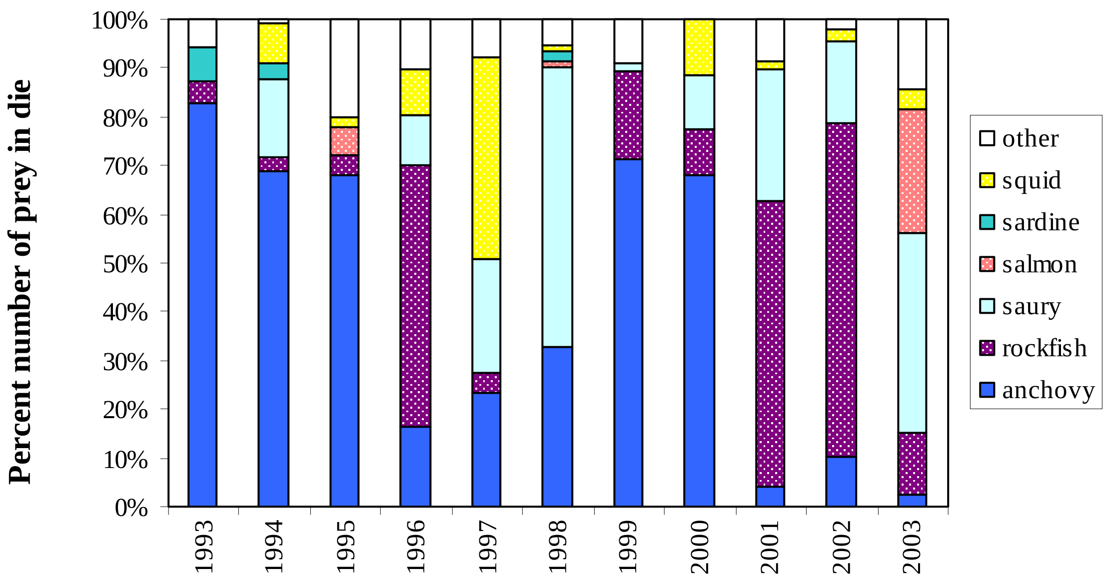

Figure 8. Percent number of prey species in Rhinoceros Auklet chick diet on Año Nuevo Island over 11 years, 1993-2003.

In 2003, 614 regurgitated Brandt's Cormorant pellets and 323 Pelagic Cormorant pellets were collected from January – March and August - December. Funding is required to analyze prey remains in these pellets. Overall, little is known about the diet of these species, especially during breeding, with only a handful of papers in existence (e.g., Ainley et al. 1981, Zelenskaja 2001). Diet and prey availability influence seabird reproductive success (Decker et al. 1995, Sydeman et al. 2001, Takahashi et al. 2001) and population dynamics (Anker-Nilssen et al. 1997, Kuletz et al. 1997). Thus, understanding prey resource availability and use by seabirds is critical to conservation and management decisions.

Fisheries Interactions

In 2003 as in earlier years, we participated in meetings hosted by the California Department of Fish and Game (CDFG) to develop new fishery management plans. Our overarching goal is to represent the ecological needs of marine birds and mammals in these meetings. We also prepared policy statements for the California Fish and Game Commission concerning the effects of various fisheries on seabirds in central California. According to California's Marine Life Management Act (MLMA) and the federal Magnuson-Stevens Act, these fisheries must be managed from an ecosystem perspective, meaning that there must be protection afforded ecologically-dependent species, such as seabirds.

We participated in the Squid Research Scientific Committee and recently reviewed the Market Squid Fishery Management Draft Plan. Although market squid (*Loligo opalescens*) are an important part of marine bird and mammal diet (Baltz and Moorejohn 1977, Lowry 1999), provisions in this draft plan do not adequately protect this prey resource in the MBNMS. Additionally, the preferred alternative in the draft plan concerning fishing closures neglects seabird colonies south of Pillar Point, such as ANI, where squid fishing may become concentrated after closures in northern areas. Bright lights used in this fishery at night may illuminate parts of breeding colonies making seabirds more vulnerable to predators, or may disorient birds as they fly to and from colonies, resulting in collisions with the boats (Anderson et al. 2001). Night lighting has resulted in nest abandonment and low reproductive success for seabirds in southern California (F. Gress, pers. comm.).

Conclusions

In the past 5 years, marine bird populations have increased on ANI yet reproductive success has been variable. Through these studies, we have gained valuable new information on survival, recruitment and immigration, demographic processes that are important to better understand seabird population dynamics. Prey is also key to population dynamics, but highly variable due to climate change and at risk from certain fisheries. Sustained time-series of marine bird population trends, productivity and prey use are valuable for tracking long-term changes in community and ecosystem health.

Future work should involve analysis of cormorant diet. Analyses of ANI seabird population dynamics, reproductive success and prey use in relation to other colonies would also be beneficial to understand how populations of these species in the MBNMS compare to the dynamics of these populations elsewhere.

Acknowledgements

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