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STATUS OF SEABIRDS ON SOUTHEAST FARALLON ISLAND DURING THE 2010 BREEDING SEASON

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INTRODUCTION

PRBO Conservation Science biologists, in partnership with USFWS and the Farallon National Wildlife Refuge, have monitored the population size and reproductive success of seabirds on Southeast Farallon Island (SEFI) continuously since 1971. We also collect information on survival, phenology (timing of breeding), chick growth, environmental conditions (weather and sea surface temperature) and prey use (diet composition). These long-term data give us a unique ability to examine trends over multiple time scales and look at variability in the context of long-term patterns and trends.

This status report contains general information on the reproductive performance and population trends of seabirds on Southeast Farallon Island (SEFI; Farallon National Wildlife Refuge) and West End Island (WEI), California, during 2010. We monitored twelve species: Ashy Storm-petrel, Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Western Gull, California Gull, Black Oystercatcher, Common Murre, Pigeon Guillemot, Tufted Puffin, Rhinoceros Auklet, and Cassin's Auklet. We determined reproductive performance for nine of these species by monitoring nest sites from initiation until chick fledging. Productivity (number of chicks fledged per pair) was determined for first attempts and for all attempts (including first attempts, relays, and second-broods). We compared productivity for all attempts to values from the previous season as well as to the long-term average for each species. Due to inaccessibility of Puffin crevices and California Gull nest sites and poor visibility of Double-crested Cormorant nesting areas, no reproductive data were collected for these species.

WEATHER AND OCEAN

Oceanic conditions during 2010 appeared to be favorable for overall high productivity. Monthly sea-surface temperatures (SST) at the Farallones were moderately warm through April, likely due to the influence of a weak El Niño that lingered into the spring. Another signal of the El Niño pattern was the persistence of southerly storm systems into late May. These storms produced late rains and may have contributed to delayed breeding for some species. However, as these conditions waned and upwelling increased, SST dropped and remained cool for the rest of the season.

The mean seasonal SST from March to August was approximately 0.2°C warmer than last season but still cooler than the long-term average of 11.95 °C for these months. Generally, relatively cool SSTs are correlated with greater ocean productivity in this area and higher reproductive success for seabirds. Although ocean conditions were not as cool as in previous productive seasons, moderate to strong northwesterly winds during the spring and summer allowed strong and productive upwelling along the coast. As a result, there was high primary productivity, euphausiids were abundant throughout the season, and some forage fish species (particularly juvenile rockfish) were plentiful around the island.

Juvenile rockfish was once again abundant in chick diet while anchovy were almost entirely absent. Rockfish comprised greater than three-quarters of the diet for Common Murres, the highest proportion of rockfish observed since 1987. They were also comprised more than half of the prey items delivered for Pigeon Guillemots and Rhinoceros Auklets. A high proportion of rockfish in the diet typically correlates with greater reproductive performance. This certainly seemed to be the case in 2010 as those species able to take advantage of the abundant rockfish had very high productivity. Also, when rockfish are abundant they tend to be close to the island, thereby lessening the effort required to obtain them. Feeding rates were among the highest we have observed for murres and guillemots and the total number of feedings observed was almost six times greater than last season. This suggests that foraging adults were able to quickly locate prey and make frequent short trips to provision dependent offspring. Sculpins, flatfishes, lingcod and saury also contributed to the diet of auklets and guillemots, though in much smaller proportions. Anchovies, which had been the most important component of chick feedings for murres and auklets between 2002 and 2008, were scarce this season. They comprising less than 3% of murre diet and less than 0.5% of auklet diet. This lack of anchovy in the diet did not have a significant impact on productivity for most species, but may have had negative consequences for Brandt's Cormorants and possibly Western Gulls which did not seem to be able to take advantage of the abundant rockfish stocks.

REPRODUCTIVE PERFORMANCE

Seabirds on SEFI had their greatest reproductive performance since 2004 with most species exhibiting higher productivity in 2010 relative to last season. Cassin's Auklets, Common Murres, Pigeon Guillemots, Rhinoceros Auklets and Pelagic Cormorants all had exceptionally high productivity (Fig.1). Brandt's Cormorants had low productivity but increased over the previous two seasons and Ashy Storm-petrels were equal to last year. The only species to have a decline in productivity were Western Gulls, which suffered the lowest productivity ever recorded on SEFI (Fig. 1).

Cassin's Auklets exhibited unprecedented productivity this season. The number of chicks fledged per breeding pair was more than double the long-term mean productivity and the highest ever recorded for this species anywhere within its range. This exceptionally high productivity was likely due to extremely abundant prey resources (primarily euphausiids) and a very high rate of double brooding. Cassin's Auklets are the only alcid capable of successfully fledging multiple broods in the same season, and they only do this in an extremely limited portion of their range. During 2010, 75% of all sites that successfully fledged a chick attempted a second brood. Seventy-five percent of those sites that attempted a second brood successfully fledged a second chick. The rate of double brooding and the extremely high success of double broods are also the highest ever recorded. Abundant krill allowed chicks to grow quickly and fledge at relatively heavy weights.

Reproductive success of COMU was also among the highest observed for this colony. As noted above, murres seemed to thrive on the abundant rockfish available this season. This is a sharp contrast to last season when, even though rockfish were the dominant prey item delivered, feeding rates were low and productivity was among the lowest in the time series. There were no cases of egg or chick abandonment this season and chicks appeared to be growing quickly and fledging in good condition. As usual, the USP study plot had the highest productivity of the four study plots followed on the island. The Upper Upper plot had lower success due in large part to a higher rate of egg loss resulting from Common Raven and Western Gull disturbance at this colony.

Rhinoceros Auklets and Pigeon Guillemots also had increased breeding success. For RHAU, 2010 was the highest reproductive performance in over 20 years and third

highest on record. Pigeon Guillemots had their greatest success since 2004 and many sites were able to fledge both chicks in the brood. As with all the alcids, fledging success was exceptionally high and chicks were leaving the nest site in good condition.

Brandt's Cormorants suffered low reproductive success again in 2010, their third consecutive year of poor productivity (Fig. 1). Although conditions improved over the complete reproductive failure seen in 2009, breeding propensity remained low and overall nest success was poor. In contrast, Pelagic Cormorants had very good productivity, the highest since 2004 and were well above the long-term mean. The causes of this disparity are unclear. The lack of anchovies and other larger forage fish likely caused reduced breeding effort and success for Brandt's Cormorants. Pelagic Cormorants may have been able to exploit different prey resources, such as juvenile rockfish and sculpin, which may not have been available for Brandt's due to differences in their foraging habits. In contrast to the Farallones and other central California colonies, Brandt's Cormorants nesting farther north (northern California and Oregon) or south seemed to have moderate to high breeding success, suggesting that localized prey depletion may still be affecting this region.

Productivity of Western Gulls further declined during 2010 and was the lowest ever observed (Fig. 1). High rates of intraspecific predation and high chick mortality coupled with low food availability likely led to the overall poor success. As mentioned above, prey may have been abundant in the area but simply not readily accessible to surface feeders.

POPULATIONS

Population size was estimated for all species except Ashy Strom-petrels and Rhinoceros Auklets and is presented in Fig. 2. Breeding population sizes were higher than the 2009 estimates for all species except Cassin's Auklets. Population increases ranged from 8% for TUPU to 300% for BRCO when compared to last season.

Farallon Cassin's Auklets declined considerably since the early 1970's (Fig. 2). The current population is now less than one-quarter of the population estimate made in 1972 and less than half the population estimated during 1989. This population suffered high mortality during the strong 1997/1998 El Niño event and reached its lowest

abundance (10,458 birds) in 1998. Between 2001 and 2004, the population was increasing, but declined again during 2005 and 2006, coinciding with reduced breeding effort and lower reproductive success. The burrow counts for 2010 were 10% lower than in 2009, indicating a continuing downward trend for this population. Recent analyses of the trends in burrow density in our index plots indicate an overall population decline of 2.4% per year since 1991; though there have been varying periods of growth and decline (PRBO unpublished data). It is unknown why the population dipped this season given favorable oceanic conditions and high nest box occupancy. The largest declines in burrow density were in areas on the marine terrace where vegetation was dense late into the season. This may have made it difficult for auklets to burrow in these areas and forced them to use more crevices or nest boxes.

Historically, the Common Murre population on the Farallones was estimated to be between 400,000 and 1 million birds, but egg collecting, oiling, gill net entanglement and human disturbance drastically reduced these numbers. However, murres have recovered substantially since the islands became a refuge and SEFI is currently the largest colony in California. Favorable oceanographic conditions and abundant prey, coupled with relatively strong reproductive success and probable elevated juvenile has led to incredible population growth since 2000. Due to the large number and high density of murres, we are no longer able to conduct a full island census. Instead, we estimate the population trend based on the relative change in the numer of birds counted in a series of index plots established around the island. The counts from this season indicated a 12% increase in murre numbers this year when compared to 2009. This is roughly equivalent to the average annual rate of increase in our index plot counts over the past decade. The apparent increase observed this season is likely due to favorable foraging conditions leading to greater breeding propensity and possibly a greater proportion of birds attempting to breed for the first time.

Pigeon Guillemot numbers have also been increasing of the last decade based on morning raft counts and were the highest ever recorded during 2010. Occupancy of monitored PIGU crevices was high in 2010 (75%) when compared to previous years suggesting a greater breeding effort in concordance with the increased population estimate. It is difficult to contrast these results with historic estimates since our methods

have changed, but the current population is likely the highest it has been since PRBO began monitoring this species in the 1970's.

The Brandt's Cormorant breeding population declined substantially during the 1980's and 1990's but then began to recover and was expanding rapidly between 1999 and 2007. However, this population crashed following the 2007 season and the 2009 population estimate was the lowest ever recorded for the Farallones (Fig. 2). Although there was a greater breeding effort during 2010, the overall population remained low; roughly 25% of the population from 2007. It is likely that much of the apparent decline was a result of birds either skipping breeding due to unfavorable conditions or moving to a different colony. However, significant adult mortality also likely plays some role. With highly favorable oceanic conditions and abundant prey resources available we would have expected a greater increase in the breeding population if birds were simply skipping during bad years.

The Pelagic Cormorant breeding population also began to increase in the early part of this decade, peaking in 2004. However, the population crashed following that season and has been slow to recover. Breeding populations were extremely low through 2007 but have been increasingly moderately since that time. The 2010 estimate was roughly 20% higher than last season, though still less than half the number of birds breeding in 2004.

Approximately 50% of the world population of Ashy Storm-petrels breeds on the Farallones, but little is known about their true population status. Ashy Storm-petrels are difficult to census, but appear to have been increasing at the Farallones in recent years based on a greater number of birds banded each season and increasing capture rates during our mist netting effort. Detailed analyses of mark/recapture data which more accurately modeled capture rates to account for year and date effects demonstrate a positive non-linear trend in the number of birds captured per hour of netting effort (D. Lee, PRBO unpublished). Capture rates during 2010, however, were lower than the previous two years. In contrast, occupancy of existing nest sites and total number of breeding sites were both higher during 2010.

Tufted Puffins are surveyed during two week-long surveys, one in May during the pre-breeding and early egg laying period and a second during August when puffins are

feeding chicks. Population estimates are based on the overall number of active sites observed during these surveys. 2010 had the greatest number of active nest sites ever observed for this species on the Farallones and was approximately 8% higher than during 2009.

SUMMARY

2010 was an exceptionally productive year for most seabirds on the Farallones. Those species that were able to take advantage of exceptionally high zooplankton production and abundant juvenile rockfish stocks fared well this season. Cassin's Auklets far surpassed their previous best year and Common Murres, Pigeon Guillemots, Rhinoceros Auklets, Pelagic Cormorants and Ashy Storm-petrels also exhibited very high productivity. In contrast, Brandt's Cormorants again suffered very low reproductive success and Western Gulls had their poorest year on record. It seems that an overall depletion in the abundance of anchovies and other larger forage fish species resulted in very poor foraging conditions, reduced breeding success and reduced breeding effort for these species. The continuing poor performance of Brandt's Cormorants and the increasing unpredictability of prey resources in particular are of great concern.

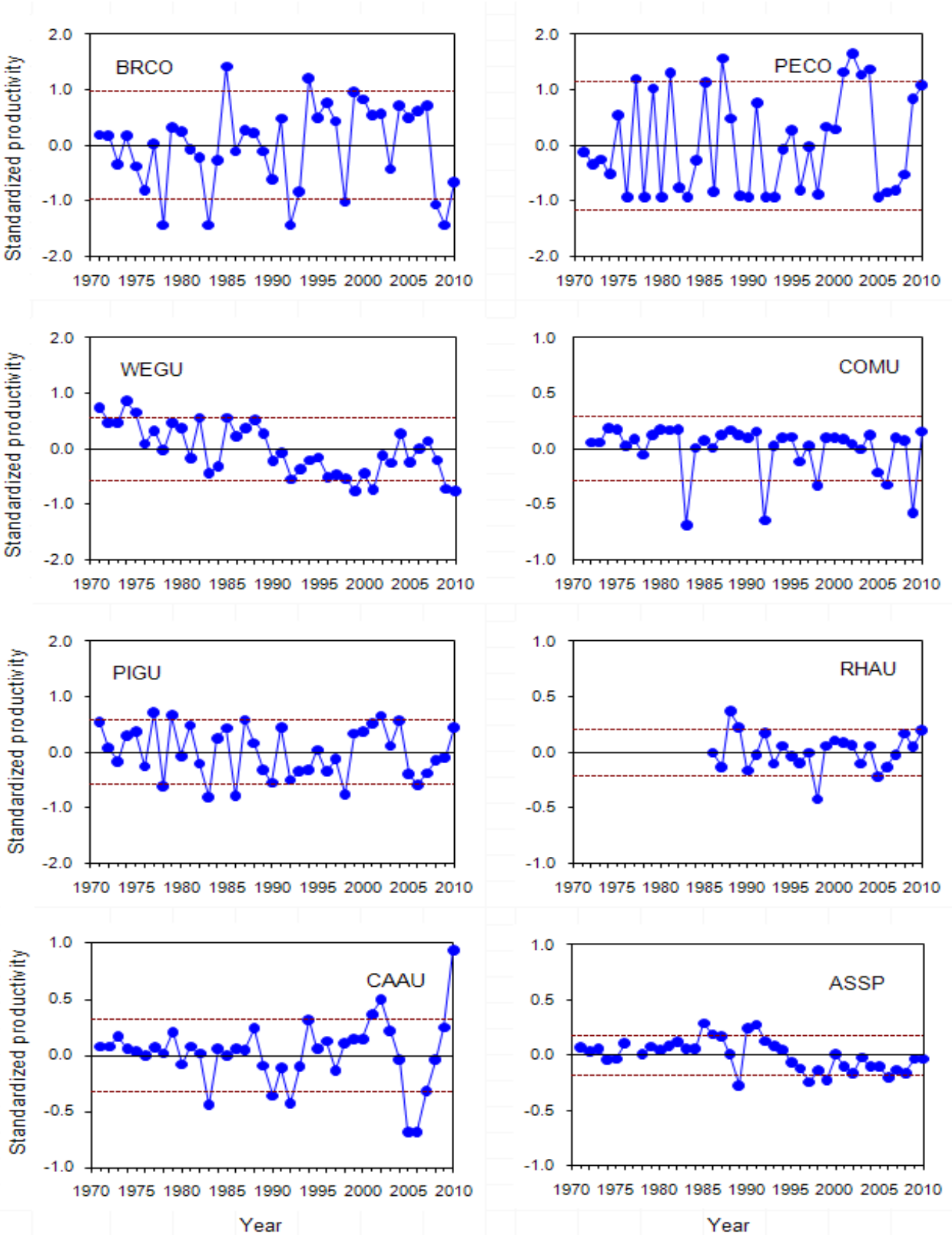

Fig. 1 Standardized productivity anomalies (annual productivity - long term mean) for 8 species of seabirds on SEFI, 1971-2010. The dashed lines represent the 80% confidence interval for the long term mean.

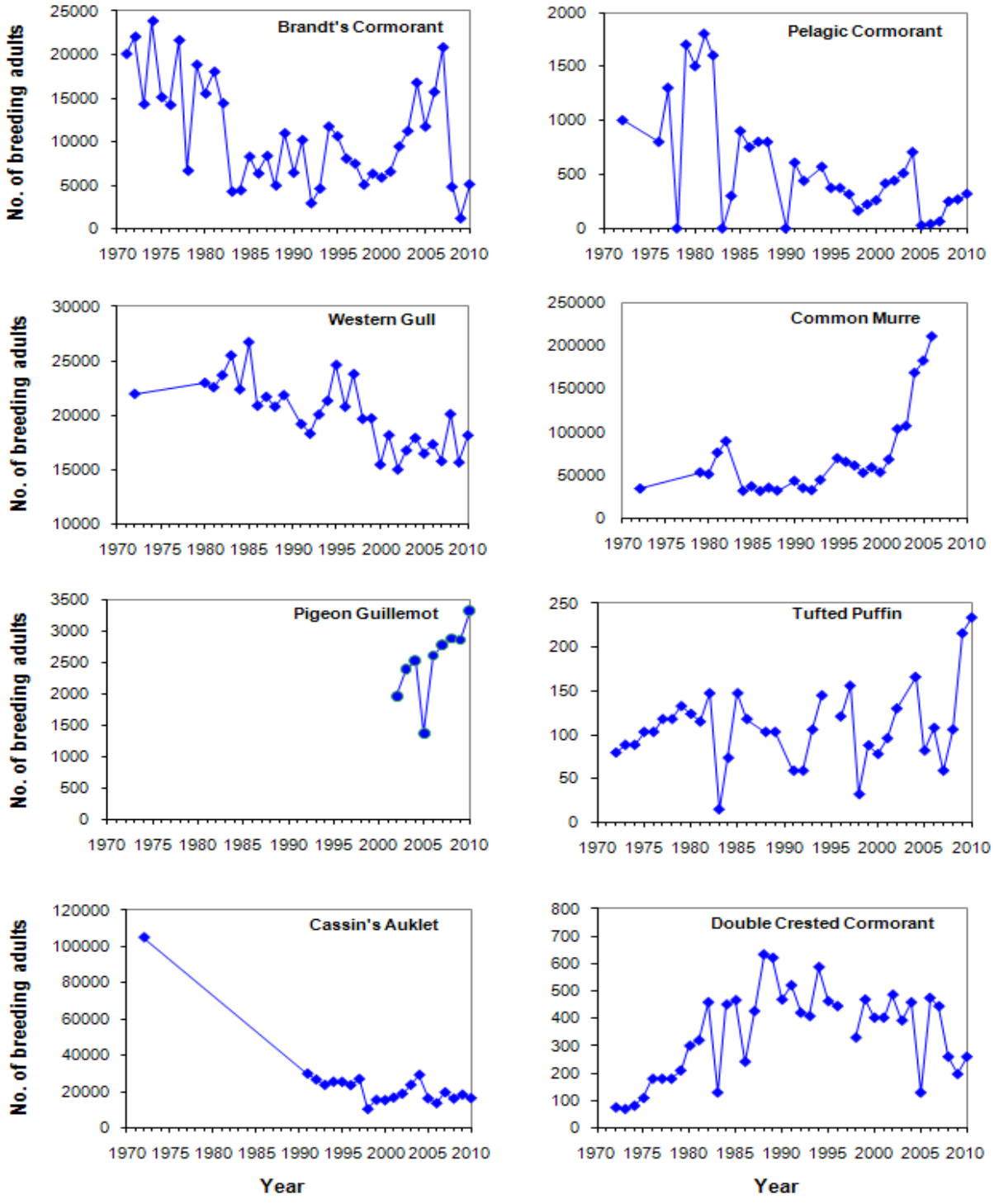

Fig. 2 Population trends for 8 species of seabirds on Southeast Farallon Island, 1972-2010. Populations were determined by counting either individuals or nests on all visible areas on SEFI and West End. Please note the different scales on the Y-axis. PIGU evening raft counts done prior to 2002 are not comparable to current methods and are not displayed. COMU whole colony estimates not made after 2006 (see text).