**Ashy Storm-Petrel Species Report Notes for Discussion**

**By Gerry McChesney**

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Need to change all Nur et al. (2012) and Nur (2012) to Nur et al. (2013).

Page 3, paragraph 2:

Reads:

“Studies on SE Farallon Island showed a maximum longevity of 35 years for ashy storm-petrel (Bradley and Warzybok 2003, p. 122; Nur 2012, p. 16).”

Should read:

“Studies on SE Farallon Island showed a maximum observed longevity of 35 years for ashy storm-petrel (Bradley and Warzybok 2003, p. 122; Nur et al. 2013, p. 20).”

Nur et al. (2012) was earlier draft that was replaced by Nur et al. (2013). Nur et al. (2012) is not in lit cited.

Page 17, paragraph 3:

Reads:

“However, data collected at breeding colonies may not account for nonbreeding birds that do not visit the colony (Ainley 1995, p. 8), and estimates of total population size would need to account for those birds (Nur et al. 2102), as we have done above to estimate total population size.”

Should read?:

“However, data collected at breeding colonies may not account for nonbreeding birds that do not visit the colony (Ainley 1995, p. 8), and estimates of total population size would need to account for those birds (Nur et al. 2013?), as we have done above to estimate total population size.”

Page 20, paragraph 3:

**(C) SE Farallon Island; 2000-2012; Nur *et al.* 2013**

First sentence:

“The purpose of the Nur *et al*. study was to evaluate the management benefits of house mouse eradication from the SE Farallon Islands, not to determine future trends in ashy storm-petrel populations on the Island or estimate time to extinction. The study did, however, analyze recent trends in the ashy storm-petrel population index for the SE Farralon Islands, which is based on mist-netting, and used trend results from that analysis to model future storm-petrel population trends with and without house mouse eradication.”

The second sentence conflicts with first sentence regarding estimating, or “determining”, future trends. The report does model potential future trends under various scenarios.

Suggested revision:

“The purpose of the Nur *et al*. (2013) study was to evaluate the management benefits of house mouse eradication on the Sout Farallon Islands ashy storm-petrel colony by analyzing the impacts of burrowing owl predation (which is influenced by mouse presence) on the storm-petrels. In addition to analyzing impacts of owl predation on storm-petrel predation levels and adult survivorship, the study analyzed recent trends in the ashy storm-petrel population index for the South Farallon Islands, which is based on mist-netting, and used recent estimated trends to model potential future storm-petrel population trends with and without a reduction in the number of overwintering burrowing owls. Numbers of wintering burrowing owls are expected to be reduced with no mice on the islands.  ; the latter is recommended as the more reliable interpretation and use for PVA models (Akçakaya and Raphael 1998, p. 891; Beissinger *et al.*1998, p. 832). The efficacy of PVAs for predicting long-term population trends and probability of extinction is widely debated in the literature (Fieberg and Ellner 2000, p. 2046; Coulson *et al.* 2001, p. 221; but see Brook *et al.*2000, p. 836). PVAs are considered much more reliable for comparing the efficacy of management options, as relative results such as management choices are less sensitive to data gaps or assumptions inherent to any statistical model (Akçakaya and Raphael 1998, p. 891; Beissinger *et al.*1998, p. 833, Coulson *et al.*2001, p. 221).  We also note that this study was limited to the SE Farallon Island population, and not to the entire range of the species.

Nur *et al.* used model uses data from a small number of years to predict future population trends which limits its use in determining the current and future status of the species as a whole. Only the most recent 6 years of ashy storm-petrel population index data was incorporated into the model. Only the most recent 3 years of data were used to obtain an average burrowing owl population size, which the model then used to predict future population trends of ashy storm-petrels. This small subset of data used makes the model’s predictions very sensitive to any variations in burrowing owl numbers in the future. A 6 year timeframe is likely too short to produce a significant result with these methods (Nur *et al.* 2013, p. 25). Natural variations and fluctuations in environmental conditions or population parameters are not evaluated in determistic models of the type used in this study. These models indicate that reducing burrowing owls on SE Faralon Island will likely benefit the ashy storm-petrel population on the island. However, because there is no clear long term trend in ashy storm-petrel populations, it is unknown what future population trend trajectory will accurately reflect the effect that burrowing owls will have in the future.

Ashy Storm-Petrel population trends were examined for the period 2000-2012. Using the best fit model, a significant change in trend, from increasing to decreasing, occurred between 2006 and 2007. Thus, subsequent analyses of storm-petrel population trends were split into two different trend sets: one from 2000–2006 and one from 2007–2011. This report found a significant average increase in the ashy storm-petrel population index of 22.1 percent per year from 2000–2006, and a mean non-significant decrease in the ashy storm-petrel population index on SE Farallon Island of 7.19 percent per year from 2007 to 2012 (Nur et al. 2013, p. 25). Because of high interannual variability in the storm-petrel population index, the estimated decline of 7.19% resulted in high confidence intervals. Nur et al. (2013) also recognized that the six year time frame analyzed may have been too short to detect a significant trend.

To model potential future ashy storm-petrel population projections, the recent estimated “steep” declining trend of 7.19% was input into a model to determine what effect the reduction of 50 percent or 71.5 percent of the overwintering burrowing owl population on the islands (i.e., due to mouse eradication) would have. Because of uncertainty in this trend estimate, , this report also modeled two other population trend scenerios :one based on an estimated recent decline of 3.4%( or plus one standard erro of the mean; “moderate decline scenario”); and one based on an estimated recent increase of 0.63% (or plus two standard errors of the mean; “near stable scenario”). Each of these scenerios models future population trends with “no burrowing owl reduction, 50 percent reduction, and 71.5 percent reduction”. The results indicated that a reduction of burrowing owl abundance on SE Farallon Island will decrease instances of burrowing owl predation of ashy storm-petrels on the island with resulting benefits to the population .

Nur et al. 2013 (p. 26) used the last three years of ashy storm petrel capture data to estimate the current number of breeding birds on the island. They concluded with a 95 percent confidence interval that there are between 3790 and 8778 breeding birds on SE Farallon Island, with a mean of 5768 breeders. This mean value is 117% higher than the previous Sydeman et al. (1998) estimate in 1992. Thus, despite projections of a potential declines since 2007, numbers are substantially higher than in 1992.

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***Summary of Farallon Island Population Trends***

We do not have any comparable colony size data for evaluating population trends before 1992, when standardized mist netting efforts began on SE Farralon Island. The best data available are based on the mist net population index there, and show up and down variation from 1992 to about 2001 (Figure 1, 2). Afterward, Nur *et al.* 2013 (p. 25) found an average increase in the ashy storm-petrel population index of 22.1 percent per year from 2000–2006, and a mean decrease in the ashy storm-petrel population index on SE Farallon Island of 7.19 percent per year from 2007 to 2012 (see summary, above). However, this recent negative trend was not statistically significant; ; more years of future data may be necessary to better quantify this potential recent trend.. We conclude that the population recently has been experiencing fluctuations over the pasdue to various factors, including avian predation. After assessing the best available scientific data, we have concluded that there is no consistent long term trend in the species’ population nesting on SE Farallon Island.

**Page 22:**

**Figure 1:** Annual trends in the Ashy Storm-PetrelPopulation Index on SE Farallon Island, 1992-2012, based on capture per unit effort of Mist Netted birds (Bradley 2013, pers. comm.). The index is set at 1.0 for 1992. Index values are presumed directly proportional to abundance of ashy storm-petrels on the island. Vertical axis represents variations from the baseline year of 1992.

Page 31, Table 3. Burrowing Owl. Suggest changing from slight to moderate to moderate, based on Nur et al. (2013) results.

Page 46:

*SE Farallon Island*

SE Farallon Island serves as breeding grounds for approximately 58 percent of the known ashy storm-petrel breeding population (Table 1). Avian predators are known to prey on adult ashy storm-petrels, which is a greater threat to the species than taking eggs or young. The take of adults has direct effects on adult survivorship on the island. The following are known predators of ashy storm petrel on SE Farallon Island:

***Burrowing Owl***

*SE Farralon Island*

Burrowing owls do not currently breed on SE Farallon Island, but are regular fall visitors, and several individuals (5–8) overwinter on the island (Nur *et al.* 2013, p. 47). In the fall, burrowing owls arrive at SE Farallon Island and feed upon nonnative house mice when mice are seasonally abundant (Nur 2013 *et al.*, p. 7). In late winter and early spring, the mouse population declines in numbers and burrowing owls switch from mice to prey upon storm-petrels, which are courting and prospecting for nesting sites at this time (Nur *et al.* 2013, p. 7). From January 2003 through August 2008, approximately 98 percent of ashy storm-petrel carcasses found on SE Farallon Island likely died due to avian predation, and this predation occurred between February and August (PRBO Conservation Science 2008, no pagination). It was also believed that overwintering burrowing owls had high risks of dying from starvation following the mouse population crash. To reduce this cause of mortality, Service staff from SE Farallon National Wildlife Refuge trapped and moved several burrowing owls to the mainland. Five burrowing owls were translocated to Don Edwards San Francisco Bay NWR between 2005 and 2007 (Service 2008, p. 53). As an added benefit, it was believed that owl predation on storm-petrels also would result from owl translocations. At this time, no future translocations are planned because of migratory bird permitting restrictions; also to fully realize benefits to storm-petrels, translocation would need to be conducted in perpetuity, a large and costly undertaking. At this time, the Service is developing a plan to eradicate the nonnative house mouse through rodenticide application and prevent future human introductions of mice, which is expected to reduce owl predation on Farallon storm-petrels (see **Conservation Efforts** below It is unknown to what extent burrowing owl predation occurs elsewhere, but the best available science at this time does not suggest that it is a threat outside of SE Farallon Island.

Burrowing Owls have been known to frequent SE Farallon Island since at least the late 1880s. The only recorded breeding of burrowing owls on SE Farallon Island was in 1911 by W. L. Dawson (Desante and Ainley 1980, p. 30). Between one to three burrowing owls wintered on SE Farallon Island each year from the years 1968–1976 (Desante and Ainley 1980, p. 30). The majority of individuals departed in March and April, although two burrowing owls stayed until May (Desante and Ainley 1980, p. 30).

The last 4 years (2009–2012) have had the highest abundance of burrowing owls on SE Farallon Island since recent systematic recording began in 2000 (Nur et al. 2013, p. 48). From 2003–2010, predation by burrowing owls accounted for 40 percent of ashy storm-petrel predation. Western gulls accounted for 52 percent, with the remaining predation from unknown predators (Bradley *et al.* 2011, p. 8). Therefore, the predation impact of less than ten burrowing owls on the island is comparable to the predation impact from thousands of western gulls. In recent years, burrowing owl predation has surpassed western gull predation (Figure 4; PRBO 2013c, unpublished data). In 2012, burrowing owls predated 111 ashy storm-petrels on the island, western gulls predated 56 ashy storm-petrels, while for 23 ashy storm-petrel carcasses, the cause of death was not determined (Figure 4; PRBO 2013c, unpublished data). These 23 individuals could have been predated by western gulls or burrowing owls or may have died from another cause (Bradley 2012d, pers. comm.).

Nur *et al.* 2013 found that greater monthly burrowing owl abundance resulted in greater predation on ashy storm-petrels. For 2009–2011, average burrowing owl maximum monthly abundance on SE Farallon Island from September to April was 6.29 (Nur *et al.* 2013, p. 22). In a population modeling study, Nur *et al*. 2013 (p. 20) estimated that a recent Farallon ashy storm-petrel decline of an estimated 7.2 percent per year to continue if burrowing owls continue to frequent the Island at recent levels. Nur *et al.* (2013) derived this trend by using the same modeling technique as Nur *et al.* (1999a) and Sydeman *et al.* (1998b, p. 20). At that time, the authors calculated an ashy storm-petrel decline of 2.87 percent per year for 1972–1992 due largely to gull predation. Their model predicted this decline to continue into the future. As stated earlier, the Sydeman *et al.* 1998b (p. 20) prediction of a continued ashy storm-petrel decline did not turn out as predicted since the population increased at a rate of 22.1 percent per year from 2000-2007 (Nur *et al.*, p. 25). However, since 2007, this increase appears to have stopped, and has become a decline in recent years, consistent with a recent increase in burrowing owl predation on ashy storm-petrel adults (Nur *et al.* 2013, p. 14). Results from Nur *et al.* (2013, p. 18) show that reducing the burrowing owl population will likely benefit the ashy storm-petrel population on the island.

The timing of burrowing owl predation is “ongoing” and the scope is “large,” with all individuals on SE Farallon Island potentially at risk of predation. Burrowing owl predation on ashy storm-petrel adults on SE Farallon Island is likely having effects on the population as a whole within the scope of this threat. Using data collected on SE Farallon Island from 2003 through 2012, we made a rough estimate of the effects that burrowing owls could have on ashy storm-petrels in the near future. Our calculations showed that around 10 percent of the ashy storm-petrel population on SE Farallon Island could be eliminated over the next 38.4 years. However, because the ashy storm-petrel is sensitive to adult survival and it is likely that not all predated wings are found and included in our calculations, it is possible that losses could be higher. Because the best available information predicts a decrease that does not fit obviously into any category, we conclude that the severity of this threat is “slight/moderate” (likely to destroy or eliminate the habitat or reduce the species’ population within the 56.47 percent scope by 1–30 percent).