

DISCUSSION

The three national parks surveyed during this inventory contain coastline that has adequate habitat for migratory shorebirds. The open grasslands, strand vegetation, rocky cliffs and beaches provide habitat for the three shorebird species observed. Pacific Golden Plovers, Wandering Tattlers, and Ruddy Turnstones were observed consistently in every park surveyed. Pacific Golden Plovers were found in more terrestrial habitats, reflecting their generalist terrestrial habitat preference in Hawaii. The two other shorebird species recorded during the surveys, Ruddy Turnstones and Wandering Tattlers, were counted more often where marine food resources were accessible at areas washed over by waves such as offshore islets, sandy beaches, tidepools, and sheltered bays.

Shorebirds begin migration to their breeding grounds in early spring, so the timing of these surveys may have overlapped with the departure of some individuals. Since several of the Pacific Golden Plovers were observed in their breeding plumage, it is likely that individuals may have already set out for Alaska and Siberia. It is probable that by conducting the survey in the winter months of January and February, a higher number of shorebirds, and maybe a higher number of species, would be observed.

Although the coastline has good habitat for nesting seabirds, relatively low numbers of species and individuals of species were observed. This may be a reflection of the abundance of predatory threats to nesting birds. White-tailed Tropicbirds and Black Noddies nesting in rock cavities in steep cliffs may be able to avoid depredation by rats, mongooses and cats. Seabirds nesting in burrows, like the Wedge-tailed Shearwater, or on the ground or in short vegetation, such as Red-footed Boobies and Great Frigatebirds, are more vulnerable to alien mammal predators. Implementation of small mammal control would be beneficial to nesting seabirds and may attract more species to the coastlines of these parks. Despite the presence of introduced predators, a Black Noddy was observed on a nest during the HALE survey. The nest site was on a rocky ledge along a cliff, which would make it inaccessible to larger introduced mammals.

Depredation by introduced predators, habitat degradation, and competition with more aggressive species appear to be the greatest threats to seabird and shorebird populations. The offshore islets of KALA provide potential predator free nesting habitat for seabirds, two islets are currently rat free. An attempt at rat eradication on these islets is recommended to relieve stress on breeding bird populations. Cats at KALA are fed by residents and tour groups. Feral cats are a sensitive issue within the Kalaupapa settlement, and any program to remove or reduce the feral cat population park-wide would require great delicacy. Currently there is only a trap, neuter, and release program being conducted (Guy Hughes, pers. comm.).

Excellent Wedge-tailed Shearwater nesting habitat is available along the northwestern coast of Molokai, within The Nature Conservancy's Moomomi Preserve. Through active small mammal management, the Conservancy has been able to increase the number of Wedge-tailed Shearwaters nesting in recent years (Samuel Aruch, pers. comm.). The entire coastal strand on the peninsula is potential nesting habitat for this species, but its current mongoose-infested state is not favorable for nesting seabirds. Utilization of a predator-free fence to create a habitat suitable for many nesting seabirds as well as the

Nene (*Branta sandvicensis*), or Hawaiian Goose, is a realistic goal that requires more thorough investigation.

Twelve Cattle Egrets were introduced to Maui in 1959 to help reduce the number of flies in ranch pastures (Breese 1959). Their adaptability to new environments and the availability of pasture land for foraging allowed the population to greatly increase and expand geographically. The birds prefer pastures near open water, a habitat that is plentiful along the coast in HALE. Cattle Egrets are known to prey on nestlings of the endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*) and Hawaiian Coot (*Fulica alai*) and may be a threat to nesting seabirds as well (Andrews 1981). Cattle Egrets potentially carry disease such as *Salmonella* that may infect shorebirds and seabirds (Rauzon et al. 2004). The presence of numerous Cattle Egrets along the coast of HALE and the west Hawaii parks is a potential problem for nesting seabirds.

Another factor that may explain the low number of observed seabirds is the seasonal timing of the survey. Since most seabirds only come to shore to nest in the spring and summer, many may not have returned from sea at the time of the survey. Black Noddies are an exception as they nest in winter, occasionally extending into summer during years of inclement weather (Harrison 1990), which may account for the fact that we observed higher numbers of Black Noddies than of any other species.

Fewer Black Noddies were noted during the early part of the HAVO survey than at the end, even though the steep high cliffs in the western portion of the park seemed suitable Black Noddy nesting habitat. This difference may be attributable to observer error or timing. During the first day of the surveys, the rugged landscape made hiking difficult and may have affected observer ability. In addition, observer attention may not have been focused on the ocean but rather the shoreline, scanning for shorebirds. A visit to Na Puu o na Elemakule later in the season revealed two Black Noddies riding thermals at the sea cliffs. This observation suggests that more Black Noddies might be counted along the western coastline of HAVO later in the year.

Because shorebirds and seabirds are present on the main Hawaiian Islands at different times of the year, it would be advantageous to perform two surveys in order to increase the observation potential and timing it to when specific species are most numerous. A winter survey, conducted in November or December, would better document migratory shorebirds and winter nesting seabirds. A summer survey, conducted in June or July would document the presence of summer nesting seabirds.

ACKNOWLEDGEMENTS

We thank Fern Duvall and Shane DeMattos (Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife) for help with the survey at Haleakala National Park. Darcy Hu (NPS), Karin Schlappa and Gail Ackerman (PCSU) and Mike Hughes (NPS volunteer) helped with surveys in and near Hawaii Volcanoes National Park. We are grateful to the staff at all three parks for providing logistical support for these surveys. These inventories were carried out under a cooperative agreement between the National Park Service, Pacific Island Network and the University of Hawaii at Manoa, Pacific Cooperative Studies Unit (Task Agreement No. CA8012-A001).