



Conservation and Management of Eastern Gulf Coast Snowy Plovers (*Charadrius alexandrinus*)

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PURPOSE: This technical note summarizes current knowledge regarding the conservation and management of Snowy Plover (*Charadrius alexandrinus*; abbreviated as SNPL; also called Kentish Plover in Europe) along the eastern Gulf of Mexico coast in Florida, Alabama, and Mississippi (Figures 1 and 2). Comprehensive surveys suggest there are ~250 SNPL breeding pairs in this region. This has led to substantial concern over the long-term persistence of this population, since various anthropogenic factors seem likely to reduce this already small population in the future. Objectives of this publication are to: (1) summarize what is known about the biology of SNPL along the eastern Gulf of Mexico, with additional insights from more intensively studied populations on the Pacific Coast of the United States; (2) review the status of eastern Gulf Coast populations (using summaries of recent surveys) and compare this with survey data from the western Gulf of Mexico; and (3) discuss the factors that may affect the distribution and/or reproductive success of eastern Gulf Coast Snowy Plovers (human disturbance from recreation, predation, and habitat conditions resulting from disturbances such as storms, beach nourishment, and other coastal engineering activities).



Figure 1. Wintering Snowy Plovers along the Florida coast. The Florida population is the subject of increasing interest and focus by several agencies and organizations (Photo by Charlie Ewell).

MINIMUM ESTIMATE OF SNPL PAIRS BREEDING ALONG THE GULF OF MEXICO:

Using combined pair count data from five distinct survey efforts between 2004 and 2007 in Florida (Himes et al. 2006), Alabama (Zdravkovic 2008), Mississippi and Louisiana (Zdravkovic 2006), Texas (Zdravkovic 2005), and the Laguna Madre in Mexico (Zdravkovic 2007), a minimum of 815-824 SNPL breeding pairs were estimated around the entire Gulf of Mexico coast from Florida to the Laguna Madre in Mexico. Please note that the distribution and abundance of SNPL south of the Laguna Madre in Mexico have been poorly documented. Although each of the above surveys claimed complete coverage of suitable SNPL nesting areas, none of these surveys employed formal methodologies to estimate detection ratios (Thompson

2002). Therefore, this combined total should be viewed as a minimum estimate that assumes perfect detection as well as no movement between discrete survey areas or population change among years. The US Fish and Wildlife Service (USFWS) has proposed discrete site survey protocols for SNPL pair counts that allow for the estimation of detection ratios: <http://www.fws.gov/pacific/migratorybirds/snowyplover/Final%20Snowy%20Plover%20Discrete%20Site%20Survey%20Protocol.pdf>.

However, at the end of 2009, a coordinated effort to apply this survey methodology across the entire Gulf of Mexico region during a single, narrowly defined survey period had not yet occurred. Although such an effort should produce a more reliable estimate of the number of SNPL pairs breeding along the Gulf of Mexico, it is believed that such a survey would reveal a small and patchily distributed population, similar to that suggested by this preliminary estimate.

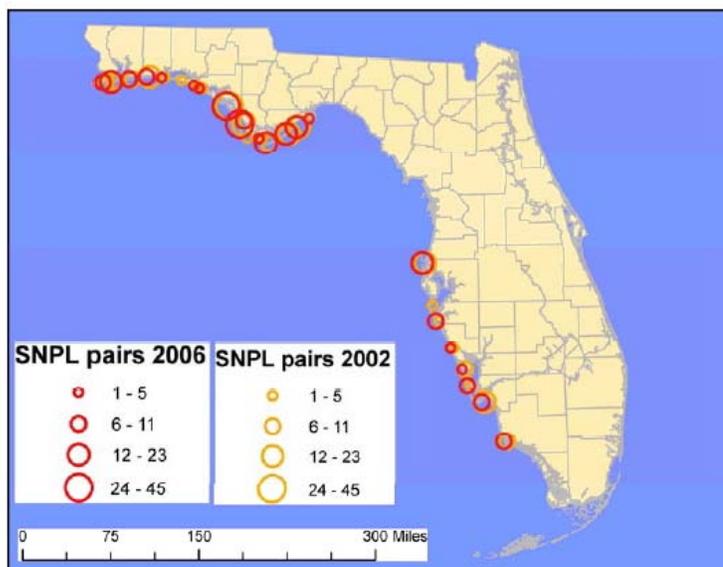


Figure 2. Distribution of Snowy Plover nesting pairs along the Florida Gulf coast (from Lott 2009). Symbols for 2002 have been slightly displaced so that counts from the same site can be seen for each survey. An additional ~28 pairs breed in adjacent coastal areas in Alabama and Mississippi (Zdravkovic 2006, 2008).

DISTRIBUTION AND ABUNDANCE OF EASTERN GULF COAST SNOWY PLOVERS: Florida's barrier islands, particularly in the Panhandle and Southwest Gulf Coast regions, host large proportions of continental wintering populations of SNPL (Himes et al. 2006, Lott 2009) (Figure 2). Recent state-wide breeding surveys for SNPL in Florida (in 2002 and 2006) have resulted in similar estimates of numbers of breeding pairs (between 213 and 222) with approximately 80% of the state population in the Florida Panhandle and the remaining 20% along Florida's Southwest Gulf Coast (Lamonte et al. 2006, Himes et al. 2006). Surveys of contiguous populations in Alabama and Mississippi in 2007 yielded an additional ~28 pairs (Zdravkovic 2006, 2008). Cumulatively then, approximately 241-250 pairs comprise a relatively small population of SNPL that breed along the sandy shorelines of the eastern Gulf of Mexico.

RELATIONSHIP WITH OTHER SNPL BREEDING POPULATIONS: With the exception of only two SNPL pairs recorded during recent surveys in Louisiana (Zdravkovic 2006), the eastern Gulf Coast population of SNPL is located ~900-1,000 km away from another SNPL breeding population on the western Gulf Coast that breeds from central Texas west and south to the Laguna Madre in Mexico. The western Gulf Coast SNPL population is also relatively small with an estimated 481 breeding pairs in Texas (Zdravkovic 2005) and 91 pairs in the Laguna Madre region of Mexico (Zdravkovic 2007). The distance between eastern and western Gulf Coast SNPL populations is greater than all others, but the most extreme outlier dispersal distances recorded in two long-term capture-recapture studies of SNPL meta-population

dynamics on the Pacific Coast (Colwell et al. 2007, Stenzel et al. 2007). Additionally, the two Gulf Coast populations are separated by a much greater distance than the ~250-300 km separating the eastern Gulf Coast SNPL population from the nearest Caribbean SNPL population to the east, which has been shown to differ genetically from U.S. populations (Funk et al. 2007). Therefore, it seems likely that little demographic connectivity exists between western and eastern Gulf Coast SNPL.

BIOLOGY OF EASTERN GULF COAST SNOWY PLOVERS: Although the breeding biology of SNPL has been studied extensively around the world (Page et al. 1995, Szekely et al. 2006), little information exists regarding the specific details of the breeding biology of eastern Gulf Coast SNPL. With the exception of a small number of pairs that breed on mainland beaches, the vast majority of eastern Gulf Coast SNPL nest on barrier island beaches or narrow sandy peninsulas that are less than 1.5 km in width (Himes et al. 2006, Lott 2009), mostly on public lands, often placing them in direct conflict with recreation activities. Public land management agencies are often understaffed to deal effectively with conflicts between SNPL protection and public recreation demands. Connections between nesting habitat and brood-foraging habitat have not been extensively studied in the Gulf Coast population, although broods have been observed foraging both near nesting sites and several kilometers away from nesting sites (Pruner 2010). In Florida, broods may forage in fresh wrack (piles of seaweed, terrestrial plants, and animal remains that wash ashore and are found in the tide line), front-beach intertidal areas (if disturbance is minimized and wave energy is not too high), ephemeral tidal pools, freshwater pools and inlets, intertidal areas near inlets, or on bay-side intertidal flats. No quantitative studies have been conducted on predators of SNPL along the eastern Gulf of Mexico. However, coyotes (*Canis latrans*), foxes (primarily *Vulpes vulpes*), and raccoons (*Procyon lotor*) are suspected to be the main mammalian predators of eggs and young. Ghost crabs (*Ocypode quadrata*), snakes, and other birds (particularly gulls and crows [*Corvus* spp.]) also prey on eggs and young, though the extent of this is unclear.

It is currently unknown if the mating system of this population is similar to the polyandrous population on the Pacific Coast where adults may successfully fledge multiple broods in one year, or the monogamous, single-brooded population in the Western U.S. interior (Page et al. 1995). Chase and Gore (1989) documented bi-parental care of young to the age of 14 days in 82% of broods, but after 14 days, 50% of broods were attended by only one adult. This observation, plus the long breeding season in Florida (from mid-February through August) suggests the potential for a polyandrous population, capable of producing multiple broods in Florida. Current research by the University of Florida with individually marked birds should lend insight to this question. Snowy Plover populations around the world show a range of migratory behaviors, from year-round residency to long-distance migration (Page et al. 1995). Chase and Gore (1989) suggested that higher counts during the breeding season than winter in Florida may indicate the seasonal movement of some SNPL away from the state of Florida. An alternative explanation for this difference is that counts in winter may have had incomplete survey coverage or lower detectability. This question will be difficult to resolve without more extensive winter surveys and without a more intensive effort to individually mark and re-sight birds in Florida.

Human use of beaches may limit the distribution and/or reproductive success of SNPL in Florida (Chase and Gore 1989, Lamonte et al. 2006, Himes et al. 2006). A recent investigation (Lott

2009) under the Corps' Shore Protection Assessment Program illustrated a strong negative correlation between sand placement projects and the presence of both wintering and breeding SNPL. This work stressed the need for future research to clarify if the negative correlation between sand placement and plovers is the result of habitat degradation that can be directly attributed to sand placement projects, and perhaps mitigated, or the tendency for sand placement projects to occur in areas of high population density where human disturbance may limit the distribution of plovers. This topic is the subject of ongoing collaborative research between the U.S. Army Engineer Research and Development Center – Environmental Laboratory (ERDC-EL) and Boise State University. Now that most of Florida's private shorelines have been developed and protected through beach nourishment, the distribution of SNPL has been mostly restricted to public lands. Engineering or restoration projects that are designed to protect public land infrastructure, such as rebuilding roads with hard structures after storms, or massive planting of dune vegetation, which restricts the storm overwash that maintains plover habitat, could also have strongly negative effects on Florida's plovers.

COLLABORATIVE EFFORTS TO IMPROVE SNOWY PLOVER CONSERVATION:

During November 7-8, 2007, a workshop facilitated by American Bird Conservancy (ABC), with assistance from the U.S. Fish and USFWS Pacific Coast Snowy Plover Recovery Lead, was held at the University of Florida's Gulf Coast Research and Education Center in Plant City, Florida. Twenty-eight biologists and land managers attended this meeting, representing the majority of all research and monitoring efforts occurring on nesting areas for SNPL in Florida. Representatives were primarily from large public land management agencies and conservation organizations. Although concerns have existed for the status of SNPL in Florida for many years (Chase and Gore 1989, Gore 1996), this was the first time that biologists from across the entire state gathered to discuss conservation and management challenges. This workshop led to the formation of a shorebird working group that meets annually: <http://www.flshorebirdalliance.org/index.html>.

Formal workshop presentations (available as pdf documents at <http://el.erc.usace.army.mil/dots/coastalbirds.html>) focused on potential limiting factors grouped by three main categories: habitat, predators, and human disturbance. These presentations included (1) an overview of the life history traits of SNPL (Casey Lott, ABC); (2) results of three years of Florida Fish and Wildlife Conservation Commission (FWC)-coordinated statewide surveys for SNPL distribution and abundance (in 1989, 2002, and 2006; Nancy Douglass, FWC); (3) a comparison of SNPL nest and brood habitat use and success with spatial patterns in disturbance and food availability (Brad Smith, Sanibel-Captiva Conservation Foundation); (4) an overview of the brood ecology of SNPL in the eastern Panhandle from Tyndall Air Force Base east to St. Vincent's National Wildlife Refuge (proposed MS thesis research by Raya Pruner, University of Florida); (5) an overview of coordinated conservation efforts across large regions and lessons learned from approaches to habitat, disturbance, and predator issues that have been taken on the Pacific Coast (Jim Watkins, USFWS recovery lead for Pacific Coast SNPL); and (6) potential limiting factors for Florida's SNPL, and monitoring and research approaches that might be taken to address these factors (Casey Lott, ABC).

With the exception of ongoing studies by the University of Florida, Boise State University, and the Sanibel Captiva Conservation Foundation, SNPL habitat use has not yet been studied in

Florida. However, the three state-wide surveys provided some information about habitat features around nest sites (Chase and Gore 1989, Lamonte et al. 2006, Himes et al. 2006). Nearly all of Florida's SNPL nest on sandy beaches, either in front of the primary dune line (often early in the nesting season), in dune pocket openings and washover passes, or behind the primary dune line (often later in the nesting season after initial nests have failed due to disturbance or storm washover). Brood-rearing habitat and habitat use during the non-breeding season have yet to be described quantitatively. More detailed descriptions of habitat use, particularly connectivity between nesting habitat and brood rearing habitat, are necessary to effectively conserve Florida's SNPL. Recently completed field research was designed to provide more information on this question (Pruner 2010, Webber 2011).

It is possible that coastal engineering projects, particularly beach nourishment and dune restoration, have degraded SNPL nesting habitat in some locations by removing or decreasing habitat heterogeneity at several scales (from nesting substrate to landscape features). Dune restoration projects, particularly those that result in thickly vegetated dunes due to heavy plantings of sea oats, may present barriers for chicks traveling between nesting and brood-rearing habitats, or may reduce the availability of barren sand areas used for nesting on narrow beaches. It has been hypothesized that some threshold level of human disturbance may preclude the use of otherwise suitable habitat; however this threshold has not been defined (Chase and Gore 1989). A collaborative effort between ERDC-EL and Boise State University was initiated during 2009 in the Florida Panhandle to investigate the effects of habitat features and human disturbance on SNPL distribution. This study is occurring in both nourished and "natural" areas.

The prevalence of various types of predation of nests or chicks has not been quantified for any nesting areas in Florida. Some land managers have successfully removed mammalian predators through a combination of relocation or lethal control. In several cases this has resulted in positive responses from breeding beach nesting birds (Engeman et al. 2010). Land management agencies are doing active predator management on their own or through contracted services with the U.S. Department of Agriculture. Predator removal has not been attempted in Florida for ghost crabs, snakes, or avian predators. Nest exclosures have been used to increase hatching success, by limiting predator access to eggs in some SNPL populations (U.S. Fish and Wildlife Service (USFWS) 2007); however, exclosures have not been used in Florida to date, and may not be used due to concerns over increasing adult mortality due to predator attraction.

Human disturbance presents a variety of challenges for nesting SNPL in Florida. Direct mortality of eggs and chicks has been observed due to vehicle traffic on beaches (both trucks and ATVs) and from foot traffic. Standard Operating Procedures (SOPs) for beach driving have been adopted by several land management agencies to minimize the negative effects of beach driving (<http://www.myfwc.com/shorebirds/BNB/pdf/SOP-beach-driving.pdf>). In some areas, heavy vehicle use of beaches is due to recreation. However, in other areas, the most heavy vehicle use of beaches is administrative; coming from law enforcement personnel, park rangers, beach managers, and sea turtle survey crews. Efforts in recent years have been directed towards educating these users to the presence of shorebird nests and young on beaches and minimizing the likelihood of mortality from vehicle traffic. Symbolic fencing is an effective conservation tool for restricting access to portions of the beach that are currently being used for nesting (USFWS 1996). If signs and fencing are obeyed, this can provide protection for nests and, to a

lesser degree, for chicks (if they stay within the fenced area). If broods congregate in foraging areas outside of the areas that are fenced to protect nests, brood foraging areas may merit symbolic fencing as well. The intensity and exact locations of human disturbance during the non-breeding season have not been studied in Florida, although potential for disturbance is high during winter when SNPL aggregate in communal roosts or at important foraging sites. Symbolic fencing may also be useful to protect these areas during both the non-breeding season and the breeding season. Beach closures have rarely been employed to protect SNPL in Florida, but this would provide even greater protection from disturbance than symbolic fencing. Many public beaches have rules or ordinances prohibiting use by dogs, or require that dogs are on leash at all times. These rules and ordinances are regularly disobeyed and infrequently enforced. Although dogs on beaches can be a significant source of disturbance to nesting SNPL (Lafferty 2001), it is unclear the extent to which they contribute to loss of eggs, chicks, or adult SNPL. This potentially large problem deserves additional study along the Gulf Coast and existing leash laws need greater enforcement.

FUTURE NEEDS AND ACTIONS: Workshop participants identified several important action items to advance SNPL conservation along the eastern Gulf of Mexico coast:

1. Regular coordination of land managers and public land biologists on properties with plovers is needed. Biologists working on SNPL should meet more regularly to coordinate projects, discuss improvements to existing sampling methods, and identify research and management needs. Following the 2007 workshop, an SNPL Working Group (WG) was formed consisting of all meeting participants, comprising mostly participants from Florida. Hopefully, this group will grow to include representatives from agencies and organizations concerned with SNPL conservation in Alabama and Mississippi.
2. A more robust sampling methodology is needed to accurately estimate the number of breeding pairs in Florida (and adjacent states). There is consensus among biologists that the three state-wide surveys for SNPL that occurred in Florida in 1989, 2002, and 2006 have not been sufficient to track long-term SNPL population trends. Therefore, workshop attendees agreed to conduct an annual breeding season window count, similar to the range-wide window count conducted for Pacific Coast SNPL, to provide additional data for population trend analyses. Biologists at FWC are reviewing the Pacific Coast window count survey protocol and modifying it to be more appropriate for Florida's Barrier Islands. Progress on this topic has been documented at: <http://www.flshorebirdalliance.org/index.html>.
3. Protocols for the placement of symbolic fencing and signage for SNPL nesting, brood-rearing, and non-breeding habitat protection are needed and this practice should be more widely implemented across the eastern Gulf of Mexico coast, although staff and financial resources for widespread implementation of this simple and effective conservation measure (USFWS 1996, Hecht and Melvin 2009) are lacking in many areas.

SUMMARY: This technical note summarizes the current state of knowledge on the conservation and management of the eastern Gulf Coast population of SNPL as reviewed from the literature, much of it grey, during a 2-day workshop at the University of Florida's Gulf Coast Research and Education Center in Plant City, Florida, in November 2007

(<http://el.ercd.usace.army.mil/dots/coastalbirds.html>). This meeting was prompted by strong concern over the conservation status and long-term viability of this SNPL population. It resulted in the formation of an SNPL Working Group, which has evolved into a multi-species shorebird working group that now meets at least twice annually (<http://www.flshorebirdalliance.org/index.html>). Current and future research described in this note will provide significant input to the scientific knowledge base on eastern Gulf Coast SNPL and will assist in guiding management decisions on coastal beaches (e.g., for beach nourishment and other engineering activities) as well as future research efforts.

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