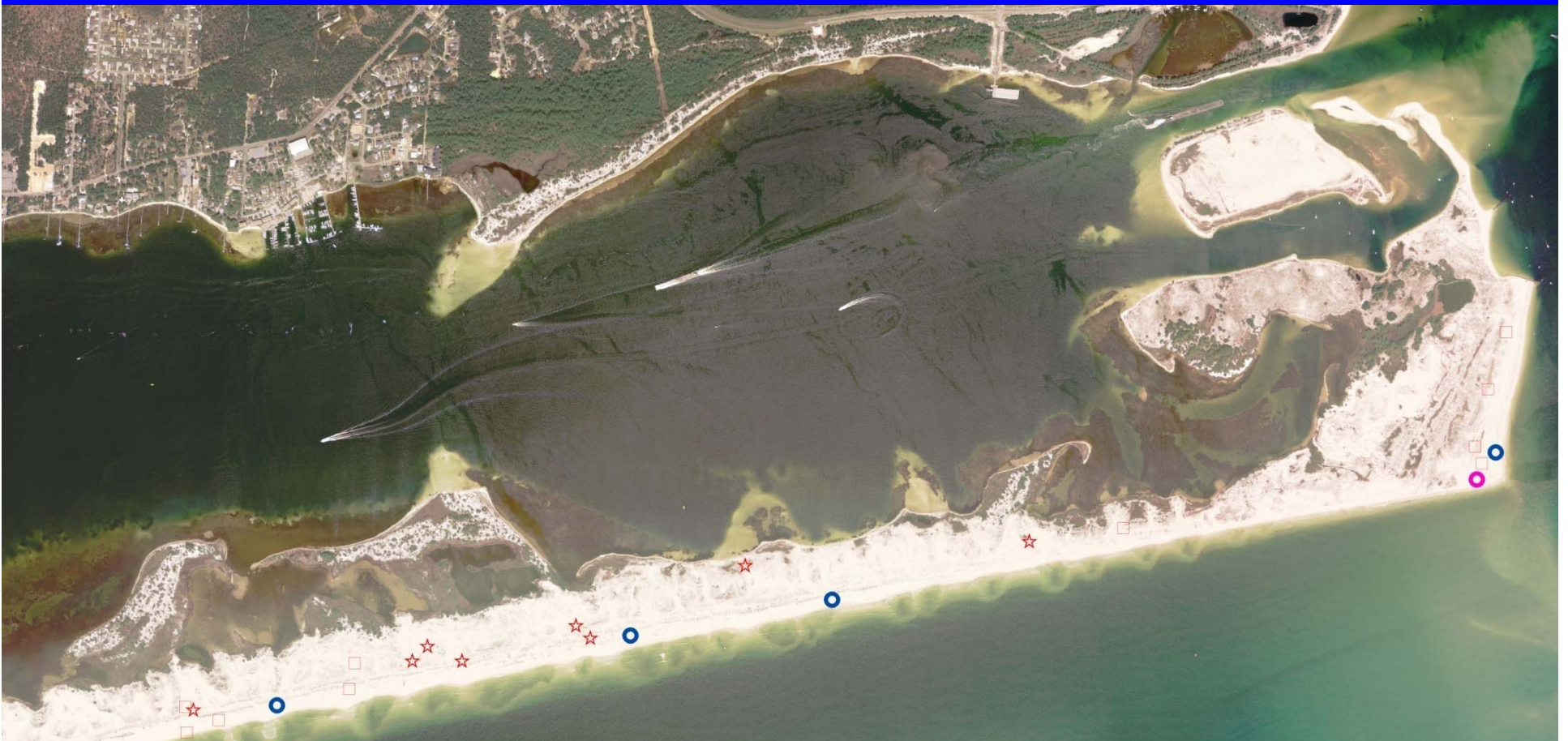


Ecology and conservation of Florida's Snowy Plovers

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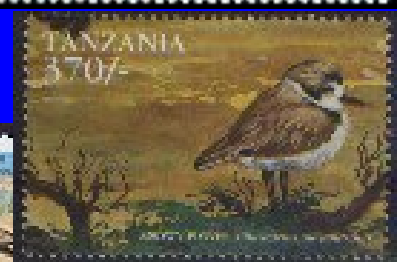
The small, sandy-colored shorebird slide



The Snowy Plover (SNPL), *Charadrius alexandrinus*, also known as the Kentish Plover in the Palearctic, is a sexually dimorphic species with precocious, self-feeding young that leave the nest within several hours after hatching. SNPL display bi-parental care during incubation and then, most frequently, male-only care during the chick period (although both bi-parental care and female-only care do occur). SNPL regularly re-nest after nest failure or after fledging successful broods (with as many as 6 re-nesting attempts per season). Adult SNPL can raise between one and three successful broods each year with one to three fledged young per brood. Nests are typically placed on bare substrates in open areas and parents lead young anywhere from several hundred meters to several kilometers from the nest to brood-rearing habitats shortly after hatch. Adults and chicks forage for small invertebrates by pecking or probing at the surface of a variety of substrates, including intertidal flats, ephemeral pools, wrack, and live vegetation. Natal and between-season adult dispersal is generally short-distance, although dispersal distances as great as 1,000 kilometers have been observed. Females frequently desert broods and re-mate with different males. Females may disperse many kilometers between nesting attempts within the season. Migratory behavior ranges from year-round residency to long-distance migration. SNPL are gregarious during the non-breeding season, particularly at roost sites. **216 words.**

Snowy Plover *Charadrius alexandrinus*

SNPL = Kentish Plover in eastern hemisphere



Sexually dimorphic plumage



- Note darker markings on male (above)

Precocious chicks



- Self-feeding chicks leave nest hours after hatch

BOTH bi-parental and uni-parental care



- Bi-parental care during incubation (female/daytime)
- Male-only care of chicks is common
- Bi-parental and female-only care of chicks also occurs



Complex population biology- sex differences

- Different number of re-mating opportunities for males and females
- Females often desert broods and re-mate with another male in same season
- Sometimes females will travel long distances (>100km) to re-nest in same season



Re-nesting and fledging multiple broods

- Adult SNPL regularly re-nest after nest failure, brood desertion, or fledging a brood
- Up to 6 nesting attempts possible per season
- SNPL may have 1, 2, or rarely 3 successful broods of 1, 2, or 3 chicks per year



Feeds in intertidal zone, wrack, vegetation, e-pools



Nest site selection

- Bare ground, sometimes near sparse vegetation
- Coarse sand, gravel, or shell substrates
- Conspicuous object near nest (driftwood, shell)
- Landscape features vary among populations (e.g., in front of or behind primary dunes, inside washover passes/dune pockets, near inlets)



Brood-rearing period



- Adult(s) lead chicks
100m- 3km from nest
- Shown foraging areas
- Chicks brooded
- Predators evaded
- Chicks defended from
other SNPL broods



Natal dispersal is usually short distance

- Humboldt Bay/Arcata
- Monterey Bay

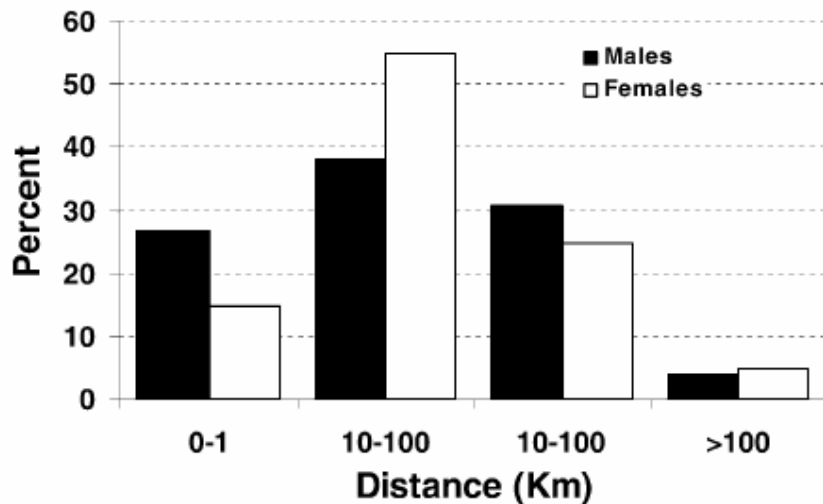


FIG. 2. Dispersal distances of Snowy Plovers (females [□, $n = 20$] and males [■, $n = 26$]) in coastal northern California.

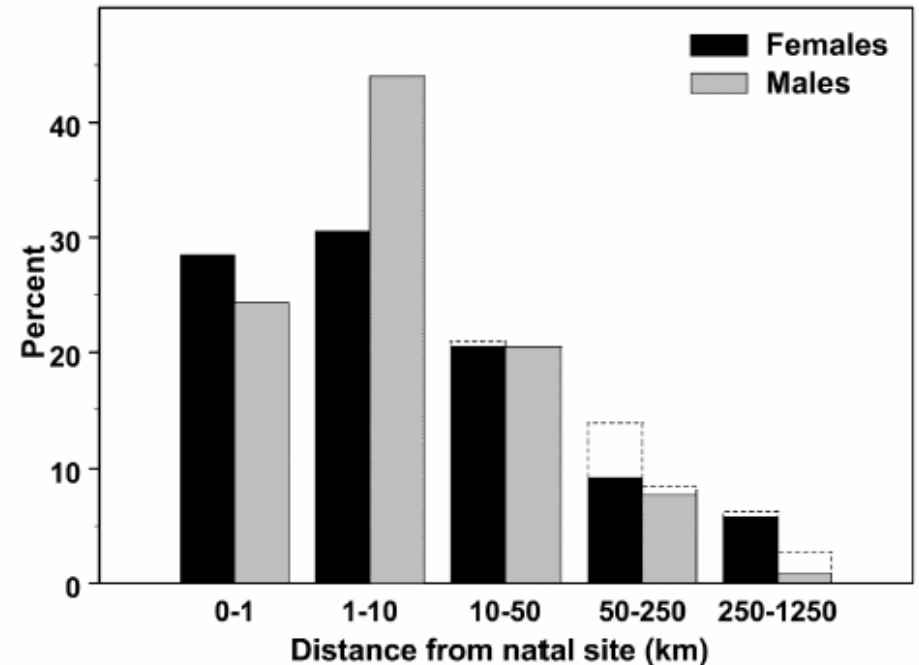


FIG. 3. Natal dispersal distances for 238 females and 259 males fledged in the Monterey Bay area. Birds without evidence of breeding are indicated by broken line.

Colwell et al. 2007 *Wilson Journal of Ornithology*

Similar results in Eurasian studies

Stenzel et al. 2007. *The Auk*

Migratory tendencies vary among populations

<u>Group using Monterey Bay, CA.</u>	<u>% F</u>	<u>% M</u>
Breed AND winter in Monterey Bay	40	38
Breed in Monterey Bay, winter away	19	37
Breed elsewhere, winter in Monterey	14	6
Monterey Bay during migration only	27	19

Stenzel et al. 2007, the Auk

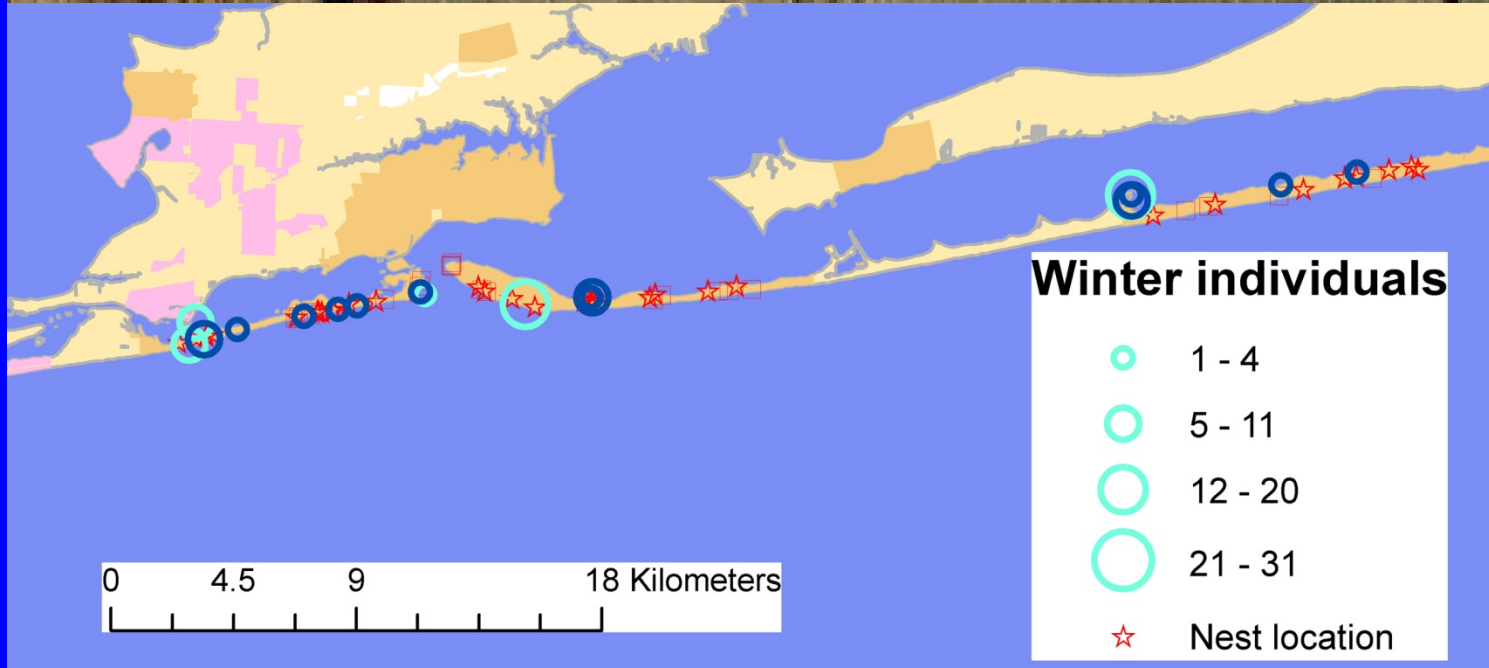
- What are seasonal movements of SNPL in FL?
- FWC pair estimates of 213 (2002) & 222 (2006)
- winter counts of individuals= 311 (2001, IPPC), 289 (2002, FWC), and 215 (1998, Nichols)

Most Florida SNPL are unbanded

- Large-scale banding and re-sighting would help to understand connections with other populations
- Banding adults would help to explain links between nesting and brood rearing habitats
- Banding helps to study reproductive success



Gregarious at roosts and feeding areas in winter



Snowy Plover annual cycle

- Pre-breeding period at nesting areas (5-45 d)
 - Nesting/brood rearing habitat selection (??)
 - Territory acquisition (males) (Jan-Mar)
 - Pair formation (Jan-Mar)
 - Copulation/egg-laying (late Mar-Aug)
- Incubation period (27 d) (mid Mar- mid-Jul)
- Brood-rearing period (30-47 d) (mid-Apr- mid-Aug)
 - Brood desertion (variable) (2 parents for ≥ 14 days in 82% broods, then 50% w/1 parent, Gore and Chase 1989)
- Non-breeding period (Sep- Dec or Mar)
 - Migration?
 - Winter
- Population limitation can happen at ANY point in annual cycle (limiting factors differ)

Potential limiting factors for FL SNPL

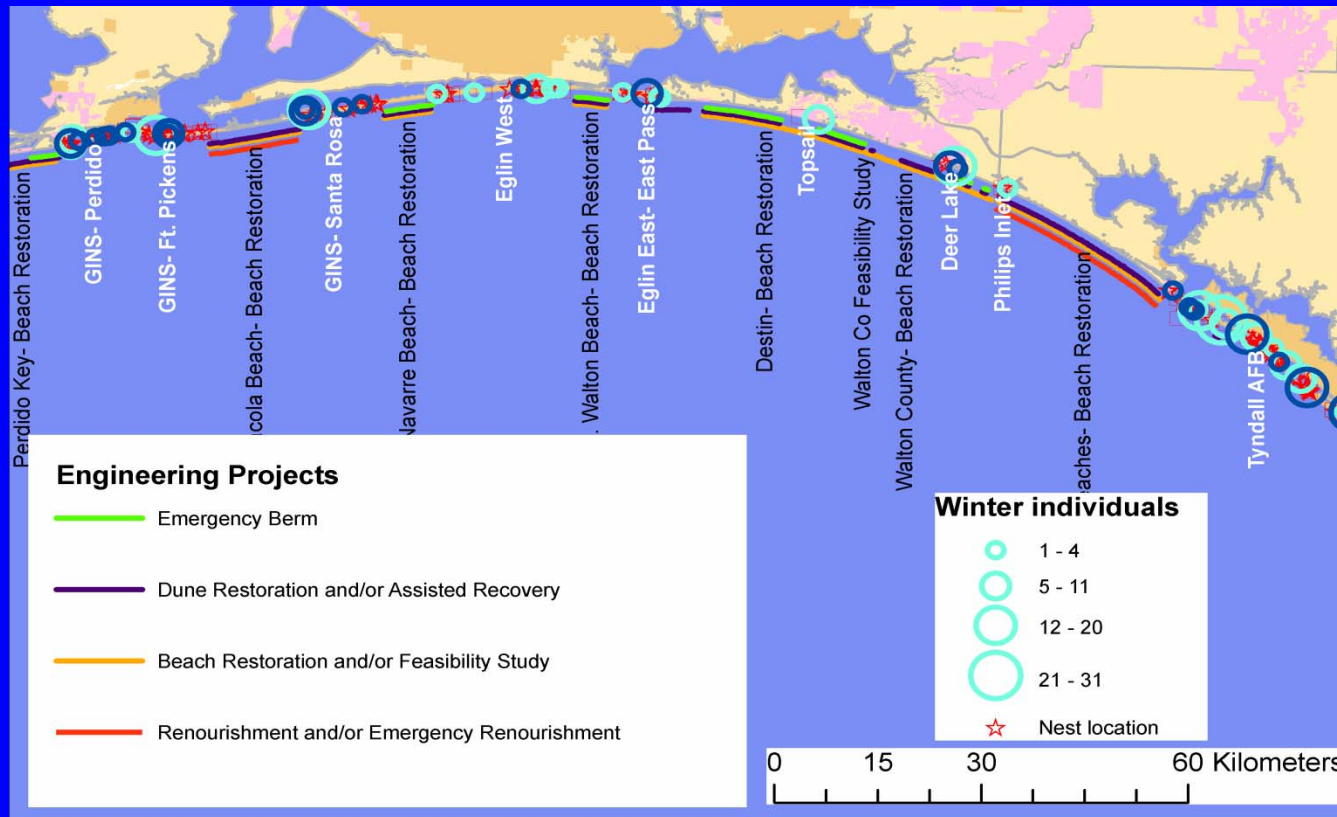
HABITAT FACTORS- LIMIT PRESENCE

- Availability of suitable nesting habitat
- Availability of suitable brood-rearing habitat
- Connectivity between nesting and brood-rearing habitat
- Availability of suitable non-breeding habitat
- Availability of mates

DISTURBANCE FACTORS- LIMIT SUCCESS

- Predators
- Human disturbance

Factors that limit presence



- SNPL not present in engineering project areas
- Is this due to habitat loss and/or disturbance??
- When birds are NOT present, reproductive success is always 0; management options are pretty limited

Gradient from habitat degradation to loss



- Development and dune plantings focus birds AND people on front beach
- Chicks cut off from bayside foraging areas
- Front beach resources lost or unavailable due to disturbance



“Natural” areas with available habitat

- Nesting, brood rearing, and non-breeding habitat are abundant and connected
- Natural processes are allowed to occur
- Management can focus on predators and disturbance
- Rare across state- limited to mostly public lands
- Actions leading to habitat loss must be avoided!



Managing SNPL where they occur

- Ecological approach is necessary
 - Ecology is the study of the physical and biological factors that affect distribution and abundance
- Species-based definition of “habitat” is critical
 - Defining habitat as a vegetation type is not very useful for conservation (e.g., beach, dune)
 - An animal’s habitat is the sum of the resources necessary for survival and reproduction
 - Nest site
 - Brood-rearing areas
 - Food resources
 - Features that allow predator and disturbance evasion
 - Connectivity among habitat patches

How do SNPL make it though the year?

- Pre-breeding period (decision to nest in an area)
 - Nesting & brood rearing habitat present/connected
 - Mates available
 - Disturbance threshold??
- Incubation period (survive to hatch)
 - Eggs viable
 - Eggs survive predators, storms, feet, and vehicles
 - Eggs cared for by adults
- Chick rearing period (survive to fledging)
 - Chicks find enough food for growth
 - Chicks survive predators, storms, feet, and vehicles
 - Chicks cared for by adults
- Non-breeding period (survive to next breeding season)
 - Fledglings and adults survive predators and weather
 - Fledglings and adults find enough food to survive
 - Fledglings and adults survive dispersal or migration

Stage-specific mechanisms for population limitation

- Incubation- reasons SNPL eggs don't survive
 - Eggs not viable
 - Natural defects/ genetic abnormalities
 - Contaminant issues
 - Eggs depredated
 - Racoons, coyotes, foxes, crabs, gulls, crows, etc.
 - Eggs destroyed by weather
 - Eggs destroyed by washover
 - Eggs buried by wind
 - Eggs destroyed by heavy rain/hail
 - Eggs crushed by people
 - Eggs stepped on
 - Eggs crushed by ATVs or other vehicles
 - Parental care/ nest attendance inadequate
 - Eggs not attended due to heavy disturbance
 - Eggs depredated due to heavy disturbance

Managing SNPL limiting factors

- What do you think is limiting SNPL reproduction or survival in your area?
- Can you identify mechanisms?
- Are you sure it's not something else? How?
- Can you do anything about the problems you have?
- How will you know if you have done the right thing?
- Can you monitor habitat, nests, broods, or over-winter survival in a way that helps you understand mechanisms affecting survival and reproduction?
- Can you use this information to guide adaptive management and track successes or failures?

Need site-based data on birds and disturbances, by habitat patch, for adaptive management!!

