

**RARE BIRD SURVEY
of the
TIMUCUAN ECOLOGICAL AND HISTORIC
PRESERVE**

**Final Report to
National Park Service**

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**Southeast Conservation Science Department
The Nature Conservancy**

INTRODUCTION

The following report summarizes the results of avian censuses conducted at Cedar Point, comprising approximately 392 acres at the southern end of Black Hammock Island proposed for inclusion into the Timucuan Ecological and Historic Preserve. Emphasis was placed on the identification and census of endangered, threatened, unique, rare, notable and species of special concern identified by the U.S. Fish and Wildlife Service (USFWS), the Florida Game and Fresh Water Fish Commission (FGFC), and the Florida Natural Areas Inventory (FNAI). Objectives of the project were to 1) to provide a baseline inventory of avian populations using the Cedar Point area and 2) identify particular species of concern in need of management and/or monitoring.

METHODS

Emphasis was placed on characterizing the structure of avian communities, rather than estimating population densities or habitat relationships. Cedar Point surveys were conducted 11 times during the spring migration, from 19 April to 1 June 1995. Censuses were conducted in the early morning. No attempt was made to randomize for tidal conditions, although there is evidence that tidal period significantly affects bird counts (R. Clark, pers. comm.). Birds were counted as heard and as observed. Confirmation of breeding status was made only upon observation using standard breeding bird survey methods (see attached). The forested areas were surveyed systematically using the existing trail system. The existing trails provided good coverage of all of the existing habitats and allowed for rapid assessment during all seasons with good visibility of foraging birds. In some situations, recorded screech owl (*Otus asio*) calls were played to attract birds to random census locations.

Relative abundance of species was represented as percent of census dates that the species was observed and the mean number of individuals of each species observed per census date. Species richness was estimated as the combined number of species on each census date.

RESULTS

Avian Community Structure

During the combined census period, 108 species were recorded on the trails on Cedar Point and the marshes and tidal channels associated with Horseshoe and Cedar Point Creeks. Bird species are listed in the Appendix I. Bird groups occurring in the greatest abundance were wading birds and passerines (Tables 1 and 2).

Species richness was relatively static, averaging 55 different species observed during each census (Figure 1). Species richness can be expected to vary with season, reaching annual low during the winter months. The relative species composition (represented by species groups) changed during the course of the survey period (Figure 2). This difference in relative abundance of species groups reflects variability due to census date which argues for targeted and repeated census of particular groups of interest (e.g., wading birds, migratory songbirds).

Most of the wintering species were gone from Cedar Point by about 22 April, although a few notable species (including three hermit thrushes observed on 19 April) attested to a delayed migration in 1995. The spring migration was essentially over by about 25 May (R. Clark, pers. comm.).

Counts also varied widely due to the range of habitats found on and around the Cedar Point area, ranging from tidal marshes and channels to relatively mature, second growth maritime forest. Avian use of forested and wetland habitats is strongly influenced by the structure of the vegetation and the interspersed habitat types. The relatively high species richness and species diversity observed at Cedar Point is a reflection of the range of available habitats.

Avian communities were similar in species composition and diversity to those at nearby Fort George Island and in other coastal forests in Florida (Pruitt 19__). Species composition was also very similar to that recorded for the same area by the Duval Chapter of the Audubon Society (see Appendix II).

The most commonly sighted bird in terrestrial habitats on Cedar Point during the spring surveys was the common yellowthroat, which was observed during all surveys, with an average of 16.6 individuals observed per survey. The ten most commonly observed species, on Cedar Point and using the marshes along Horseshoe Creek, in order of relative abundance (number of censuses and number of individuals per census), were:

- Common yellowthroat (*Geothlypis trichas*)
- Red-winged blackbird (*Agelaius phoeniceus*)
- White-eyed vireo (*Vireo griseus*)
- Northern cardinal (*Cardinalis cardinalis*)
- Tufted titmouse (*Parus bicolor*)
- Blue-gray gnatcatcher (*Poliophtila caerulea*)
- Boat-tailed grackle (*Quiscalus major*)
- Mourning dove (*Zenaida macroura*)
- Fish crow (*Corvus ossifragus*)
- Great egret (*Casmerodius albus*)

Figure 3 illustrates the variability in the observed numbers of six warbler species. These graphs indicate that 1) for permanent residents, there is considerable variability

in bird numbers between census dates, which argues for repeated censuses during the course of the season; and 2) for migrants and winter resident species, censuses must be started early and continued into the breeding season to capture some of these species.

Figure 4 shows similar information for wading birds observed in the marshes and tidal creeks around Cedar Point. The data suggest that the tri-colored heron and great egret were the most commonly observed waders. In general, the smaller wading birds (night herons, green herons, and cattle egrets) tended to be less often observed and were never seen in large numbers.

Bird censuses were significantly affected by tidal stage (R. Clark, pers. comm.). In general: 1) more birds tend to use estuarine habitats during low tides when mud flats are exposed or shallow water covers other habitats; 2) birds tend to use different habitats during different tidal stages; and, 3) the overall number of birds foraging in and around salt marsh habitats was greatest during low tides.

Species of Concern

A total of 17 species observed at Cedar Point are found on the list of special vertebrates maintained by the Florida Natural Areas Inventory (Table 3). Six are species of special concern, one (least tern) is listed as threatened, and one (wood stork) is a state endangered species.

Twelve species of songbirds observed on Cedar Point were listed by the Southeast Working Group for Partners in Flight as requiring immediate management and/or monitoring attention (Table 4). The painted bunting which breeds in the area has demonstrated significant declines in its populations over the past 26 years (Hunter *et al.* 1993a). All of the listed birds suffer from one or more of the following problems: 1) limited distribution and a high degree of threat during the breeding and/or non-breeding seasons, 2) widespread evidence of a recent or long-term decline in numbers; and/or 3) dependence on threatened habitats in the Southeastern U.S. that are essential for the conservation of the full variation inherent in the species (Hunter *et al.* 1993a). In particular, maritime (coastal) shrub-scrub and forest habitats on the Atlantic and Gulf coasts (including the forested areas in and around Black Hammock Island and Timucuan Preserve) are critically important for many Neotropical migrants (those species which breed (at least partially) in the North American temperate zones and migrate (at least partially) south of the continental United States during the non-breeding seasons) (Hunter *et al.* 1993b).

American oystercatcher (*Haematopus palliatus*) was identified as a focal species used to identify important habitat areas in Florida (Cox *et al.* 1994). American oystercatchers are uncommon or rare throughout most of the United States and are

year-round resident over the species remaining range. The oystercatcher was a relatively rare bird seen on only two census dates flying over the marshes east of Cedar Point. Habitats associated with these marshes are probably not particularly suitable for foraging and birds will likely find better habitats further east on the coastal marshes.

Least tern (*Sterna antillarum*) is considered threatened by the FGFWFC and G5/S3 (moderately rare) in Florida by FNAI. Habitat loss of the saltmarshes, tidal creeks, and sloughs in which they feed is a key threat. They are known to nest on nearby Blount Island with potential breeding habitat (dry flat beaches of coarse sand or shell) also occurring on Pinder's Island (Newman *et al.* 1988) and are also known to forage in the marshes and tidal creeks around Pelotes Island (Duever *et al.* 1989). Terns were seen foraging in marshes east of Cedar Point on 7 census dates. This was a fairly common over our limited sample, with a mean of about 4 birds/day. Again, just as likely to be seen in the marshes elsewhere on the Preserve. No areas appear to be suitable for breeding.

Brown Pelicans (*Pelicanus occidentalis*) were observed flying over the Cedar Point study area near the marshes associated with Horseshoe Creek. They were also observed swimming in the channels in marshes elsewhere on the Preserve (notably at the Theodore Roosevelt Area (TR) and the Nassau River). Pelicans were observed on only two days at the Cedar Point area (3 individuals on 4-30 and 2 on 5-5). It is likely that the marsh channels and the Nassau River offer suitable loafing and foraging habitats.

Cooper's Hawk (*Accipiter cooperii*), only one immature individual was observed on 5-13.

Osprey (*Pandion haliaetus*), a species of special concern in some parts of Florida, were commonly seen flying over and foraging in marshes near Cedar Point. Osprey nests are known from the marshes associated with Clapboard Creek and Pelotes Island south and west of the Point (Newman *et al.* 1988, Simmonds 1988).

This was another species observed on every census date (mean of about 5 per census day). Ospreys were observed actively foraging in the Horseshoe Creek marshes, but generally observed as fly-over. There are two confirmed nestss along Cedar Point and Pumpkin Hill Creeks, and two other probable nests Ospreys are known to nest further west in marshes along Cedar Point Creek (R. Clark, pers. comm.).

Wood Stork (*Mytheria americana*) is considered endangered by both the Florida Game and Fish Commission and the U.S. Fish and Wildlife Service and is ranked G5/S2 (seriously threatened) in Florida by FNAI. The primary threat to wood stork populations is habitat loss, including the loss of suitable rookery sites and foraging areas. Storks were commonly seen flying over or perched at Cedar Point. There is a large rookery west of Pumpkin Hill Creek (outside of the preserve) on St. John Water Management District property.

Wood storks typically forage within 10-35 miles of colony sites (TNC 1989) so that it is important to protect existing marshes, including minimizing human disturbance associated with recreational use of marsh areas. Storks are very sensitive to changes in water levels in foraging marshes because, rather than actively stalking prey like egrets and herons, they tend to forage by groping about in areas of high prey density. Thus any monitoring program directed at storks should focus in areas where tidal water levels are dropping, which tends to concentrate prey in isolated pools.

Little Blue Heron (*Egretta caerulea*) were observed on 7 of the 11 sample dates. Most often only 1 or 2 birds were observed, with a maximum of 6 observed on 4-22.

Snowy Egret (*Egretta thula*) were observed on 9 of the 11 sample dates. The snowy egret was generally more abundant than the Little Blue Heron, with a maximum of 8 observed on 4-24. It was a fairly common species found loafing and foraging in marshes east and west of Cedar Point and commonly seen around the Kingsley Plantation.

Tri-colored Heron (*Egretta tricolor*) were another fairly common species, observed on all sample dates with 14 seen on 5-25. This heron was fairly common throughout the Preserve.

Worm-eating Warbler (*Helmitheros vermivorus*) is a migrant observed using the forested areas in the southern portion of Cedar Point on one day (6 birds observed on 4-19).

American Redstart (*Setophaga ruticilla*) is also a migrant. It was observed on 7 census dates and was fairly common on some days in edge habitats.

Wading Birds

Wading birds observed foraging in the marshes within the study area are listed in Table 2. Three species (snowy egret, little blue heron, and tri-colored heron) are species of special concern in Florida.

A wading bird rookery was known to be active on Pelotes Island from 1979 through 1982, supporting over 1,600 active nests. Species breeding in the mixed rookery included cattle egret, snowy egret, great egret, little blue heron, tri-colored heron, black-

crowned night heron, white ibis and anhinga . However, surveys during the breeding season in 1987 revealed no nests (Newman et al. 1988). Another active rookery was reported by the Florida Game and Fresh Water Fish Commission on Cedar Point Road also known as the Pumpkin Hill Rookery) is still very active. While colonial wading birds typically used nesting sites repeatedly from year to year, abandonment of sites is not uncommon (Rodgers and Smith 1995).

Wading birds are generally of conservation concern due to declining habitat availability. Snowy egrets and little blue herons are still considered fairly common, but are of concern. Black-crowned night herons appear to be somewhat rare. Several of these species were known to nest at nearby Pelotes Island. A nesting colony of great egrets and great blue herons was located on the north side of Fort George Island in 1984, consisting of approximately 30 to 40 nesting pairs (Pruitt 19__). There is also another small rookery and roost at Blues Pond on Fort George Island (R. Clark, pers. comm.). Least terns are also known to breed in the vicinity of the island. All have been observed foraging along the tidal creeks or roosting in adjacent areas. The salt marshes, creeks and sloughs, and mudflats along tidal creeks are important feeding areas for wading birds, as well as larids (gulls and terns), particularly at low tide. Clapper rails are often heard in the marshes at the Point. No special management is necessary for most species of wading birds. Protection of foraging areas, including maintenance of hydrologic regimes, should protect foraging habitats.

MAPPING SUITABLE NESTING AND FORAGING AREAS

Nesting Areas

Suitable nesting areas for wading birds (most of the species of special concern) are generally defined by the presence of the birds themselves. There are Great Blue Herons nesting at the TR area, but we didn't observe any rookeries or breeding behavior at Cedar Point. This doesn't mean that waders are not breeding within the Preserve boundaries, only that we didn't observe it in our sample. There are suitable areas for nesting along marshes on the eastern side of Cedar Point. Now that human use of these areas is to be more closely managed and disturbance reduced, they may in time support a rookery. Monitoring on an annual basis would be a good idea.

As mentioned earlier there is a need for a more detailed survey of the Preserve wetlands. However, that means considerable man-power and boat time. Some of the smaller waders (the night-herons) were rarely observed and may not be present in large numbers.

Feeding Areas

Again, all of the marshes in the Preserve appear to be in pretty good shape and appear to offer suitable habitat for foraging waders, as well as good foraging opportunities for

terns and skimmers. Foraging birds were seen in and around Horseshoe Creek at Cedar Point, at the TR area, and even in the channel at Kingsley Plantation. But, as mentioned earlier, no one place is more or less likely to support the birds (at least, not when we were working there). Now that the fish camp on eastern Cedar Point is going to be closed and human influences reduced, the marshes along Horseshoe Creek may become a more viable habitat for different species. Long-term monitoring is, obviously, required to see if this actually happens. For example, it is likely that the known locations for breeding terns and skimmers (such as Talbot Island and points east) are much better habitats for these species, but it would be interesting to see whether they make more use of Cedar Point now that the people have been removed.

MONITORING

The ability to make much progress in setting up a meaningful monitoring protocol for any species or species group was limited to the short time of the project. It would be difficult to determine which species and where to monitor after only one season in one year. Actually Roger Clark is already in the process of setting up some monitoring protocols. Literature on how to structure a program and what kinds of data can be best gotten in the sort of situations one finds at Cedar Point was sent to Roger.

The lack of good aerial photographs of the area, severely limits the ability to quantify the different habitats and, consequently, of targeting those habitats for appropriate sample sizes, etc. Hopefully this lack of photographs will soon be rectified, but it does not help us now.

As discussed with Roger, there are two primary ways of surveying/monitoring bird populations in a repeatable fashion. Some biologist prefer line transect censuses for a variety of statistical and manpower reasons. Others use plot-based censuses. In general, both methods give reasonable results and are easy to analyze. It still has not been decided which procedure makes most sense to be used at the Point. The problem with transects is that, in areas composed of very dense hammock such as the Point, trying to lay out and then follow linear transects becomes very difficult. Particularly when faced with swarming yellow flies. Plot-based methods can be adapted to existing geographic features, like the trails that already exist down on the Point. On the other hand, it may be just as meaningful to use the existing trails, walked in the same manner at the same time of day on repeated dates, as *transects* (as the breeding bird surveys do; this may be the best use of staff for the first year). Then, too, a lot depends on the quality of your volunteer staff. If they all have really good birding skills, then transect sampling is easier (a good birder can spot or hear a lot more birds when moving along a transect than a novice, whereas plot-based methods give the observer more time to nail down his or her ID).

In plot methods, you would generally establish a number of circular plots of, for example, 40 m radius, at least 130 to 150 m apart within each habitat you are interested in. The plot center would be flagged and the circumference at the cardinal compass directions visible from the plot center so you can tell when a bird is in or out. Surveys would be conducted at each plot by recording all birds heard or seen in the plot for 8 to 10 min. This method becomes almost impossible in dense vegetation and requires considerable effort to initially establish the plots. With this method you would get some data that you might not using a transect method, but over-all it poses some problems for volunteer workers who may not be "in to" crawling around in the underbrush.

There are also combination methods. For example, strip censuses involve long transects divided into rectangular segments that are similar to plots. An example, would be running a 250 m transect across the habitat types of interest (say, extending across the clear cut that dominates the northwestern portion of the Cedar Point area and into the adjacent forest to determine what birds are using the clearing, edge, and forest). For example, observation posts might be established every 25 m. It is necessary to make sure you have equal numbers of plots in each of the habitats and you would sample them repeatedly in each of the seasons you were interested in. This kind of method works really well for surveying linear features, like salt marsh edges. For example, a 500 m x 60 m strip is layed out with the center of the strip on the marsh edge (or on the forest/clearcut edge, etc.). The observer then walks along the center line, counting all birds that flush or are seen within the strip boundaries (within 30 m to the left or right of the center line).

Another important factor that must be considered in setting up monitoring protocols is the decision as to whether you are interested in breeding birds, all birds, etc. Originally, we were thinking in terms of developing a breeding bird list, the way the state breeding bird atlases are constructed. Of course, depending on when you have staff available, that may or may not work. Again, for the first year, a list of breeders and a list of migrants would be the best sort of data to capture. Based on that data, you can go exploring for answers to specific questions in later years. One concern is that the existing trails may not give you a completely representative sampling of all of the habitats at the Point. It would be really nice to be able to outline where those trails are on an aerial photo so that you could see just how much of the point you would actually be surveying, if you stay on the trails.

MANAGEMENT IMPLICATIONS

Continuing development and increased recreational use of coastal areas poses serious threats to wildlife that uses estuarine and maritime habitats (Bildstein *et al.* 1991, Clark *et al.* 1993, Reinert and Mello 1995). Species such as the seaside sparrow, least tern and clapper rail that are dependent on salt marshes for foraging and/or breeding, are

particularly sensitive to human encroachment into estuarine habitats. In general, tidal flats and creeks provide foraging sites for waders, gulls, terns and swallows, while the marsh surface is used for resting and feeding (Craig and Beal 1992, Weller 1994, Reinert and Mello 1995). In addition, long-distance migrants, including warblers, terns and shorebirds, rely on coastal and maritime habitats as resting and feeding sites. Thus, loss or degradation of estuarine habitats can have regional and even global implications (Howe *et al.* 1989, Pfister *et al.* 1992). Maritime forests along the eastern coast of the U.S. support unusually high densities of migratory and over-wintering birds (Pruitt 19__). Surveys on Fort George Island in late October and November revealed 23 species of migrant and resident birds, which was comparable to other coastal forests in Florida (Pruitt 19__). Bird diversity on mainland Cedar Point was significantly higher even given the limited sample period, suggesting that the forest habitats on the Point provide important habitats for migrant birds. The forest at Cedar Point, like that on Fort George Island, is very dense and structurally complex, offering a large array of potential niches and high carrying capacity. The presence of a black-billed cuckoo, a species that tends to be relatively rare and difficult to find in Florida, pointed to the importance of the coastal forests on the Preserve for migratory species.

In the urbanizing corridor along the north Florida coast, the habitats at Cedar Point and the islands provides important stopover and breeding habitats for an array of birds. Detailed and continuous monitoring of bird populations over a number of years would be necessary to fully document its importance. However, protected areas such as the Timucuan Preserve are very important in developing landscapes.

Efforts should concentrate on confirming breeding birds. A checklist for the Cedar Point area showing breeding birds, migrants, and permanent residents is well underway. The ideal situation would be to have that kind of a list for the entire Timucuan Preserve, north and south of the river and including the Roosevelt area. That's not our mandate under the current contract, but based on your work at Cedar Point it *should* be some time soon.

Several researchers have called for systematic avian monitoring programs in coastal areas to fill information gaps required for effective management strategies for estuarine birds (Pitelka 1979, Burger *et al.* 1982, Senner and Howe 1984, Colwell and Cooper 1993). There remains a general lack of sound population trend data available at local levels for many migrant species. Monitoring programs are needed to track trends in the numbers of migrants, as well as breeding species and permanent residents (such as many of the wading birds which are undergoing habitat loss). There is some disagreement about many issues in monitoring populations, including habitat definitions, sample sizes necessary to make informed management decisions, and decision rules to be used in determining management approaches (Hunter *et al.* 1993a). However, even in preliminary data concerning the species composition of avian communities using the forests in and around Timucuan preserve, the numbers of wading birds using marshes along the tidal streams, and the composition of migratory

flocks will provide valuable information on the status and population trends of many species of immediate concern.

Timucuan in a Regional Context

A recent report prepared by the Florida Game and Fresh Water Fish Commission (FGFC) (*Closing the Gaps in Florida's Wildlife Habitat Conservation System: Cox et al. 19__*) identified regionally important areas that were recognized as being "essential to sustaining many rare plants, animals, and natural communities." Pertinent to the Timucuan Preserve are the designated **Coastal Areas of Duval and Nassau Counties**, which includes (followed by FNAI element occurrence records):

Blount and Nearby Islands: southern bald eagle, great egret (rookery), least tern (nesting), seaside sparrow, shorebird aggregation area, and gopher tortoise.

Ward's Bank (Hugenot Park, Mayport Jetties): Wilson's plover, black skimmer (nesting), royal tern, least tern, piping plover, American oystercatcher, and shorebird aggregation area.

Ft. George Island/Talbot Islands: least tern (nesting), shorebird aggregation areas (Little Talbot), gopher tortoise, loggerhead turtle, eastern indigo snake, terrestrial peperomia, southern lip fern, and green ladies-tresses.

Amelia Island, South Amelia River, and Fernandina Beach: West Indian manatee congregation area, Smyrna seaside sparrow, least tern (nesting), shorebird aggregations (Ft. Clinch jetty, Amelia Island drawbridge, Amelia Island, north shore of Ft. Clinch), and gopher tortoise.

A number of the "focal species" that were used to develop the state-wide analysis of important areas either occur or may occur on the Preserve, including American oystercatcher, wood stork, and piping plover. There is a significant lack of information on the habitat requirements, population biology, and management of each species.

In addition, FGFC identified a number of Habitat Conservation Areas as important for the maintenance of biodiversity in Florida. These include **"Wetlands Important to Wading Birds."** The Upper St. Johns River marshes were singled out as an example of a large wetland system particularly important for waders. Wetlands along the St. Johns River are designated as a Strategic Habitat Conservation Areas because they 1) support at least three species of wading birds and 2) they are within 15 km of known wood stork colonies.

It is important to consider wading bird use of the Timucuan Preserve in a regional context. For example, it is one thing to know that a given area supports a certain

number of breeding pairs of a given species with a total population size of x , but quite a different thing to know that the area's breeding pairs are the only colony within the region. Increasing human use of coastal areas, including areas adjacent to colonial waterbird breeding sites, has resulted in increasing human disturbance of rookeries (Rodgers and Smith 1995). Skagen *et al.* (1991) demonstrated that human disturbance during wildlife viewing can subtly disturb the dynamics of avian communities. This is particularly true in mixed wading bird rookeries where the mixed-species aggregations may increase sensitivity to flushing of some species (Stinson 1988). Rodgers and Smith (1995) recommended minimum set-back distances of 100 m for wading birds and 180 m for mixed tern/black skimmer colonies to buffer breeding sites from human disturbance.

Monitoring efforts should be directed toward wading birds using the Timucuan marshes. An annual monitoring effort directed at wading birds may be a cost-effective way of generating some important data on those species. Twice monthly census of waders is suggested, to avoid disturbance, since bird numbers tend to remain fairly constant outside the migratory season, but weekly during the migration to capture subtle changes in species composition.

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Table 1. Wading birds and shorebirds observed at Cedar Point during spring 1996 censuses.

Species	Percent of Census Dates	Mean No./Census
WADING BIRDS		
Great egret	100	8.0
Tri-colored heron	100	5.4
Wood stork	91	5.8
Great blue heron	91	3.0
Snowy egret	82	3.7
Little blue heron	64	2.0
Green-backed heron	64	1.6
White ibis	36	9.0
Cattle egret	36	3.0
Black-crowned night-heron	9	2.0
Yellow-crowned night-heron	9	1.0
SHOREBIRDS		
Willet	82	2.7
Spotted sandpiper	55	2.5
Semi-palmated plover	36	9.7
Black-bellied plover	36	3.0
Short-billed dowitcher	27	8.7
Whimbrel	18	4.0
American oystercatcher	18	2.0
Killdeer	9	2.0
Semi-palmated sandpiper	9	1.0

Table 2. The 25 most frequently occurring passerine species observed at Cedar Point during spring 1996 censuses.

Species	Percent of Census Dates	Mean No./Census
Common yellow-throat	100	16.6
Red-winged black bird	100	12.4
White-eyed vireo*	100	10.5
Northern cardinal*	100	10.5
Tufted titmouse*	100	9.9
Boat-tailed grackle	100	8.7
Blue-gray gnatcatcher	100	8.7
Mourning dove	100	8.5
Fish crow	100	8.2
Blue jay	100	6.7
Red-bellied woodpecker*	100	6.2
Painted bunting	100	4.7
Northern mockingbird	100	4.2
Northern parula*	91	14.4
Carolina wren*	91	8.9
Chimney swift	91	5.8
Eastern towhee	90	11.0
Summer tanager*	90	3.1
Bobwhite	82	6.0
Great crested flycatcher	82	5.7
Red-eyed vireo	82	1.6
Blue grosbeak	81	1.8
Indigo bunting	81	1.8
Yellow-throated warbler	73	4.3
* species which tend to be attracted to forest edges (Noss 1991)		

Table 3. Bird species included on the Florida Natural Areas Inventory list of Special Vertebrates (March 1994).

Common Name	Scientific Name	Global Rank	State Rank	Federal Status	State Status
Brown pelican	<i>Pelicanus occidentalis</i>	G4	S3	N	LS
Great egret	<i>Casmerodius albus</i>	G5	S4	N	N
Little blue heron	<i>Egretta caerulea</i>	G5	S4	N	LS
Snowy egret	<i>Egretta thula</i>	G5	S4	N	LS
Yellow-crowned night heron	<i>Nyctanassa violacea</i>	G5	S3?	N	N
Black-crowned night heron	<i>Nycticorax nycticorax</i>	G5	S3?	N	N
Tri-colored heron	<i>Egretta tricolor</i>	G5	S4	N	LS
White ibis	<i>Eudocimus albus</i>	G5	S4	N	N
Wood stork	<i>Mycteria americana</i>	G4	S2	LE	LE
Cooper's hawk	<i>Accipiter cooperii</i>	G4	S3?	N	N
Osprey	<i>Pandion haliaetus</i>	G5	S3S4	N	LS
American oystercatcher	<i>Haematopus palliatus</i>	G5	S3	N	LS
Black skimmer	<i>Rynchops niger</i>	G5	S3	N	N
Least tern	<i>Sterna albifrons</i>	G4	S3	N	LT
Caspian tern	<i>Sterna caspia</i>	G5	S2?	N	N
Worm-eating warbler	<i>Helmitheros vermivorus</i>	G5	S1	N	N
American redstart	<i>Setophaga ruticilla</i>	G5	S3	N	N

Global Rank

- G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences)
G2 = Imperiled globally because of rarity (6 to 20 occurrences)
G3 = Either very rare or local throughout its range (21-100 occurrences)
G4 = Apparently secure globally (may be rare in parts of range)
G5 = Demonstrably secure globally

State Rank

Definition parallels global rank: substitute "S" for "G" in above Global Ranks

Federal Status

- LE = Listed as Endangered species by the USFWS
N = No federal Status

State Status

- Animals (Florida Game and Fresh Water Fish Commission)
LE = Listed as endangered species
LT = Listed as threatened species
LS = Listed as species of special concern
N = No state status

Table 4. Population trends (26-year) of highly ranked species identified for the Southeast in need of management and/or monitoring which were observed at Cedar Point (after Hunter *et al.* 1993a).

Species	Occurrence ¹	Regional Score ²	Population Trend ³
Painted bunting	SR	30	-*
Prothonotary warbler	SR	28	++
Wood thrush	M	27	-*
Worm-eating warbler	M	26	+
Acadian flycatcher	M	25	++
Black-billed cuckoo	M	24	?
Yellow-billed cuckoo	SR	24	0
Great crested flycatcher	SR	24	0
White-eyed vireo	PR	24	0
Black-throated blue warbler	M	24	?
Kentucky warbler	M	24	++
Orchard oriole	SR	24	++

¹ Seasonal occurrence in northeastern Florida: M = migrant; SR = summer resident; PR = permanent resident.

² Regional scores reflect relative need for increased conservation attention in the Southeast on the basis of the regional prioritization scheme described by Hunter *et al.* (1993b):

30-35 Extremely high priority
 24-29 Very high priority
 19-23 High priority
 13-18 Moderate priority
 7-12 Low priority

³ Population trend: -* = significant decline; - = possible decline; 0 = no trend; + = possible increase; ++ = significant increase (after Hunter *et al.* 1993a).

Figure 1. Species richness (total species observed) on each census date during spring avian surveys at Cedar Point, Timucuan Preserve, April-June 1995.

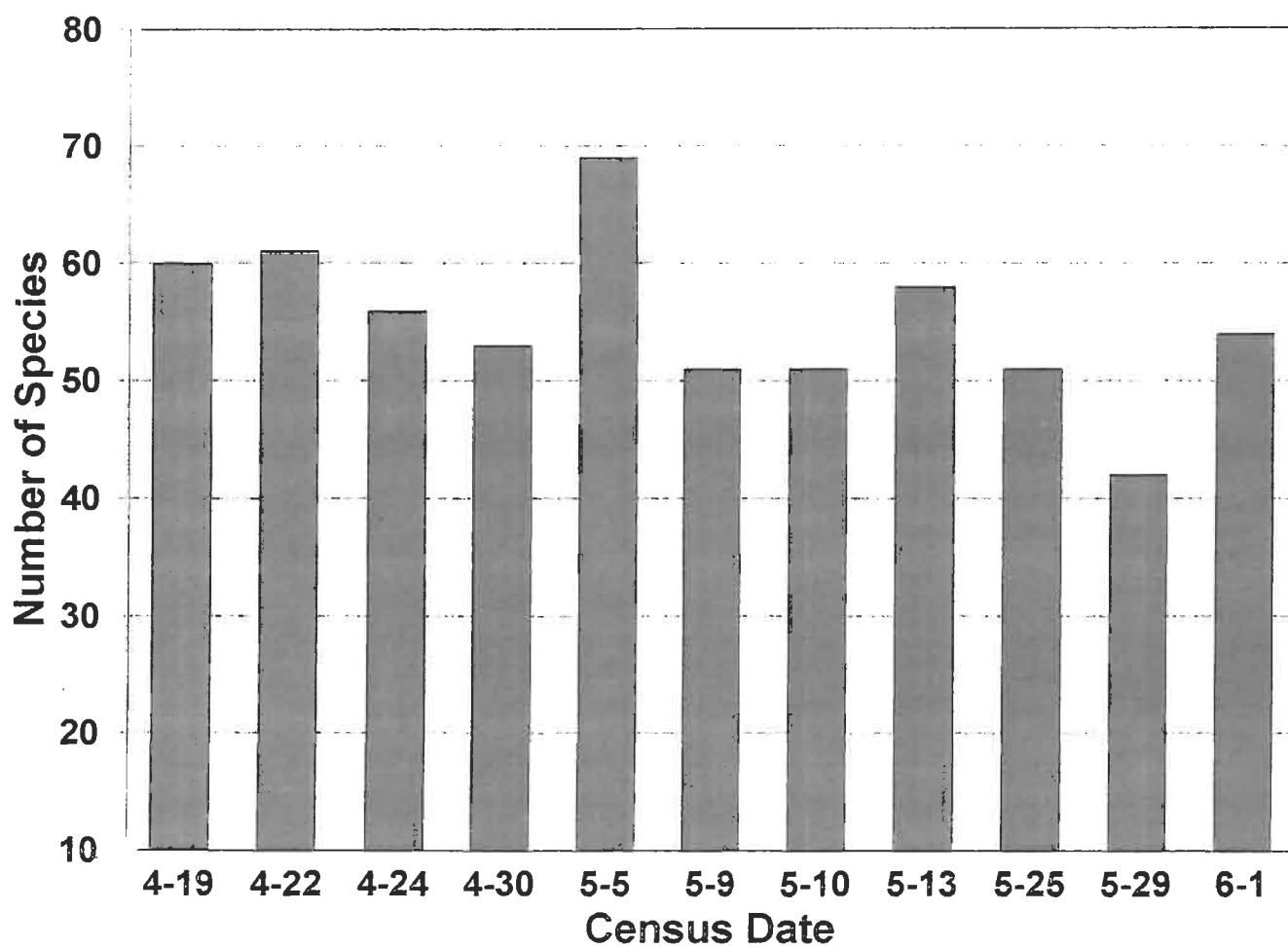


Figure 2. Relative abundance (percent of total species observed) of major species groups during avian surveys at Cedar Point, Timucuan Preserve, April-June 1995.

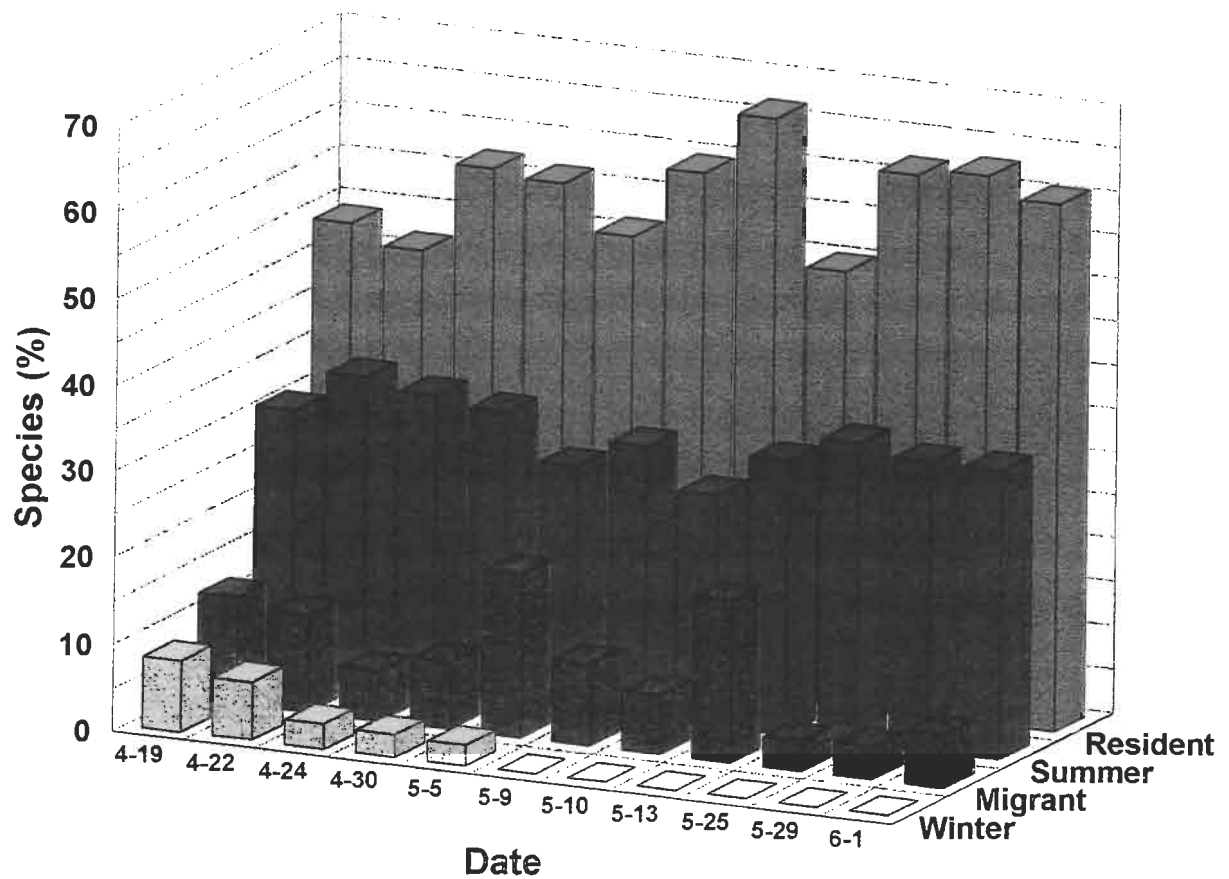


Figure 3. Abundance by census date for six warbler species observed at Cedar Point during avian surveys, Spring 1995.

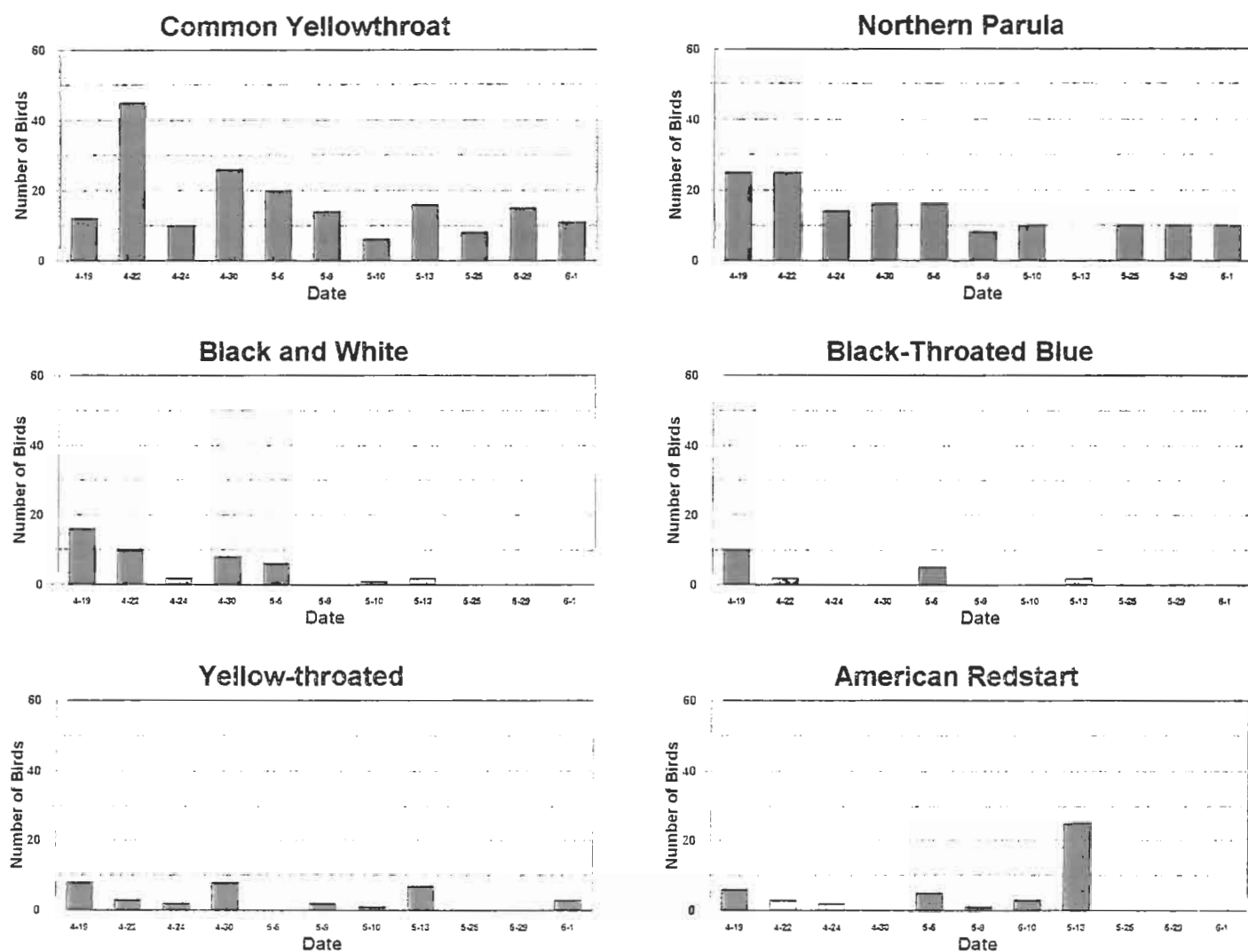
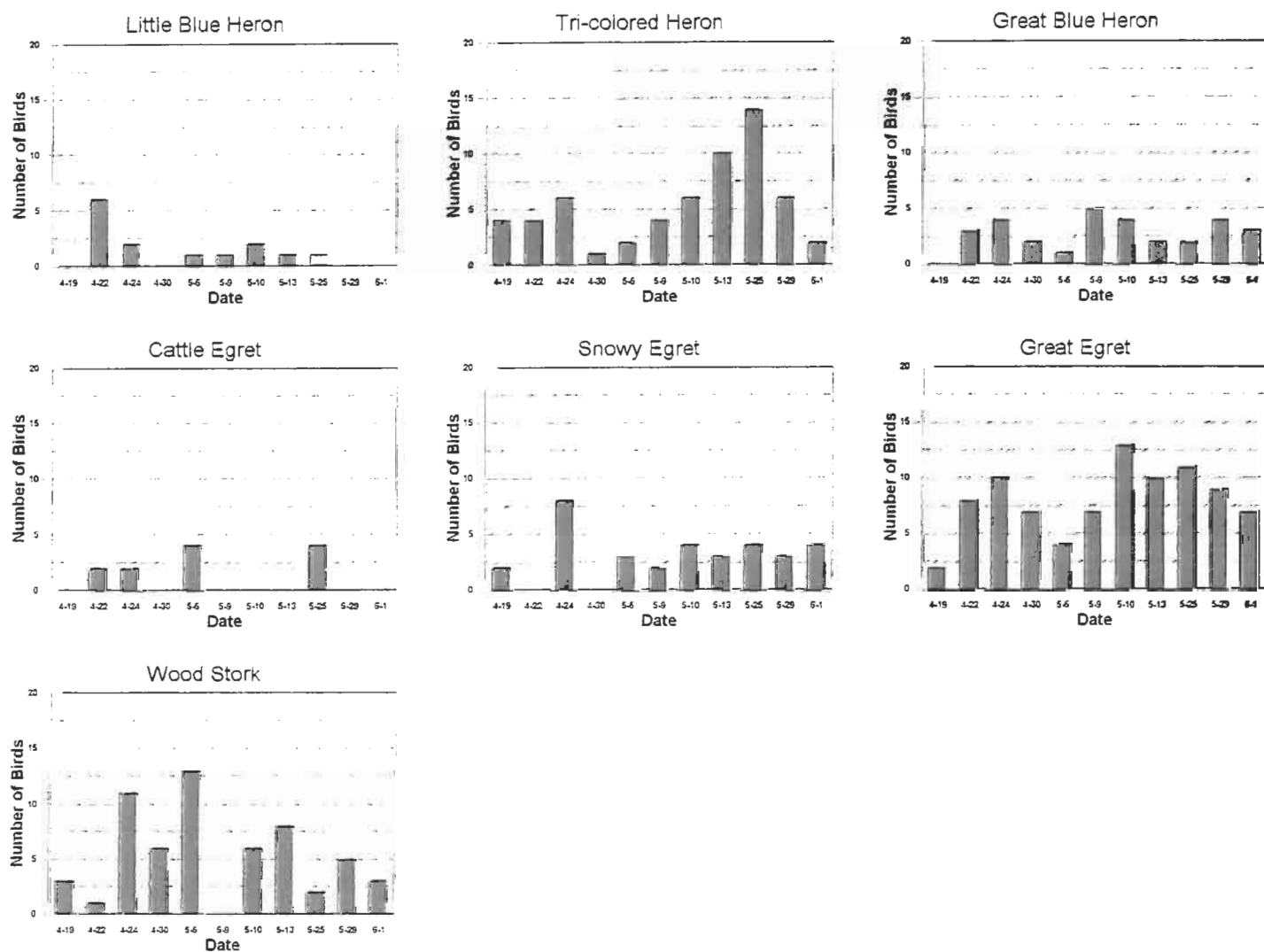


Figure 4. Abundance by census date for wading bird species observed at Cedar Point during avian surveys, Spring 1995.



APPENDIX I

Bird species observed during censuses of Cedar Point, 19 April to 1 June 1996, percent of total censuses during which each species was observed, and mean number of individuals recorded per census.

Common Name	Scientific Name	Occ ¹	% of Dates ²	# per Date ³
PELICANS AND THEIR ALLIES:				
Brown pelican	<i>Pelicanus occidentalis</i>	PR	18	2.5
Double-crested cormorant	<i>Phalacrocorax auritus</i>	PR	73	3.1
HERONS AND EGRETS:				
Great blue heron	<i>Ardea herodias</i>	PR	91	3.0
Great egret	<i>Casmerodius albus</i>	PR	100	8.0
Snowy egret	<i>Egretta thula</i>	PR	82	3.7
Little blue heron	<i>Egretta caerulea</i>	PR	64	2.0
Tricolored heron	<i>Egretta tricolor</i>	PR	100	5.4
Cattle egret	<i>Bubulcus ibis</i>	SR	36	3.0
Green heron	<i>Butorides striatus</i>	SR	64	1.6
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	PR	9	2.0
Yellow-crowned night-heron	<i>Nyctanassa violacea</i>	PR	9	1.0
STORKS AND IBISES:				
White ibis	<i>Eudocimus albus</i>	SR	36	9.0
Wood stork	<i>Mycteria americana</i>	PR	91	5.8
WATERFOWL:				
Wood duck	<i>Aix sponsa</i>	PR	36	2.0
VULTURES AND HAWKS:				
Black vulture	<i>Coragyps atratus</i>	PR	73	9.8
Turkey vulture	<i>Cathartes aura</i>	PR	100	6.3
Osprey	<i>Pandion haliaetus</i>	SR	100	4.8
Northern harrier	<i>Circus cyaneus</i>	WR	18	1.5
Cooper's hawk	<i>Accipiter cooperii</i>	PR	9	1.0
Red-tailed hawk	<i>Buteo jamaicensis</i>	PR	36	1.3
GALLINACEOUS BIRDS:				
Northern bobwhite	<i>Colinus virginianus</i>	PR	82	6.0

Common Name	Scientific Name	Occ ¹	% of Dates ²	# per Date ³
RAILS AND THEIR ALLIES:				
Clapper rail	<i>Rallus longirostris</i>	PR	73	3.4
SHOREBIRDS:				
Black-bellied plover	<i>Pluvialis squatarola</i>	WR	36	3.0
Semipalmated plover	<i>Charadrius semipalmatus</i>	WR	36	9.7
Killdeer	<i>Charadrius vociferus</i>	PR	9	2.0
American oystercatcher	<i>Haematopus palliatus</i>	PR	18	2.0
Willet	<i>Catoptrophorus semipalmatus</i>	PR	82	2.7
Whimbrel	<i>Numenius phaeopus</i>	M	18	4.0
Spotted sandpiper	<i>Actitis macularia</i>	WR	55	2.5
Semipalmated sandpiper	<i>Calidris pusilla</i>	M	9	1.0
Short-billed dowitcher	<i>Limnodromus griesus</i>	WR	27	8.7
GULLS AND TERNS:				
Laughing gull	<i>Larus atricilla</i>	PR	91	5.2
Gull-billed tern	<i>Gelochelidon nilotica</i>	SR	36	2.5
Forster's tern	<i>Sterna forsteri</i>	WR	18	2.0
Caspian tern	<i>Sterna caspia</i>	WR	18	1.0
Least tern	<i>Sterna albifrons</i>	SR	64	3.7
Black skimmer	<i>Rynchops niger</i>	PR	18	2.0
PIGEONS AND DOVES:				
Rock dove	<i>Columba livia</i>	PR	9	1.0
Mourning dove	<i>Zenaida macroura</i>	PR	100	8.5
Ground dove	<i>Columbina passerina</i>	PR	9	2.0
CUCKOOS:				
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	SR	73	1.3
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	M	9	1.0

Common Name	Scientific Name	Occ ¹	% of Dates ²	# per Date ³
OWLS:				
Eastern screech-owl	<i>Otus asio</i>	PR	64	3.7
GOATSUCKERS:				
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	SR	18	5.0
SWIFTS:				
Chimney swift	<i>Chaetura pelagica</i>	SR	91	5.8
KINGFISHERS:				
Belted kingfisher	<i>Megaceryle alcyon</i>	PR	9	1.0
WOODPECKERS:				
Red-bellied woodpecker	<i>Centurus carolinus</i>	PR	100	6.2
Downy woodpecker	<i>Picoides pubescens</i>	PR	64	1.7
Northern flicker	<i>Colaptes auratus</i>	PR	9	1.0
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	PR	9	1.0
Pileated woodpecker	<i>Dryocopus pileatus</i>	PR	73	1.6
FLYCATCHERS:				
Acadian flycatcher	<i>Empidonax virescens</i>	M	9	1.0
Great crested flycatcher	<i>Myiarchus crinitus</i>	SR	82	5.7
SWALLOWS:				
Tree swallow	<i>Iridoprocne bicolor</i>	WR	27	8.7
Barn swallow	<i>Hirundo rustica</i>	SR	73	2.8
Bank swallow	<i>Riparia riparia</i>	M	9	1.0
JAYS AND CROWS:				
Blue jay	<i>Cyanocitta cristata</i>	PR	100	6.7
American crow	<i>Corvus brachyrhynchos</i>	PR	36	1.5
Fish crow	<i>Corvus ossifragus</i>	PR	100	8.2

Common Name	Scientific Name	Occ ¹	% of Dates ²	# per Date ³
CHICKADEES AND TITMICE:				
Carolina chickadee	<i>Parus carolinensis</i>	PR	36	4.8
Tufted titmouse	<i>Parus bicolor</i>	PR	100	9.9
WRENS:				
House wren	<i>Troglodytes aedon</i>	WR	27	1.3
Carolina wren	<i>Thryothorus ludovicianus</i>	PR	91	8.9
Marsh wren	<i>Cistothorus palustris</i>	PR	9	1.0
KINGLETS AND GNATCATCHERS:				
Blue-gray gnatcatcher	<i>Poliophtila caerulea</i>	PR	100	8.7
THRUSHES:				
Hermit thrush	<i>Catharus guttatus</i>	WR	18	2.0
Wood thrush	<i>Hylocichla mustelina</i>	M	9	1.0
MIMIDS:				
Gray catbird	<i>Dumetella carolinensis</i>	WR	45	10.6
Northern mockingbird	<i>Mimus polyglottos</i>	PR	100	4.2
Brown thrasher	<i>Toxostoma rufum</i>	PR	55	1.5
WAXWINGS:				
Cedar waxwing	<i>Bombycilla cedrorum</i>	WR	36	24.3
STARLINGS:				
European starling	<i>Sturnus vulgaris</i>	PR	27	1.7
VIREOS:				
White-eyed vireo	<i>Vireo griseus</i>	PR	100	10.5
Solitary vireo	<i>Vireo solitarius</i>	WR	9	2.0
Red-eyed vireo	<i>Vireo olivaceus</i>	SR	82	1.6
WARBLERS:				
Northern parula	<i>Parula americana</i>	SR	91	14.4
Black-throated blue warbler	<i>Dendroica caerulescens</i>	M	36	4.8

Common Name	Scientific Name	Occ ¹	% of Dates ²	# per Date ³
WARBLERS (CONT.):				
Cape May warbler	<i>Dendroica tigrina</i>	M	18	1.0
Yellow-rumped warbler	<i>Dendroica coronata</i>	WR	9	1.0
Yellow-throated warbler	<i>Dendroica dominica</i>	PR	73	4.3
Prothonotary warbler	<i>Protonotaria citrea</i>	M	27	5.7
Pine warbler	<i>Dendroica pinus</i>	PR	9	3.0
Prairie warbler	<i>Dendroica discolor</i>	M	18	5.0
Palm warbler	<i>Dendroica palmarum</i>	WR	9	4.0
Blackpoll warbler	<i>Dendroica striata</i>	M	54	7.8
Black-and-white warbler	<i>Mniotilta varia</i>	WR	64	6.4
American redstart	<i>Setophaga ruticilla</i>	M	64	6.4
Worm-eating warbler	<i>Helmitheros vermivorus</i>	M	9	6.0
Kentucky warbler	<i>Oporornis formosus</i>	M	9	1.0
Common yellowthroat	<i>Geothlypis trichas</i>	PR	100	16.6
Yellow-breasted chat	<i>Icteria virens</i>	SR	73	2.6
Northern waterthrush	<i>Seiurus noveboracensis</i>	M	27	1.0
Ovenbird	<i>Seiurus aurocapillus</i>	M	45	9.6
GROSBEAKS AND BUNTINGS:				
Northern cardinal	<i>Agelaius phoeniceus</i>	PR	100	10.5
Blue grosbeak	<i>Sturnella magna</i>	SR	81	1.8
Indigo bunting	<i>Passerina cyanea</i>	SR	81	1.8
Painted bunting	<i>Passerina ciris</i>	SR	100	4.7
TOWHEES AND SPARROWS:				
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	PR	90	11.0
Savannah sparrow	<i>Passerculus sandwichensis</i>	WR	27	1.5
Seaside sparrow	<i>Ammospiza maritima</i>	PR	18	3.0
Swamp sparrow	<i>Melospiza georgiana</i>	WR	36	2.0

Common Name	Scientific Name	Occ ¹	% of Dates ²	# per Date ³
Blackbirds and Orioles:				
Bobolink	<i>Dolichonyx oryzivorus</i>	M	9	35.0
Red-winged blackbird	<i>Agelaius phoeniceus</i>	PR	100	12.4
Boat-tailed grackle	<i>Quiscalus major</i>	PR	100	8.7
Common grackle	<i>Quiscalus quiscula</i>	PR	72	3.4
Brown-headed cowbird	<i>Molothrus ater</i>	WR	63	2.7
Orchard oriole	<i>Icterus spurius</i>	SR	54	1.5
TANAGERS:				
Summer tanager	<i>Piranga rubra</i>	SR	90	3.1

¹ Season of occurrence (*Checklist of Florida's Birds*, Florida Game and Fresh Water Fish Commission):

PR = permanent resident

WR = winter resident

SR = summer resident

M = migrant

² Percent of all census dates on which species was observed

³ Mean number of individuals observed per census date

APPENDIX II

Element Stewardship Abstracts for Selected Species

Note: The abstracts for the Brown Pelican and Piping Plover were existing abstracts and Florida information has been added to these in bold. The original creators of the abstracts are noted.

ELEMENT STEWARDSHIP ABSTRACT

PREPARER
CLIFTON EAKES

NAME
Haematopus palliatus

COMMON NAME
American Oystercatcher

DESCRIPTION

A large shorebird with a large, straight, laterally compressed red-orange bill (orange bill color not as extensive in juvenile). Long pale pink legs; Yellow eyes with a red eye ring; head and neck black, contrasting with a brown back; wings are dark with a broad white stripe and the tail is dark with a large white patch at the base. The dark upper parts are scaly-looking in juveniles. The average length is 47 cm with a weight between 400-700g (NGS 1983).

Oystercatchers differ from other shorebirds in having a large, straight, laterally compressed, orange bill with a rounded tip and both mandibles the same length. This species differs from an American black oystercatcher by having extensive white areas in plumage (vs. all-black plumage). In poor light and at a great distance the oystercatcher might be mistaken for a black skimmer.

HABITAT

The American Oystercatcher makes use of coastal habitats including: rocky and sandy seacoasts and islands (AOU 1983); rivermouths and estuaries, especially where rocks are exposed at lowtide; mudflats, salt ponds (Stiles and Skutch 1989). This species nests on the ground in open sites often on high parts of sandy beaches, also among rocks, on islands, on shingle beds, occasionally in saltmarsh (Harrison 1979, Harrison 1978, Shields and Parnell 1990). In marsh habitats, nested on sand in North Carolina, on sand, wrack, or grass in New York and New Jersey (Lauro and Burger 1989).

BIOLOGY-ECOLOGY

Oystercatcher feeding areas are restricted to intertidal areas. Because of this, distribution of the species is believed to be limited by the availability of intertidal areas supporting shellfish beds (Stevens and Anderson 1994). Using its knife-like, laterally compressed bill, the oystercatcher pries shellfish from their attachment and brings them to shore to eat. Their diets consists mainly of bivalves, mollusks, echinoderms, crustaceans, and marine worms (Terres 1980). While feeding in the

intertidal zone it pecks and probes the mud or sand, often through shallow water (Stiles and Skutch 1989).

Migratory only at northern and southern extremes of range (Bent 1929). Northern populations migrate as far south as northern South America; migrant in Costa Rica August-early October and April-May (Stiles and Skutch 1989).

Nests sites are normally shallow scrapes' in the sand; sometimes lined with bits of shell, and with some pieces around the nest.

Most often observed in pairs. Nesting density was 0.66-1.00 pairs/ha in Virginia, 4.86-13.05 pairs/ha in New York (Lauro et al. 1992).

Clutch size is 2-4 (usually 2-3). Incubation lasts 27 days, with both sexes alternating incubation stints for this period of time. Young are tended by both parents, leave nest in 1-2 days, probably first fly at about 5 weeks. Initially, young depend almost entirely on parents for food. In Virginia, reproductive success was highly variable; large proportion of pairs failed to fledge young; losses due mainly to high tides and predation (Nol 1989). Typically monogamous; the care of both parents may be required for successful reproduction; communal breeding has been observed (Lauro et al. 1992).

THREATS

Although often referred to as a wary species, many in Florida are easily approached and can fall victim to irresponsible gunners (Stevenson and Anderson 1994). Occasionally a bird is captured by its prey as the bivalve clamps down on its bill and holds on till the rising tide drowns the bird. The diet of shellfish renders them vulnerable to pesticides, low levels of DDE has been found in their tissues (Nol and Humphrey 1994). Other birds such as the Herring and Greater Black-backed gulls not only prey on the eggs of Oystercatcher, they may also compete for nesting habitat (Nol and Humphrey 1994).

MGMT-NEEDS-COMM

As with many other shore birds, efforts should focus protecting the breeding and feeding habitat. With the innate fragileness of the nesting area is best protected by excluding the presence of humans. In areas such as islands where there are few to no terrestrial predators, the species is more successful (Nol and Humphrey 1994).

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ELEMENT STEWARDSHIP ABSTRACT

STEWARDSHIP-ABSTRACT-RESPONSIBILITY

NORTH CAROLINA NATURAL HERITAGE
DEPARTMENT OF NATURAL RESOURCES & COMMUNITY DEVELOPMENT
DIVISION OF STATE PARKS AND RECREATION
BOX 27687
RALEIGH, NC 27611

PREPARER

STEPHEN P. HALL
HARRY E. LEGRAND, JR.

Updated

CLIFTON EAKES with Florida information.

NAME

PELECANUS OCCIDENTALIS

COMMON-NAME

BROWN PELICAN

DESCRIPTION

The Brown Pelican is one of the largest and most identifiable of our coastal waterbirds. They range in length from 42 - 54", in wingspan up to 7.5', and in weight up to 8 lbs (Palmer, 1962). Males average only slightly larger than females. The enormous gray-black beak and pouch are the most diagnostic features; the beak length averages 319 mm in males and 294 mm in females (Palmer, 1962).

The general body color is gray, streaked with white. The upper parts of the adults are silvery gray to blackish brown while the underparts are gray to black. The head and neck are white with a pale yellowish wash; in the breeding season the nape becomes dark chestnut and a small crest of rufous feathers develops on the top of the head. The legs and feet are blackish gray, the eye is pale yellow, and the facial skin is blue to lead gray.

Juveniles are similar to the adults but are darker above, with rufous tips to their feathers, and are whiter below. Their head and neck are also grayish-brown instead of white and chestnut. The juvenile plumage gradually changes to the adult form over two years (Palmer, 1962).

Pelicans are virtually silent as adults, giving at most only an occasional grunt. Nestlings, on the other hand, are quite vocal.

This species is quite gregarious at all times of the year. They are often observed flying together in long lines low over the surf, usually flying within the troughs between waves. The flight is surprisingly buoyant for such a heavy bird, and they typically soar for long periods, with only occasional wingbeats used to gain altitude. The neck is folded during flight but extended at the last moment during plunge diving, their characteristic mode of foraging.

HABITAT

The Brown Pelican is strictly a maritime species, found only along the coast and fishing in shallow salt or brackish waters. Nesting occurs only on islands, either natural or man-made. Nests are usually built either on the ground or in low shrubs and only very rarely in trees (Palmer, 1962; Guravich and Brown, 1983).

BIOLOGY-ECOLOGY

The six subspecies of the Brown Pelican occur only in the New World. Three occur in North America: *P. o. occidentalis* in the Caribbean, from the Bahamas through the Antilles; *P. o. californicus* along the west coast, from California to western Mexico; and *P. o. carolinensis* along the Atlantic and Gulf Coasts, from North Carolina to Venezuela. The other three species are found in Central and South America and the Galapagos Islands (Palmer, 1962).

In the eastern United States, *carolinensis* breeds from North Carolina south to Florida and west around the Gulf to Louisiana and Texas. This population winters over much of this same area, with stragglers occurring as far south as Cuba and Guatemala. Some winter regularly in North Carolina (Parnell, 1977). By 1988, the species has become locally common in winter; at least 1,000 birds winter in the Hatteras Inlet area (Harry LeGrand, pers. obs.). In Florida the pelican breeds along the coast from Levy County (except for one small colony in Bay County) south to the Florida Keys, and north to Brevard County on the Atlantic coast. It ranges along entire coastal Florida and occasionally seen inland (ESR 1992).

Brown Pelicans were first recorded in North Carolina as nesting birds only in 1929 (Pearson, et al., 1959). Until recently only one colony was known, located in Ocracoke Inlet. The adult populations grew to 500 by 1958 but then declined to 68 in 1970, possibly due to food depletion or DDT poisoning as happened more dramatically elsewhere in the country (Parnell, 1977; see Threats). Since the early 70's (when DDT was banned in this country) the population has grown rapidly: in 1977 82 nests were counted in two colonies, a small group having formed after 1975 in the Cape Fear estuary; in 1983 the number of nests was 1,382 with yet a third colony having formed (Parnell and Soots, 1979). In 1988, there were approximately 2,400 pairs in six colonies, and birds have now been found nesting at Oregon Inlet.

State-wide(Florida) biennial pelican surveys conducted by the FLGFC Bureau of Wildlife 30-60 colony sites based on 1989 and 1991 surveys, steadily up from the 20-25 colonies reported in the 1970's and early 1980's. A state wide colonial wading bird survey undertaken by FL GFC Nongame Wildlife Section from 1986-1989 estimated 63 colonies. Abundances estimates were made in 55 of the 68 colonies, with 42% in the size class 199 birds , 33% in the 100-499 size class, 14% in the 500-1000 size class, and 11% in the >1000 size class. Pelicans were not observed nesting in Dade and St. Lucie counties during the 1980s survey, where they had occurred in the mid-1970s. The 1991 state-wide population survey estimated 26,621 to 33,776. The lower number represents total for adults and subadults prior to onset of nesting and the larger number includes the young born in 1991. The 1989 population was estimated at between 32,750 and 57,250 individuals (FNAI ESR 1992)

The peak breeding season in North Carolina is late March through June (Parnell and Soots, 1979); further south it begins earlier and may extend irregularly over much of the year (Palmer, 1962; Schreiber, 1980). In California a strong post-breeding period of northward vagrancy occurs in response to favorable fishing conditions (Anderson and Anderson, 1976,). Along the east coast, however, this is not known to occur (Clapp, et al., 1982), although prior to the first nesting in North Carolina, birds from the Florida population regularly appeared here in large numbers during the summer (Pearson, et al., 1959). Fall and spring migration appear to be fairly irregular; as noted above, many birds stay as far north as North Carolina year round.

Brown Pelicans are gregarious throughout the year and nesting is highly colonial; most colonies in the Southeast contain between 50 to 500 pairs (Clapp, et al., 1982). Although feeding territories do not exist, each pair defends the area immediately around its nest. The inter-nest distance usually is twice the extended body length plus bill (Palmer, 1962). Nest defense is particularly important in this species since cannibalism as well as theft of nest material is known to occur (Palmer, 1962).

The mating system is seasonal monogamy. Both parents share in nest construction, incubation and feeding the young. One clutch is raised per year (two might possibly be raised in areas with year-round nesting -- Palmer, 1962). Laying replacement clutches following loss of the first varies depending on environmental conditions: Schreiber observed a range between 0 - 29% renesting following failure, with up to four attempts being made (Schreiber, 1979). The normal clutch size is 2 - 3 eggs but up to 4 - 5 have been observed; the average in one Florida colony was 2.62 (Schreiber, 1979). Clutches laid early and mid- way in the breeding season tend to be larger than those laid later.

Incubation lasts 30 days (Palmer, 1962; Schreiber, 1979). Hatching success varies widely: Schreiber observed a range between 53 - 89% with the average being 70.9% (Schreiber, 1979). Nestlings leave the nest on foot at five weeks but do not fly until they are around nine weeks of age (Palmer, 1962). Fledgling success again varies widely: Schreiber recorded rates varying between 16 - 77% per hatched egg, with 52.1% being average (Schreiber, 1979). More young are raised in years with high food availability. In poor years brood reduction occurs due to starvation of the youngest nestlings or by cannibalism (Palmer, 1962). Young birds also suffer from aggression by adults (Palmer, 1962). Overall mean nesting success (young fledged per nest) ranges between 0.69 - 1.00 in areas not affected by DDT induced reproductive failure (Clapp, et al., 1982).

The period of post-fledgling dependence appears to be very short if it exists at all. Fledglings depend on fat stored during the nestling period while they are learning to forage for themselves (Schreiber, 1976). Feeding by juveniles is very inefficient compared to the adults', and failure to catch

enough food during their first season is a significant mortality factor.

Brown Pelicans breed as early as their second year, while still in juvenile plumage (Palmer, 1962), but most begin reproduction in their third year (Clapp, et al., 1982). Currently, the longest life-spans recorded for this species in the wild are 19 years (Clapp, et al., 1982) and 25 years (Guravich and Brown, 1983).

The Brown Pelican feeds primarily on small fish obtained by plunge-diving; scoop feeding, the usual mode of foraging in the White Pelican, is infrequent (Palmer, 1962). In the Southeast, Menhaden can comprise up to 90 - 95% of the diet (Palmer, 1962). Other commonly eaten species are herrings, anchovies, mullets, and other schooling fish. As mentioned, cannibalism also has been observed, as has scavenging and klepto- parasitism on herons (Palmer, 1962; Clapp, et al., 1982).

EO-QUAL-DET

Nesting colonies are quite conspicuous and should be looked for in North Carolina primarily on estuarine islands.

THREATS

The Brown Pelican was one of the seabird species hardest hit by organochlorine-induced reproductive failure. Following drastic declines in seabird numbers occurring in the 1960's, high concentrations of organochlorine residues were assayed from the tissues of pelicans and other species (Risebrough, et al., 1967), and correlated with severe eggshell thinning (up to 50% at Anacapa Island, California) leading to complete loss of reproduction in many colonies (e.g., Risebrough, et al., 1971). Elsewhere, notably in Louisiana, population crashes were attributable to direct adult mortality by pesticide poisoning, particularly by endrin; the entire Louisiana nesting population appears to have been destroyed by this cause and by declines in food fishes also due to endrin poisoning (Lowery, 1974). With the ban on DDT in this country since 1972, Brown Pelican numbers have shown marked recoveries, although still not reaching the reproductive rates observed previous to the organochlorine plague (Anderson, et al., 1975). Other forms of pollution, including bacterial toxicity due to sewage spills (Guravich and Brown, 1983) and oil spills (Clapp, et al., 1982) remain significant threats to this species as well as to many other seabirds.

Perhaps more important as a current threat to the Brown Pelican is human disturbance and habitat loss due to development. While pelicans are quite tolerant of man where they are not persecuted, they are prone to abandon their nests when disturbed, at which time their young or eggs become easy victims to gulls, crows, vultures and other predators or to heat or cold (Palmer, 1962; Clapp, et al., 1982). Prior to 1950 -- before the effects of pesticide poisoning -- a decline from 95,000 to 20,000 occurred which Parnell (1977) attributed mainly to the effects of human interference with nesting colonies. In North Carolina such disturbance may be especially important, since all nesting is confined to just a very few islands located in increasingly popular recreational areas (Parnell, 1977). In addition to interference with nesting, which may be only inadvertent, pelicans are often directly persecuted by fishermen or sadistic vandals; they also frequently

become entangled in abandoned fishing nets or monofilament line, or impaled by fish hooks (Guravich and Brown, 1983).

Apart from human-related population decreases, Brown Pelicans are known to undergo extreme fluctuations, both in adult numbers and reproductive effort, due to such natural causes as storms and nest-site flooding, extreme cold weather, and especially crashes in food species (Anderson and Anderson, 1976,; Clapp, et al., 1982). With respect to stresses on the adults, the effects of pesticide residues may be important contributing causes of mortality even though they might not be expressed in good times (Lowery, 1974).

LAND-PROT-SPECS

Protection of the nesting islands has the highest priority. Key islands need to be acquired by either the state or conservation organizations such as the National Audubon Society, and protection agreements should be negotiated with private landowners for the remainder. The long-term survival of waterbirds such as the Brown Pelican will also depend on protecting the overall coastal environment.

RECOVERY-POT

The Brown Pelican is currently undergoing a rapid population expansion in North Carolina, although its breeding remains restricted to approximately six islands (James Parnell, pers. comm.). While in no immediate danger of extirpation, continued success by this species requires a concerted effort to preserve critical nesting habitat as well as to secure these sites from human disturbance. The prognosis for this species is potentially good but by no means certain.

BIOL-MONIT-NEEDS

A regular census of the nesting colonies must be maintained.

BIOL-MONIT-PROCS

Census techniques for wading bird colonies are well-described in Parnell and Soots (1979). Given the large size of the Brown Pelican, good counts can often be made from aerial surveys alone, avoiding the disturbance of ground surveys. Adjustments must be made when nesting is not synchronous, as when inclement weather forces substantial amounts of re-nesting.

If ground visits are required, great care must be taken to avoid disturbing the colony at certain critical periods, especially when the young have just hatched and cannot regulate their body temperatures in the absence of the adults and when they are also susceptible to predation. Ground censuses are recommended, therefore, mainly during the peak of incubation, before the young hatch. Censuses and other possible disturbance should be avoided during either cool or hot conditions.

BIOL-MONIT-PROGS

Dr. James Parnell of the University of North Carolina at Wilmington conducts a regular survey of the colonial waterbirds of North Carolina. The Program for Nongame and Endangered Wildlife of the N.C. Wildlife Resources Commission is also charged with the responsibility for monitoring colonial waterbirds; Tom Henson is the project leader.

The species is closely and adequately monitored by the Fl GFC, National Audubon Society, and U.S. fish and Wildlife Service. (FNAI ESR 1992)

RSRCH-NEEDS

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RSRCH-NEEDS-COMM

Although a fairly large amount of information is already available for populations in South Carolina, Florida and elsewhere, basic demographic and ecological data, including fecundity and mortality factors and relationship to food species, need to be acquired for the North Carolina population.

RSRCH-PROGS

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RSRCH-PROGS-COMM

Dr. James Parnell and his students at UNC-Wilmington maintain an ongoing research interest in the colonial waterbirds of North Carolina.

MGMT-NEEDS

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MGMT-NEEDS-COMM

Protection of existing colonies, especially during the nesting season, has the highest priority. This requires both active patrolling of nesting sites and public education regarding the vulnerability of heronries to human disturbance. Steps can also be taken to actively improve the habitat for wading birds.

MGMT-PROCS

The creation of dredge spoil islands has greatly increased the number of estuarine colonies of seabirds in recent decades. Deposition of dredge materials must be managed, however, to achieve the greatest benefit for the birds: deposition should be timed to avoid the nesting season; deposits should be placed to minimize flooding of the island (dikes should usually be avoided). In addition to regulating spoil deposition, the vegetation preferred by pelicans can also be managed. See Soots and Landen (1978) and Parnell and Soots (1979) for details.

MGMT-PROGS

Y

MGMT-PROGS-COMM

The Nongame and Endangered Wildlife Program of the N.C. Wildlife Resources Commission is charged with managing coastal waterbird colonies, and the U.S. Army Corps of Engineers also has plans for using its dredging operations to enhance the habitat for waterbirds (Parnell, et al., 1986). In addition to governmental actions, the National Audubon Society has purchased several important nesting islands in North Carolina and has provided support for wardens during the nesting season.

SUM-STEW-NEEDS

The Brown Pelican was once a marginal but currently is an expanding breeding species in North Carolina. As with other species of seabirds that feed primarily in inshore waters, the pelican is susceptible to several forms of pollution, including pesticides, sewage and oil spills. They are also prone to natural fluctuations in numbers due to climatic changes or declines in food supply. Together with the increased potential for reproductive failures due to human disturbance at the highly restricted nesting colonies, these factors continue to make this species' status vulnerable to rapid reverses. Stewardship efforts should be aimed primarily at acquiring and actively managing the islands used for breeding by this species. It is especially important to provide protection from human disturbance throughout the nesting season. Other concerns are the habitat losses and generally declining quality of the coastal environment due to the rapid boom in human development. Public education is additionally needed to avoid the misguided persecution of this species by fishermen and the threats posed by abandoned nets and other fishing gear.

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UPDATE

89-03-12

ELEMENT STEWARDSHIP ABSTRACT

STEWARDSHIP-ABSTRACT-RESPONSIBILITY

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PREPARER

J.E. EVANS

Updated

CLIFTON EAKES with Florida information.

NAME

CHARADRIUS MELODUS

COMMON-NAME

PIPING PLOVER

DESCRIPTION

A small (18 cm long) plover with pale brown upper parts, white undersides, legs orange-yellow, bill yellow or orange with black tip, head with a white band across the forehead and white neck ring. A dark stripe extends across the forehead behind the white band, and there is a black shoulder mark that often extends forward to form a full ring across the breast (Dinsmore 1981). The call is a two-noted "peep-lo" with an organ-like sound (Robins et al. 1976).

From Bent (1928), Roberts (1955), and Wilcox (1959). A small plover, wings average 117 mm, tail 51 mm, weight average 55 g (Wilcox 1959). Adult male: forehead, sides of head including lores, underparts and collar around hindneck are plain white; with a dark band across the front of the crown from eye-to-eye, and black shoulder patches that often extend across the breast; the rest of the upper parts are pale gray-brown, lightest on the rump and upper tail-coverts; the primaries dusky-black at the tips, the inner webs largely white and all but the outer two or three are more or less white on outer webs; the secondaries are largely white; the greater wing-coverts are tipped with white; the axillaries and lining of the wing are white; the tail is white at the base, the features darkening towards the end and are tipped with white; the outer retrices are mostly white; the bill is dull orange tipped with black; legs and feet are orange-yellow; the iris is dark brown, with pale yellow eyelids.

HABITAT

The Atlantic Coast and Great Lakes populations almost exclusively use sandy beaches for nesting habitat. Hall (1981) notes that piping plovers are extremely choosy about the location of their nests, picking sandy beaches that are sprinkled with small stones, usually on level open ground between

the water's edge and nearest low dune. In Maine, piping plovers nest only on sandy beaches, notably lacking in small or large stones (Vickery 1984). Another nest site exception was in Connecticut where 2 pairs nested on dried dredge spoil. The substrate was a dark charcoal-colored sludge with a silty texture. The deposit was elevated and out of sight of salt water (Zickefoose 1984). Nests, especially second nests, may also be on sandy, open flats among shells or cobble behind foredunes (e.g. in Michigan and New Jersey: Master 1983). Lambert and Ratcliff (1979), in a study of piping plovers throughout Michigan, found that the average beach used for nest habitat was 37 m wide, and that the nest was located an average of 13 m from the water's edge, 14 m from the first dune, and 109 m from the nearest tree line. They also found a preference for nesting near other water bodies (beach pools, lagoons, or cuts) that may provide additional food sources (Lambert and Ratcliff 1979). At Minnesota Point (Duluth, MN), the average ground cover was less than 5%, and plants were an average of 13 cm tall, in an area used by nesting piping plovers (Niemi and Davis 1979). Niemi and Davis (1979) found that less than 8% of the available beach habitat was suitable for piping plover nesting. At Pine and Curry Islands (Lake of the Woods, MN), piping plovers nest on a sandy island where vegetation rarely exceeds 1 m in height (Cuthbert and Wiens 1982). Here vegetation included *Salix interior*, *Artemisia campestris* ssp. *caudata*, *Lathyrus japonicus*, *Xanthium* sp., *Populus balsamifera*, *Polygonum* sp., *Oenothera* sp., and grasses and sedges. Nest habitat substrate along alkali lakes varies from clay to boulders, but always some gravel. Width of beach along alkali lakes varies from 15 feet to 100 feet (Soine 1983).

In the Great Plains, piping plovers nest on alluvial islands (Hay and Lingle 1981), on exposed shoreline of saline wetlands, along semi-permanent ponds and lakes (Soine 1982), and on sandy beaches of larger lakes (Renaud 1979). Woody species encroachment is a problem at many alluvial island sites due to reduced flows (Hay and Lingle 1981, Lingle 1983). Woody encroachment is also a problem on saline wetland shorelines, due to drawdown and irrigation pumping (Soine 1983).

Piping plovers in Florida share sandy beaches and mud flats with the similar Snowy plover and other shorebirds (Steveson and Anderson 1994).

Wilcox (1959) noted the natural progression of beach vegetation and the effect on plover nesting habitat. The 1938 hurricane leveled sand dunes, created new inlets and beach pools, and "unstabilized" dunes on Long Island beaches. This produced more piping plover habitat, and numbers increased. As dunes became recolonized by beach grass (*Ammophila breviligulata*), piping plovers declined (Wilcox 1959).

Human activity can create or destroy piping plover habitat. In Duluth Harbor, sand harbor dredge spoils created nesting habitat until invading plant communities reduced their desirability (Lakela 1940, Niemi and Davis 1979). Two of these islands are now managed specifically for piping plovers and least terns (Pfanmueller 1983). Minnesota sites where dredge spoils are still being deposited remain very attractive to plovers. At one such site, Erie Pier, one pair nested successfully in 1984 (Phanmueller 1984). In Iowa, piping plovers have successfully nested at fly ash slurry

beaches bordering power plant cooling ponds (Ewert 1984).

BIOLOGY-ECOLOGY

The breeding season for piping plovers begins when the adults reach the breeding grounds in mid- to late April, or mid-May in northern parts of the range. The adult males arrive earliest, select beach habitats, and defend established territories against other males (Hall 1981). When adult females arrive at the breeding grounds several weeks later, the males conduct elaborate courtship rituals, including aerial displays of circles and figure eights, a particular twittering, whistling song, and posturing with spread tail and wings and a rapid drumming of feet (Bent 1928, Hall 1981). Wilcox (1959) has shown that adult males tend to return to the same beach site, year after year, with only 20% settling on a new nest site farther than 1,000 feet from the previous year's locality. Adult females tend to choose new nest sites within the same geographic area (over 50% chose a new nest site over 1,000 feet from the previous year), thus adults tend to pick new mates each year (Wilcox 1959).

Nest sites are simple depressions or scrapes in the sand (Bent 1928, Wilcox 1959). The average nest is about 6 to 8 cm in diameter, and is often lined with pebbles, shells, or drift wood to enhance the camouflage effect. Males make the scrapes, and have been noted to construct additional (unused) nests in their territories; the purpose of these is not known, but they may be used to deceive predators or they may simply reflect over-zealousness (Wilcox 1959, Hall 1981). Occupied nests are generally 50 to 100 m apart (Wilcox 1959, Cairns 1977, Neimi and Davis 1979, Cuthbert and Wiens 1982).

Egg laying commences soon after mating (Cuthbert and Wien, 1982, Hall 1981). Eggs are laid every second day. The average clutch size is 4 eggs (Wilcox 1959). Renesting is fairly common among pairs that lose their eggs in the first half of the breeding season (Wilcox 1959, Cuthbert and Wiens 1982). Nest success depends heavily upon camouflage (Hull 1981). The adults exhibit counter-shading (white below and dark on top, thus the shadow cast by their underparts matches their backs, making the birds very difficult to see while on nests; Peterson 1948). The eggs are creamy white and spotted, 25x32 mm and blend into the simple nest structure (Wilcox 1959). The eggs are also described as being khaki-tan, finely flecked with chocolate brown. In comparison to tern' eggs, which are more oblong, piping plover eggs are more markedly pyriform in shape (Zickafoose 1984). The young hatch about 27 to 31 days after egg laying; incubation is shared by both adults (Wilcox 1959, Hull 1981). Hatching success ranges widely: 91% for undisturbed beaches on Long Island (Wilcox 1959), 76% for undisturbed beaches in Nova Scotia (Cairns 1977), and 44% on relatively undisturbed beaches at Lake of the Woods, (Cuthbert and Wiens 1982) and 30% maximum at disturbed Michigan beaches (Lambert and Ratcliff 1979). The chicks are downy replicas of the adults, sand-colored above, white below. About two hours after hatching the young can leave the nest, capable of running and swimming if necessary. The young remain within about 200 m of the nest, although they do not return after hatching (Wilcox 1959, Hull 1981, Johnsgard 1979). When disturbed or threatened, the young either freeze or combine short runs with freezing, blending very effectively into

their surroundings (Wilcox 1959, Hull 1981). The adults will feign injury to draw intruders away from the nest or young (Wilcox 1959, Bent 1928). Adults also defend the nest territory against other adult piping plovers, gulls, and song birds (Wilcox 1959, Matteson 1980). The chicks fledge at about 4 weeks of age (Hull 1981). First (unsustained) flight has been observed at around 18 days, with chicks molting into first juvenile plumage by day 22 (Zickafoose 1984).

Cuthbert and Wiens (1982) have provided data about reproductive success of 15 pairs of piping plover at Lake of the Woods, Minnesota in 1982. There were 15 original nesting attempts and 9 renesting attempts following destruction of the original nests. The average clutch size was 3.9 eggs. Of the 86 eggs laid, 38 hatched (44%), and 25 fledged, for a mean of 1.7 chicks fledged per reproductive pair. In the following years, hatching success has varied widely at this site, as follows: 29% (1982); 59% (1983); 13% (1984) (Phanmuell 1984). Similarly, Cairn (1977) found fledging success 1.3 to 2.1 per pair on undisturbed Nova Scotia beaches, and 0.7 to 1.1 per pair on disturbed beaches. A pair of plovers in Connecticut displayed double-clutching after a successful brood. Two chicks were fledged from a 3 egg clutch, followed by a second 3 egg clutch which was eaten by an opossum in the third week of incubation (Zickafoose 1984).

Cuthbert and Wiens (1982) found the major cause of egg mortality was predation, about 67%. Potential predators at Lake of the Woods included herring gulls, ring-billed gulls, common ravens, American crows, great horned owls, and weasels. Other studies have also found gulls as a major cause of nest mortality (Hassell and Woodford 1965, Lakela 1940, Niemi and Davis, 1979). House mice and rats sometimes raided nests, and in some situations, striped skunks, red fox, raccoons, and coyotes were a cause of egg loss (Wilcox 1959, Cuthbert and Wiens 1982). Along the Platte River, the red-sided and plains garter snakes are potential predators (Lingle 1984). Other causes of egg loss include storm damage (eggs washed away by storm waves) and human disturbance (stepping on nests) (Cuthbert and Wiens 1982). Indirect human disturbance by preventing adults from incubating eggs can be another cause of egg loss (Haig 1983). This is discussed further in the management section. Cuthbert and Wiens (1982) found that chick mortality was largely due to predators (69%) but some chicks were found dead with no apparent cause.

Food consists of worms, fly larvae, beetles, crustaceans, molluscs, and other invertebrates (Bent 1928). The chicks learn to feed themselves, and feed on smaller versions of what adults eat (Hull 1981). Piping plovers feed more leisurely than other sandpipers, alternately running and pausing to search for prey (Bent 1928). Open shoreline areas are preferred, and piping plovers avoid vegetated beaches for feeding (Cuthbert and Wiens 1982).

In Florida piping plovers have been observed foraging on sandflats and mudflats (FNAI EOR).

Piping plovers begin migration in mid- to late summer. The juveniles may remain later, but are generally gone by mid- to late August (Cuthbert and

Wiens 1982).

Longevity records indicate that only 13% of females lived to 5 years, and 28% of males lived to 5 years. Eleven years age is probably the maximum age for this species (Wilcox 1959).

Piping plovers may be commensal with terns in some instances. In Duluth Harbor, piping plovers nest within a common tern colony, are accepted by the terns, and benefit from the active defense of the colony by terns against ring-billed and herring gulls (Niemi and Davis 1979). Great Plains populations are sometimes associated with least tern colonies (Hay and Lingle 1981, Dinan 1983, Faanes 1983). Most eastern sites also have least terns (Master 1983). In Maine, beaches where piping plovers nest all have colonies of least terns (Vickery 1984). In Connecticut, populations are strongly associated with least terns. Preliminary data suggests that plovers may relocate within a least tern colony late in the season, possibly after failed nesting attempts. This provides better protection from gulls and crows, but may subject plovers to increased mammalian predation, against which least terns are defenseless (Zickafoose 1984).

Preliminary results of a 1984-85 study of productivity at sites in North Dakota indicates that piping plovers may be benefitting from a commensal relationship with American avocets (Prindiville and Ryan 1984). Like terns, avocets actively defend their territories against predators. Plovers nesting in areas also used by avocets had a 62% nesting success, compared to a success of only 29% when not associated with avocets. Once hatched, chick survival rates were similar, regardless of avocet presence.

Quinn and Walden (1966) have studied captive raising of piping plovers. A number of eggs were taken from active nests in mid-June in Maryland. These were placed in a still-air incubator at 99.4 degrees F with 78% humidity. The eggs were turned twice a day. After hatching, the chicks were kept in a brooder at 93 degrees F for one week and 85-89 degrees F the following weeks. Chicks were fed a variety of food and were most attracted to moving (live) prey. Chicks were active in captivity and required large amounts of space, especially for flight development.

EO-QUAL-DET

<< NO DATA >>

THREATS

Threats include human disturbance and destruction of nests and young, loss of nest habitat from rising water levels, irrigation projects, woody species encroachment, pollutants, predation (especially raccoons), livestock trampling, disturbance by dogs, and pollutants (see management section for references).

LAND-PROT-SPECS

Efforts must be made to restrict access to beaches used for nesting during late May to late July. If total restriction is not possible, vehicles should be prohibited for this time interval, dogs should be leashed, and people requested to avoid the upper beach area. In the Great Plains,

preserve design considerations should include control or restrictions over water flow, as reduced flows permit woody species invasion of nest habitat (Lingle 1983). Untimely flooding also can eliminate potential feeding or nesting habitat (Howe 1983). The shorelines of alkali lakes should be fenced to restrict cattle use.

RECOVERY-POT

Atlantic Coast and Great Lakes populations require major protection efforts to reduce the effect of human disturbance on breeding success. Captive breeding and restocking may be necessary (Quinn and Walden 1966). The Great Plains population requires further inventory and monitoring to determine if population levels are stable. Threats from irrigation and channelization need to be addressed. Pesticides may be a major concern.

BIOL-MONIT-NEEDS

<< NO DATA >>

BIOL-MONIT-PROCS

<< NO DATA >>

5400 BIOL-MONIT-PROGS

<< NO DATA >>

RSRCH-NEEDS

Y

RSRCH-NEEDS-COMM

In order of priority: (1) Population monitoring (determine status and extent of rangewide breeding population using standard survey techniques) and breeding success; investigate factors causing reproductive failure; (2) diet and feeding habits, effect of pesticides and pollutants on population; (3) response to habitat management (excluding visitors, clearing woody vegetation, manipulation of water levels or flows, etc.); (4) locate reliable wintering sites and migration routes; wintering ground ecology and threats; (5) identify habitat requirements for breeding and wintering grounds and reliable stopover sites.

Management experiments in restoring suitable habitat can and should be attempted. There may be results available soon (Lingle 1983, Haig 1983).

Further research is needed to determine if management for woody species is necessary. Several experiments are being conducted (Lingle 1983, Haig 1983).

RSRCH-PROGS

Y

RSRCH-PROGS-COMM

Iowa Heritage Program - Identify potential nesting habitat. Estimated date of completion: 8/20/83.

Guy Baldassarre (Dept. of Zoology-Entomology, Auburn University, Alabama) is

conducting studies on the winter ecology of piping plovers.

Minnesota Heritage Program - Major studies are underway in Duluth Harbor to recreate suitable habitat. Additional studies in progress at Lake of the Woods and Duluth Harbor, since 1982.

Sue Haig (Dept. of Biology, University of North Dakota) coordinated (1) a winter census of the suitable mudflats and beaches from the Yucatan Peninsula to Jacksonville, FL. (1984), (2) population monitoring in Manitoba from 15 April - 15 August, 1982-1984, and (3) brief censuses in Saskatchewan in 1984. Sue is also collecting information on reproductive success, habitat requirements, movements of piping plovers, and population analysis using electrophoresis.

Eleanor Prindiville and Mark Ryan (School of Forestry, Fisheries and Wildlife, Univ. of Missouri) are studying productivity and habitat requirements of piping plovers in central North Dakota. Estimated completion after 1985 field season.

Sally Gaines (Univ. of Nebraska-Lincoln) is conducting Ph.D. research on least terns and piping plovers along the Platte River under Dr. Paul Johnsgard.

MGMT-NEEDS

Y

MGMT-NEEDS-COMM

The population decline of piping plovers has been documented in a few geographic areas. On the Atlantic Coast, piping plovers do not nest on the margins of their range as they formerly did. This former range includes the north shore of the Gulf of St. Lawrence Sable Island, and the Gaspe Peninsula (Cairns and McLaren 1980). The Long Island, NY population declined from over 500 pairs (Wilcox 1939) to about 100 pairs (Cairns and McLaren 1980). A recent census has estimated a total of 910 pairs of piping plovers on the entire Atlantic coast (Cairns and McLaren 1980).

The decline of the Great Lakes population has been more dramatic. The piping plover has been extirpated from Ohio, southern Ontario, Indiana, and Illinois (Tate 1981, White 1981, McCance 1983). At Long Point, Ontario, there were over 100 pairs during 1927-1928 (Snyder 1931), 50 birds in the early 1930's (Sheppard 1935), 7 pairs in 1961-1965 (Hussel and Montgomerie 1968) and 2 pairs in 1976-1977 (Bradstreet et al. 1977). A pair of piping plovers nested along Lake Ontario in 1984 (Zickafoose 1984). In Michigan, piping plovers have been reduced in range, and essentially eliminated from the southern portion of the state (Cottrille 1957, Lambert and Ratcliff 1979), and reduced in numbers to 77 birds in 1979 (Lambert and Ratcliff 1979), 36 birds in 1981 (Master 1981), and 28 birds in 1982 (Master 1983). In Minnesota, the population in Duluth Harbor has decreased from 11 pairs in 1978 (Niemi and Davis 1979) to 3 to 5 pairs in 1981 (Niemi 1981). The population at Lake of the Woods, Minnesota was estimated as 20 to 30 pairs in 1979 (Anderson 1979), 15 pairs and 14 non-breeding adults in 1982 (Cuthbert and Wiens 1982), and about 22 pairs in 1984 (Pfanmueller 1984).

There are about 3 pairs or less in Wisconsin (Matteson 1979), all on the Lake Superior shoreline.

The Great Plains population is poorly known. Faanes (1982) estimated between 500 and 1,400 pairs in North Dakota. This was an extrapolation based on an estimation of available habitat; this figure is viewed with skepticism by most professionals in North Dakota, and data do not support a figure nearly that large (Hoose 1983). Renaud (1979) estimated between 1,000 and 1,500 adults in Saskatchewan. Dinan (1983) reported 74 pairs from Nebraska along the Missouri, Platte, and Niobrara rivers. The USFWS estimate is 50 birds and 20 nesting pairs in South Dakota. Sue Haig estimates 120 adults and 50 nesting pairs in Manitoba. In 1976 the Canadian Wildlife Service estimated 100 adults and 40 nesting pairs in Alberta (Hoose 1984). Information is lacking on population decline, stability, or increase.

Man's impact on the piping plover began in the mid-1800's when the birds were harvested for food, and brought to the verge of extinction (Bent 1928, Hull 1981). Piping plovers were protected from hunting by legislation in 1913; unfortunately populations on the Atlantic Coast and Great Lakes never increased to former levels (Hull 1981).

Management factors are: human disturbance during breeding; habitat alteration and destruction by water impoundments, irrigation projects, and reduced flows; predation by gulls; cattle trampling along alkali lakes; pollutants; and succession with *Ammophila breviligulata* (beach grass) on the east coast. Human disturbance during nesting is the major factor in many areas. Cairns (1977) found that reproductive success was 1.3 to 2.1 fledged young per pair on remote beaches, but only 0.7 to 1.1 fledged young per pair on beaches used for recreation in Nova Scotia. Lambert and Ratcliff (1979) found very low reproductive success (30% hatching rate, 0.6 young fledged per pair) at a Michigan state park with heavily used beaches. Cartar (1976) found that reproductive success at Long Point, Ontario nearly doubled following attempts to restrict access to the nesting areas.

There are several ways human disturbance lowers piping plover reproductive success. People and vehicles can trample and destroy nests of young (Lambert and Ratcliff 1979, Haig 1983, Cuthbert and Wiens 1982). Human presence can inhibit courtship, incubation, and brooding (Haig 1983). Free-running dogs are a major concern (Cairns and McLaren 1980, Quinn and Walden 1966, Lambert and Ratcliff 1979, Master 1981). Halbeisen (1977) found that dogs frighten snowy plovers (*Charadrius alexandrinus*) off, their nests an average of twice as long (5.8 versus 2.8 minutes) as people alone do. This increases the chance of egg failure or egg predation and chick mortality from overexposure, starvation, and predation.

Habitat alteration and destruction is an additional concern. Piping plovers are very choosy about nesting habitat, picking wide beaches that are essentially free of vegetation (see Habitat section). Bradstreet et al. (1977) found that rising lake levels in the Great Lakes narrowed beaches and may have caused habitat loss. Stream channelization may be

responsible for increased flood frequency and magnitude. Hay and Lingle (1981) discuss destruction of nests due to flooding. Woody species encroachment on alluvial islands in the Great Plains is a concern (Hay and Lingle 1981, Lingle 1983, Dinsmore 1981). Reduced flows may be responsible for this encroachment (Lingle 1983). Lowering of the water table due to irrigation projects and strip mines in the Great Plains may be a growing concern (Kantrud 1979, Dinsmore 1981). Woody species encroachment of lake shorelines in Manitoba may be responsible for habitat loss (Haig 1983). Invasion of sites by *Ammophila breviligulata* is a problem on the east coast; areas may need to be weeded (Master 1983).

Predation by gulls is potentially disastrous to plovers. Cartar (1976) reported that nest sites at Long Point, Ontario were invaded by large flocks of herring gulls, and nests destroyed. Nol (1980) documented adverse effects of non-breeding gull flocks on piping plover and killdeer (*Charadrius vociferus*). Some minor effects have been noted elsewhere (Lambert and Ratcliff 1979, Master 1981). It is not certain if gull control will be necessary. Predation protection through fencing and other barriers is a possible management tool. Work by the Maine Audubon Society suggests this has protected plovers from predators (Vickery 1984).

Wilcox (1959) observed adult mortality following oiling from highway tars. The effect of aquatic pollution on piping plovers is not generally known. Dinsmore (1981) speculates that pesticides may be a major concern, but no research has been done on this.

MGMT-PROCS

It is critically important that all efforts be made to reduce human disturbance. If it is not possible to restrict all visitation, then other alternatives include: (1) prohibiting free-running dogs; (2) restricting vehicles during late May to late July; (3) requesting that people use the lower beach and avoid the upper beach area where piping plovers nest; (4) posting signs and mounting a public relations campaign to ask people to avoid nesting areas, and not molest birds, as this action keeps adults from attending to eggs or young (Lambert and Ratcliff 1979, Lambert 1983, Haig 1983).

MGMT-PROGS

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MGMT-PROGS-COMM

NE - Vegetation has been burned to provide habitat for whooping cranes on Mormon Island on the Platte River. Plovers and terns appear to have responded favorably, although this practice has not been monitored systematically or defined as appropriate management (Hoose 1984). In summer 1982, staff of the Platte River Whooping Crane Trust mechanically removed about 50 acres of woody vegetation on riverine islands near Mormon and Shoemaker islands in the Platte River. In 1983 and 1984, high water flows inundated potential nesting sites. Piping plovers were seen using the areas in 1983; in 1984 least terns nested in an area previously used by piping plovers and least terns in 1979. This suggests that piping plovers will use the managed area again for nesting (Lingle 1984). The Platte

River Whooping Crane Trust will continue to monitor the effects of management efforts.

ND - Cattle have been fenced from some portions of saline wetlands, with apparently favorable response.

Fencing, posting and surveillance operations are underway in CT, RI, Nova Scotia, ME, MA, and MI.

Sue Haig (Dept. of Biology, Univ. of North Dakota) is coordinating the following management work:

- Sign posting along Lake Manitoba beach, 1983-84. Seems to keep day use down, but damage was done at night.
- Beach widening and brush removal on Lake Manitoba, 1983-84. Severe storms have since damaged the beach.
- Public awareness including sighting reports and cooperation with the Pan American Shorebird Program.

Data on habitat disturbance on several North Dakota sites are being collected and analyzed by Eleanor Prindiville and Mark Ryan of the Univ. of Missouri. Estimated completion 1983/86.

The Maine Audubon Society fenced 3 plover nest sites in 1983 with snowfence, stake and twine, electric fencing or chicken wire. Chicken wire seemed to provide additional protection from predators (Arbuckle 1983).

Julie Zickafoose, Director of the Connecticut Nature Conservancy's least tern/piping plover program, is overseeing the fencing, patrolling and public awareness projects at piping plover sites in CT. Cases where signs attracted people to nest sites influenced future decisions not to post single nests which had been well-hidden.

SUM-STEW-NEEDS

In order of priority: (1) protect known element occurrences by reducing disturbance during breeding, (2) monitor populations, (3) research on pesticide threat, (4) captive breeding and reintroduction programs.

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