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Distribution, Abundance and Habitat Use of American White Pelicans in the Delta Region of Mississippi and Along the Western Gulf of Mexico Coast

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Abstract.—Aerial surveys of American White Pelicans (*Pelecanus erythrorhynchos*) were conducted over coastal Louisiana and the delta region of Mississippi on 1-2 days during December, February, and April each year from 1997 to 1999. Additional surveys were conducted in coastal Texas and Mexico during January 1998 and 1999. The numbers, location, and habitat of all pelicans observed were recorded. The coastal zone of Louisiana consistently had higher numbers of pelicans (18,000 to 35,000 birds) than other areas surveyed (3,000 to 8,000 birds), indicating that Louisiana may be the most important wintering area for American White Pelicans east of the Rocky Mountains. Among the four regions surveyed, the average size of pelican flocks was largest in Mississippi during January-February, particularly in 1999 (\bar{x} = 245 birds/flock). Pelican numbers in Mississippi peaked in February but in Louisiana they were more variable. Pelicans in the delta region of Mississippi were found most often in fresh water and sand bar habitats during December, flooded field habitats during February, and catfish ponds in April. In Louisiana, pelicans used fresh, intermediate, and brackish marshes during December, but showed a preference for brackish and saline marshes in February and April. *Received 4 August 2001, accepted 5 January 2002.*

Key words.—Aerial surveys, American White Pelican, Gulf of Mexico coast, habitat use, Louisiana, Mississippi, Mexico, *Pelecanus erythrorhynchos*, Texas.

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The American White Pelican (*Pelecanus erythrorhynchos*) in the eastern United States breeds primarily in the northern Great Plains and winters in the Lower Mississippi Valley and along the Gulf of Mexico (Evans and Knopf 1993; Johnsgard 1993; King 1997). Wintering American White Pelicans have been irregularly counted in the delta region of Mississippi since 1993 (King 1997; King and Werner 2001). Clapp *et al.* (1982), Smith *et al.* (1984), and Chapman (1988) reported that, during the non-breeding season, pelicans use coastal marine habitats favoring shallow bays, inlets, and estuaries and open flat islands or peninsulas for loafing sites. However, there have been no coordinated surveys to determine the numbers of and habitats used by American White Pelicans along the Gulf of Mexico Coast and the delta region of Mississippi.

Several factors might influence the distribution and habitat use of wintering American White Pelicans. Commercial aquaculture production in the southeastern United States

has grown dramatically since 1985 (Mott and Brunson 1997) and American White Pelicans take advantage of this abundant and readily available food source (King 1997). In addition, coastal marshes in Louisiana and elsewhere along the Gulf coast are changing rapidly, mostly by conversion of marsh to open water (Michot 1996). The objectives of this study were to describe the relative abundance, distribution, flock size, and habitat use of American White Pelicans wintering in the delta region of Mississippi and the northern and western Gulf of Mexico coast.

METHODS

Aerial surveys were conducted over coastal Louisiana and the delta region of Mississippi on 1-2 days during December, February, and April over two years: 1997-98 (YR1) and 1998-99 (YR2). In addition, surveys were conducted in coastal Texas and northeast Mexico during January 1998 (YR1) and January 1999 (YR2). High-winged single-engine aircraft (Cessna 172, Cessna 180, Cessna 185, and Cessna 206) were used for all surveys.

Census transects were established to provide coverage of the entire delta region of Mississippi from an altitude of 500 m. The delta region of Mississippi comprises

16,000 km² of the Mississippi River alluvial plain, and extends from Vicksburg, Mississippi to Memphis, Tennessee and east of the river for approximately 70 km.

In coastal Louisiana, east-west transects (parallel to the coastline) were used to sample at least 20% of the 21,000 km² of coastal marsh habitat (Barras *et al.* 1994). Birds were counted within a 5 km swath (2.5 km on each side of the aircraft) along the transect. We estimated the total area surveyed from transect length and width, calculated the proportion of the Louisiana coastal marsh area surveyed (usually 0.20 to 0.25), then divided the total number of birds surveyed by that proportion to estimate total number of pelicans in the Louisiana coastal zone.

In coastal Texas and coastal Mexico, surveys were conducted from an altitude of approximately 60 m, concurrent with waterfowl surveys (Michot 2000). We used a cruise survey method to obtain complete coverage for all coastal wetlands, lagoons, and adjacent water bodies, usually to about 15 km (maximum 80 km) inland from the coast. The Lower Laguna Madre of Texas, between Port Mansfield and Port Isabel, was not surveyed due to logistical problems. In Mexico, we surveyed from the Texas border southward, covering the entire coast of the state of Tamaulipas, and a portion of the state of Veracruz-Llave to Laguna de Tamiahua.

In each survey, we recorded the number and location (GPS position) of all pelicans observed. Aerial photographs were taken of large concentrations of pelicans and individuals counted from projected photographs. For the purposes of this study, we define flock size as the number of birds at a given location, including lone individuals (maximum spacing between individuals = 50 m). On one Louisiana flight (February 1998), the water body size (length and width) and distance from shore for each flock observed was estimated. Data were recorded on hand-held tape recorders or directly into laptop computers during the surveys, and later transcribed to a spreadsheet. ArcView 3.1 (Environmental Systems Research Institute 1998) was used to plot pelican coordinates and overlay them on the 1997 Louisiana Coastal Marsh Vegetative Type (Braud 1999) and modified 1999 Mississippi Vegetation Type (Minnis *et al.* 2000) maps. Four marsh types were used, based on salinity (Michot 1996). We used an ArcView extension (Hooge and Eichenlaub 1997) to determine vegetation type at each coordinate pair.

Chi-square analysis was used to test for significant differences in pelican numbers among regions (Mississippi, Louisiana, Texas, Mexico) and years, and among habitats and seasons within regions (Mississippi and Louisiana). Because the Louisiana population estimate was based on a 20% sample of the study area, whereas the other three regions had a 100% sample, we used the actual count for Louisiana and 20% of the actual count for the other three regions to determine chi-square values. For the habitat analysis we used actual observed values for all four regions to determine chi-square. We used a two-way ANOVA to test for significant effects of region, season, and habitat on flock size. A reduced alpha level (0.05 divided by the number of possible combinations) was used for pre-planned pairwise comparisons to reduce Type I errors (Day and Quinn 1989).

RESULTS

The distribution of pelican flocks among the four regions during the study is shown in Fig. 1. Our surveys indicated that American

White Pelicans were common and abundant in the delta region of Mississippi and throughout the coastal marshes and lagoons of Louisiana, Texas, and northeast Mexico. Louisiana had appreciably greater ($\chi^2_3 = 429$, $P < 0.001$) midwinter numbers of American White Pelicans than Mississippi, Texas, or Mexico in both years (Fig. 2). Some 18,000 to 35,000 pelicans wintered along the Louisiana coast and about 3,000 to 8,000 birds wintered in each of the other three regions. For within-year comparisons, we found the numbers in Louisiana to be greater than those in Mississippi during all seasons, but found a significant ($\chi^2_1 = 34.3$; $P < 0.001$) difference in seasonal patterns between Louisiana and Mississippi over the two years. In Mississippi, pelican numbers peaked in February during both years, whereas Louisiana showed a December peak in 1997 and a February peak in 1999 (Fig. 3).

Mean flock size for all regions ranged from 1 to 3,500 birds ($\bar{x} = 46 \pm 4.5$ SE; $N = 1,505$) and a significant year by region effect was found ($F_{3, 1497} = 6.59$; $P < 0.001$). In 1997-98, Texas had smaller ($P < 0.005$) flocks (23 birds/flock) than Louisiana or Mississippi (87-119 birds/flock), but in 1998-99 Mississippi flocks (245 birds/flock) were larger ($P < 0.001$) than those observed in Louisiana, Texas, or Mexico (17-37 birds/flock) (Fig. 4). In Louisiana and Mississippi, we found a significant month by region ($F_{2, 713} = 8.09$; $P < 0.001$) and month by year effect ($F_{2, 713} = 5.14$; $P < 0.01$), but the 3-way interaction was not significant ($F_{2, 713} = 2.98$; n.s.). Flock sizes in February were higher ($P < 0.001$) for Mississippi ($\bar{x} = 257.14 \pm 109.2$ SE; $N = 42$) than for Louisiana ($\bar{x} = 46.03 \pm 8.86$ SE; $N = 374$), but flock sizes did not differ between regions during December or April (Fig. 5). In Mississippi, flock size was significantly greater ($P < 0.001$) in February than in December, whereas flock size in Louisiana did not vary among months (Fig. 5).

In Mississippi, we found a significant ($\chi^2_{15} = 2,329$; $P < 0.001$) seasonal effect in habitat use. In December pelicans were found more frequently in fresh water and sand bar habitats, in February they used flooded fields almost exclusively, and in April they showed a preference for catfish

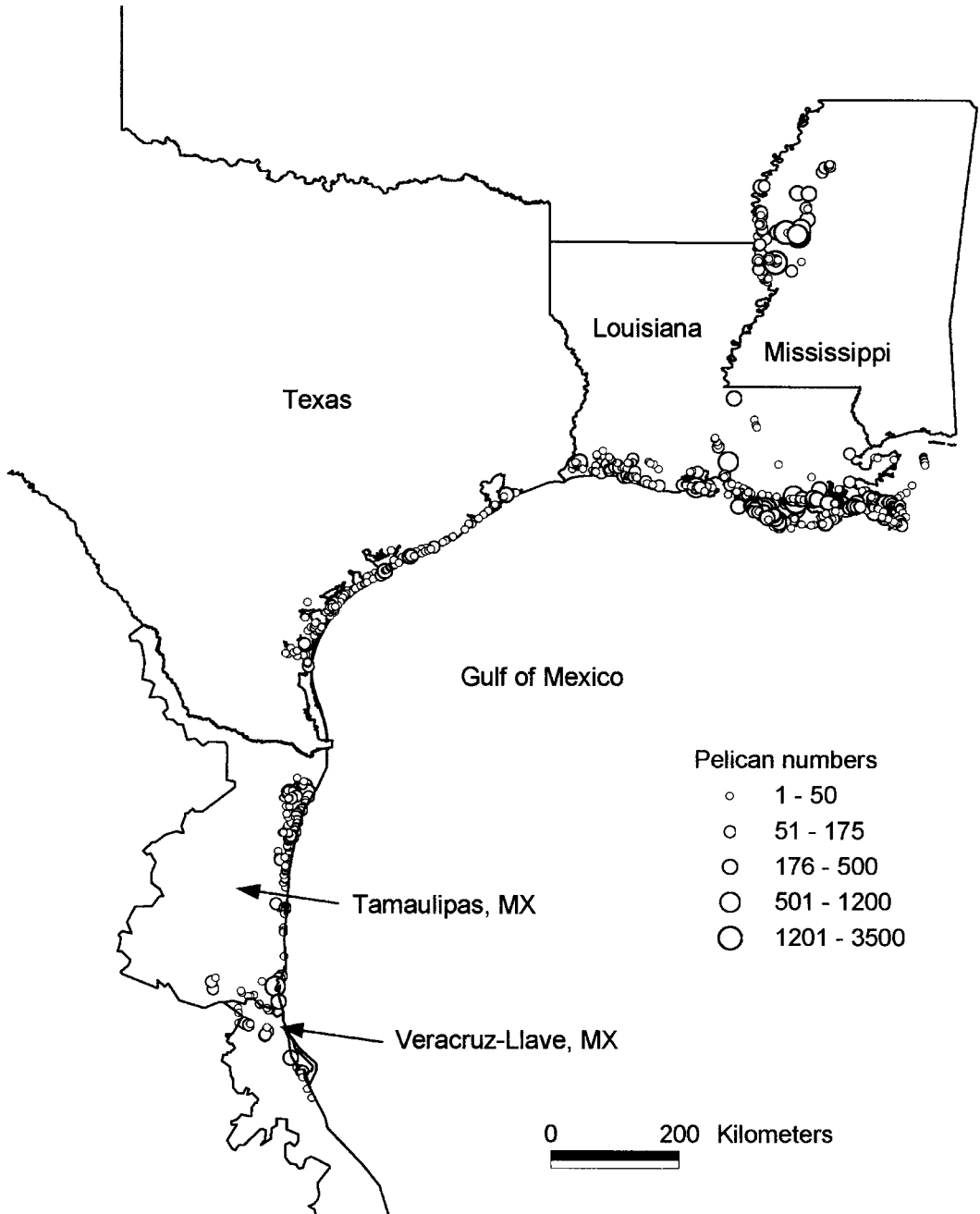


Figure 1. American White Pelican locations and flock size classes recorded during aerial surveys in the delta region of Mississippi and the Gulf Coasts of Louisiana, Texas, and Mexico (MX) from 1997-99.

ponds (Fig. 6). In Louisiana, we also found a significant ($\chi^2_{12} = 6.7$; $P < 0.001$) seasonal effect in habitat use. In December, pelicans used fresh, intermediate (Michot 1996), and brackish marshes equally and avoided saline marsh, whereas they showed a preference

for brackish and saline marshes in February and April (Fig. 7). Mean water body size (length and width) used by pelicans in Louisiana was about 1,600 m \times 1,300 m ($N = 66$) and flocks were located in water about 24 m from the shoreline (range = 0-350 m, $N = 63$).

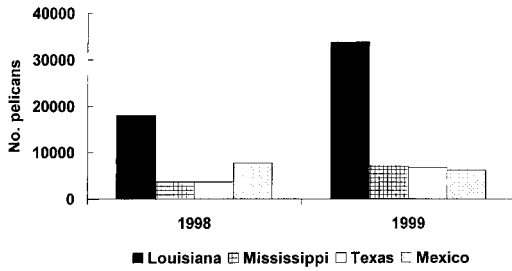


Figure 2. Numbers of American White Pelicans observed during aerial surveys in the delta region of Mississippi and the Gulf Coasts of Louisiana, Texas, and Mexico during January (Texas, Mexico) and February (Mississippi, Louisiana) 1998-99.

DISCUSSION

Pelican numbers in Mississippi followed a trend similar to that described by King (1997), but were more variable in Louisiana. The coastal zone of Louisiana consistently had higher numbers of pelicans than other areas surveyed, suggesting that coastal Louisiana may be the most important wintering area for American White Pelicans east of the Rocky Mountains. These results suggest that a major portion of the birds in eastern North America winter in the four regions studied.

In other winter surveys conducted in areas that were outside of this study area, we noted that American White Pelicans continued to be common and abundant in Mexico, all along the southern coast of the Gulf of Mexico and the Bay of Campeche, north to the tip of the Yucatan Peninsula. Pelican flocks were observed infrequently or rarely along the Caribbean coasts of Mexico, Gua-

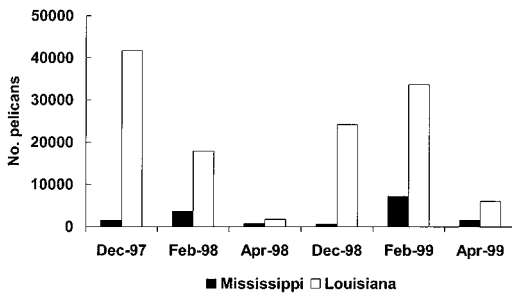


Figure 3. Numbers of American White Pelicans observed during aerial surveys in the delta region of Mississippi and coastal Louisiana during December-April 1997-99.

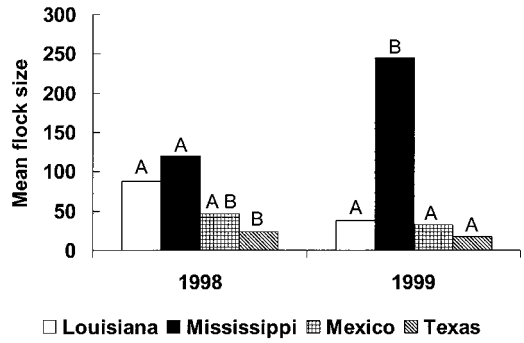


Figure 4. Mean flock sizes of American White Pelicans observed during aerial surveys in the delta region of Mississippi and the Gulf Coasts of Louisiana, Texas, and Mexico during January and February 1998-99. Bars with different letters are significantly ($P < 0.05$) different.

temala, and Honduras, and along the Pacific coast of Honduras, El Salvador, Guatemala, and Mexico (up to the Isthmus of Tehuantepec). American White Pelicans were also observed infrequently along the northern and eastern Gulf of Mexico coasts of Mississippi, Alabama, and Florida, as far as the Dry Tortugas (T. C. Michot, unpubl. data).

Although numbers and flock sizes of pelicans may follow regional and seasonal trends, they are variable. In Mississippi, high numbers and large flock sizes of pelicans typically occurred in February, at the onset of spring migration (King 1997; T. King, unpubl. data). Pelican flocks we observed wintering along the Gulf of Mexico and in the delta region of Mississippi were generally larger than the daytime summer flock sizes of four to 90 birds previously reported (Behle 1958; O'Malley and Evans 1982; McMahon and Evans 1992).

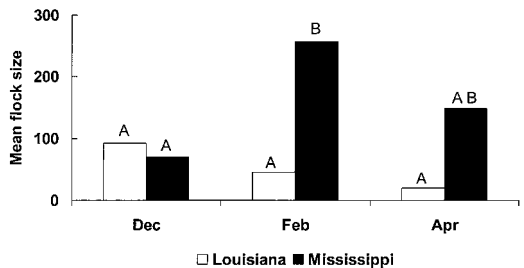


Figure 5. Region by month mean flock sizes of American White Pelicans observed during aerial surveys in coastal Louisiana and the delta region of Mississippi from 1997-99 (pooled over years). Bars with different letters are significantly ($P < 0.05$) different.

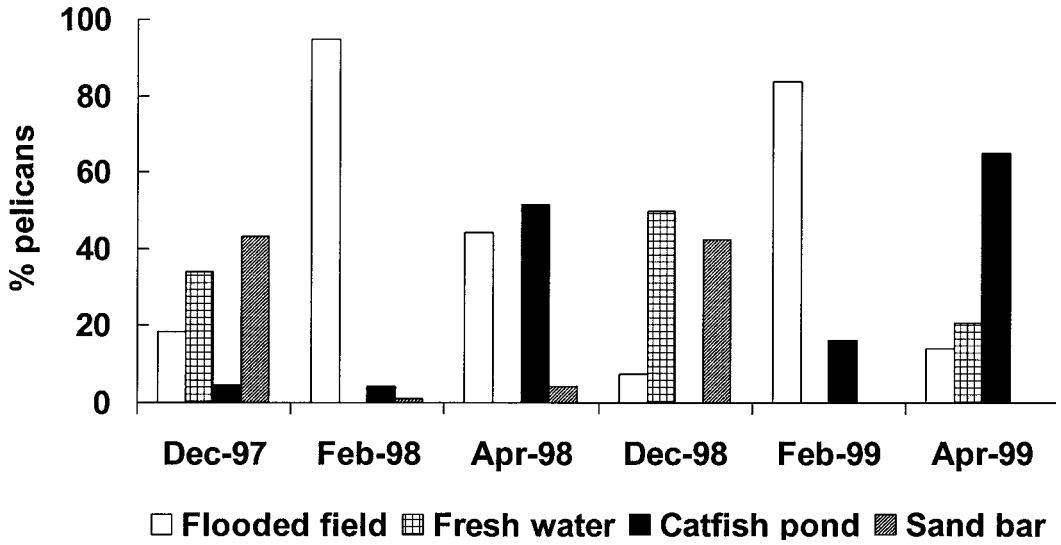


Figure 6. Percentage of American White Pelicans observed in flooded field, fresh water, catfish pond, and sand bar habitats during aerial surveys in the delta region of Mississippi from 1997-99.

In the delta region of Mississippi, the seasonal shift in habitat use from fresh water and sand bars to flooded fields to catfish ponds may be due in part to changes in water levels at pelican loafing sites. In December, the Mississippi River typically is low, with many exposed sand bars. During this period, pelicans in the delta region of Mississippi usually loaf and forage near the Mississippi River and in oxbow lakes adjacent to the riv-

er (King 1997). However in February, the water level in the Mississippi River is usually high with no exposed sand bars; therefore, fields flooded intentionally for waterfowl or by precipitation provide loafing habitats for pelicans. During late winter and continuing through spring, the number of complaints from farmers about pelicans foraging at catfish ponds increased as pelicans became more persistent in their foraging efforts and

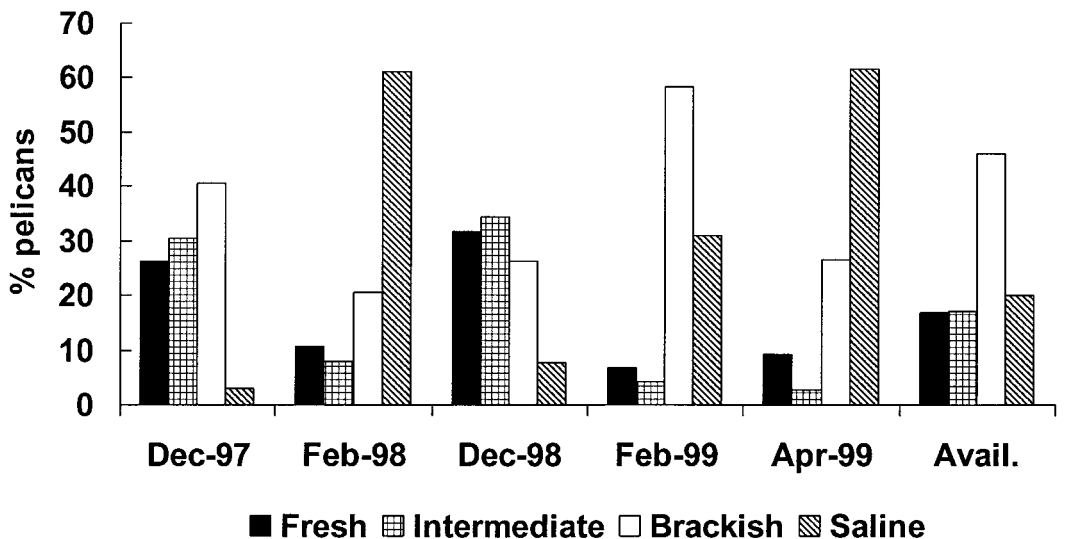


Figure 7. Percentage of American White Pelicans observed in fresh, intermediate, brackish, and saline marsh habitats during aerial surveys in coastal Louisiana from 1997-99, and percent of available marsh habitats surveyed (Avail.).

more difficult to disperse (King 1997; King unpubl. data). This suggests that, like Double-crested Cormorants (*Phalacrocorax auritus*; Glahn *et al.* 1999), pelicans increase use of aquaculture habitats prior to and during migration to their breeding areas.

In Louisiana, the seasonal shift from fresh marshes to more brackish and saline waters could be linked to seasonal shifts in abundance of prey items such as fishes and crustaceans (Herke and Rogers 1989). Visser *et al.* (1994) also noted a higher use of salt marsh than of brackish and fresh/intermediate marshes by American White Pelicans in Louisiana, but did not mention seasonal shifts.

This study provides a baseline of information on distribution and abundance of American White Pelicans on their wintering grounds. More information is needed on use of inland lakes, reservoirs, and adjacent wetlands (not covered in this study). Changes in landscapes and land use patterns associated with increased aquaculture, changing agricultural practices, and coastal land loss (conversion of marsh to open water) all have the potential to affect changes in distribution of wintering pelicans. Although Double-crested Cormorants have shown a substantial increase on the wintering grounds (Glahn *et al.* 1999), the data that exist for American White Pelicans (e.g., Christmas Bird Count) fail to reveal any trend over time (King 1997). This study provides a baseline from which future studies can assess changes in numbers over time.

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