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SURVEY OF BROWN PELICANS (*Pelecanus occidentalis*) IN JACKSONVILLE, FLORIDA

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Abstract.—The Brown Pelican (*Pelecanus occidentalis*) is a year-round resident in Duval County, Florida; however, a comprehensive survey and the development of population trends for this area have not been conducted. We gathered data at three sites, one riverine, one estuarine, and one marine, in Jacksonville, Florida to investigate seasonal trends in population abundance and demography. We qualitatively compared our survey results to local eBird data on Brown Pelicans. Additionally, we noted pelican-human interactions and discuss the consequences of these interactions. Pelicans were most abundant in spring (n = 823), with counts nearly twice what they were in fall (n = 416) and winter (n = 447). The lowest abundance of pelicans occurred during the summer (n = 36). Pelicans were approximately three times more abundant at Mayport (n = 1092) as compared to the other sites, most likely do to its close proximity to commercial fishing. While adults were more numerous (1065 adults as compared to 657 juveniles), age class differences in abundance were not significant across seasons or sites. Whereas our highest counts were in spring, more pelican observations were submitted to eBird during the winter and both our results and eBird's indicate that pelicans are least abundant in the summer. Pelicans frequently followed shrimp boats, and begged for handouts. We observed some pelicans with injuries from fishing gear.

Brown Pelican (*Pelecanus occidentalis*) populations in the southern United States showed large declines in the 1970s from pesticides such as endrin and DDT; however, their populations have since rebounded and in some areas their numbers have more than quadrupled (Schreiber 1980, Shields 2002, Foster et al. 2009). For example, observations of a Gulf Coast population on Mustang Island in Texas increased by 586% between 1979 and 2007 (Foster et al. 2009). While increases have not been as large in Atlantic populations (Shields 2002), nestling data from South Carolina show an increase in nest counts during the 1980s, and even with recent declines in nest counts, they are nearly twice what they were in the 1970s (Jodice et al. 2007).

Florida supports breeding, resident, and migratory populations of the eastern Brown Pelican *Pelecanus occidentalis carolinensis* (FWC 2003). The statewide population is estimated at 8,000 to 12,000 breeding pairs annually, and the non-breeding winter population includes individuals that breed in other states (FWC 2011). Emigration from

Florida occurs in February and March while immigration to Florida takes place in October and November (FWC 2003).

Despite the current positive trend in population growth in Florida, several natural and man-made threats to pelicans continue to affect the stability of the pelican population (FWS 2009). These include severe weather events (e.g., hurricanes, deep freezes), oil spills, climate change, habitat alteration, and human disturbance of nesting colonies (Jodice et al. 2007, Nevins et al. 2011, Selman et al. 2012, Walter 2012, Walter et al. 2013a). Recreational and commercial fishing can also affect pelicans, either through competition for food resources, alteration of natural foraging behaviors, or entanglement in fishing gear (Anderson et al. 1980, Nesbitt 1996, Moore et al. 2009, Wickliffe and Jodice 2010).

Citizen science is gaining popularity across the globe and can inform scientists and conservationists about a variety of organisms, including the Brown Pelican (Wood et al. 2011). eBird was established in 2002 as a joint venture between the National Audubon Society and the Cornell Lab of Ornithology (Sullivan et al. 2009). It allows birders to report their observations in a standardized format that can then be turned into data on bird abundance, location and seasonal distribution. These data are available to a variety of users including birders, governmental agencies, academics, and students (Sullivan et al. 2009).

We conducted a survey of Brown Pelicans in Duval County, Florida to examine seasonal and site abundance of juveniles and adults and to note the effects of fishing on pelicans. Additionally, we qualitatively compared our data on seasonal abundance to eBird data for Duval County (Jacksonville), Florida.

METHODS

We surveyed the Brown Pelican population at three locations: Jacksonville Beach Pier (Jax; marine site), Jacksonville University Dock (JU; riverine site), and Mayport's Safe Harbor Dock (May; estuarine site) from 8 September 2012 to 20 August 2013 (Fig. 1). We conducted point counts at least twice a month for 30 minutes at each site for a total of 188 counts. We grouped the counts into seasons (fall [Sept. – Nov.], winter [Dec. – Feb.], spring [Mar. - May], summer [June- July]). During each point count, we counted all juveniles and adults. We differentiated age class based on plumage (juveniles: brown flight feathers and a brown head; adult: gray flight feathers and a white head; Schreiber 1976). We compared counts between seasons (fall, winter, spring, and summer), sites (Jax, JU, May), and age classes (adults, juveniles) using a negative binomial test (White and Bennetts 1996). We used SAS (SAS Institute 2003) for all statistical tests, tested all interactions, and report both average \pm SE and total counts. All three sites were areas in which pelicans could come into contact with humans, mainly via the fishing industry, thus we also noted *ad libitum* any pelican-human interactions and/or pelican injuries.

We qualitatively compared our results to eBird data on Brown Pelicans in Duval County, Florida for the combined years of 2012 and 2013 (eBird 2012). We examined the abundance (average number of birds reported on all checklists), average count (average



Figure 1. Survey locations in Jacksonville, Florida: A. Jacksonville University dock on the St. Johns River; B. Mayport Safe Harbor docks; C. Jacksonville Beach Pier.

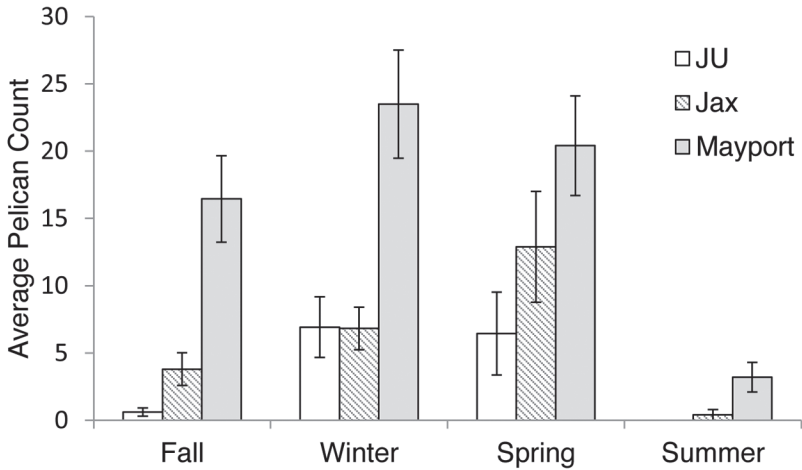
number of birds detected when encountered), and totals (number of birds from all checklists). Similarly to how we treated our data, we divided the eBird data into four seasons. Unlike our data set the eBird data did not differentiate between age classes.

RESULTS

A total of 1722 Brown Pelicans (1065 adults and 657 juveniles) were counted.

There were seasonal differences across sites (season*site interaction, $\chi^2 = 25.90$, $p = 0.0002$). The total number of pelicans (adults and juveniles) was lowest in the summer ($n = 36$) and increased through the fall ($n = 416$), winter ($n = 447$), and were highest in the spring ($n = 823$). Pelicans were most abundant at Mayport ($n = 1092$), followed by the Jacksonville Pier ($n = 394$) and JU dock ($n = 236$) (Fig. 2). Total counts dropped from fall to winter at Mayport (329 to 282 pelicans), whereas they increased from fall to winter at JU (11 to 82 pelicans) and Jacksonville Beach (76 to 82 pelicans). Lowest total counts were in summer ($n = 36$) and no pelicans were counted during the summer at JU or at the Jacksonville Beach Pier. The number of adults and juveniles was not significantly different between sites (Fig. 3) or seasons (Fig. 4,

b.



b.

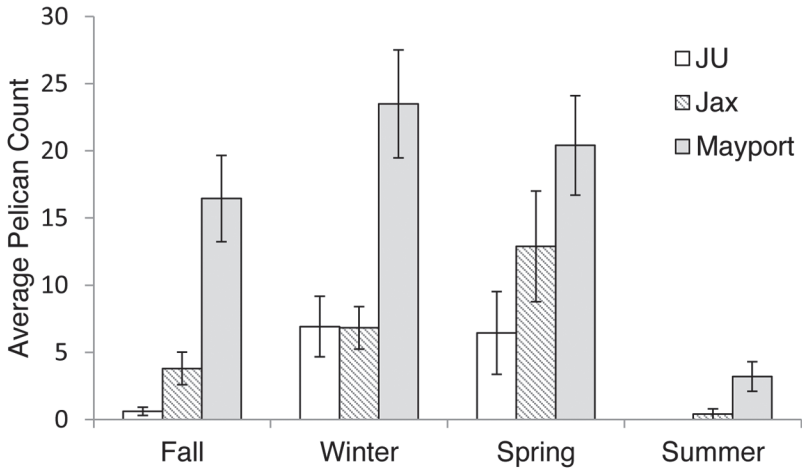


Figure 2. Seasonal differences in pelican abundance between three sites in Jacksonville (a. total pelican counts; b. average pelican counts).

age*site*season interaction $\chi^2 = 7.46$, $p = 0.28$, age*site interaction $\chi^2 = 3.93$ $p = 0.14$, age*season $\chi^2 = 0.02$ $p = 0.99$, age $\chi^2 = 0.0$, $p = 0.99$), averaging 11.33 ± 1.61 adults and 10.61 ± 1.09 juveniles per count.

At all three sites we observed pelicans interacting with humans. We observed pelicans following shrimp trawlers on the St. Johns River off the JU dock and pelicans begging for and receiving handouts at both Jacksonville Pier and Mayport. Three pelicans were observed tangled in fishing line and one pelican was seen with a fish hook through its wing. On one occasion we also witnessed a pelican swallowing a hook.

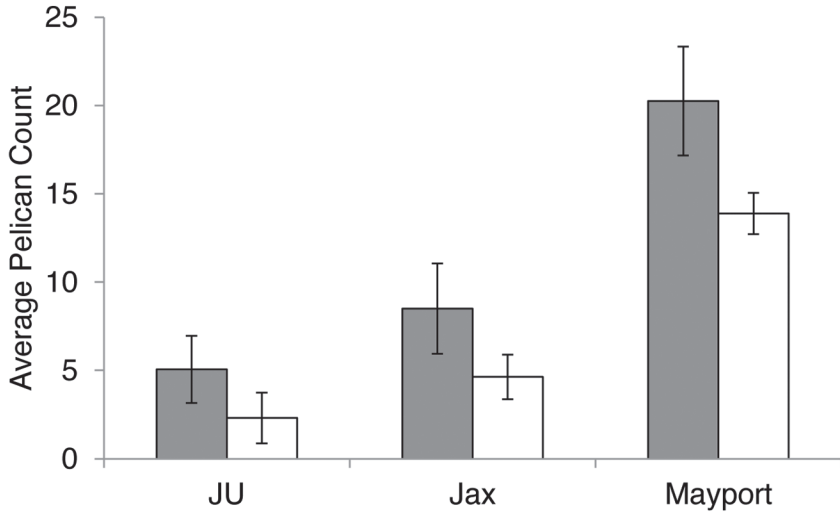


Figure 3. Comparison of average counts of adults (solid) versus juveniles (open) at three locations.

The eBird data showed seasonal differences (Fig. 5), in which abundance was highest in winter averaging 6.60 ± 0.55 pelicans cited on all checklists submitted to eBird. Of the checklists including pelicans, the highest average count was in the fall (25.10 ± 0.13), followed

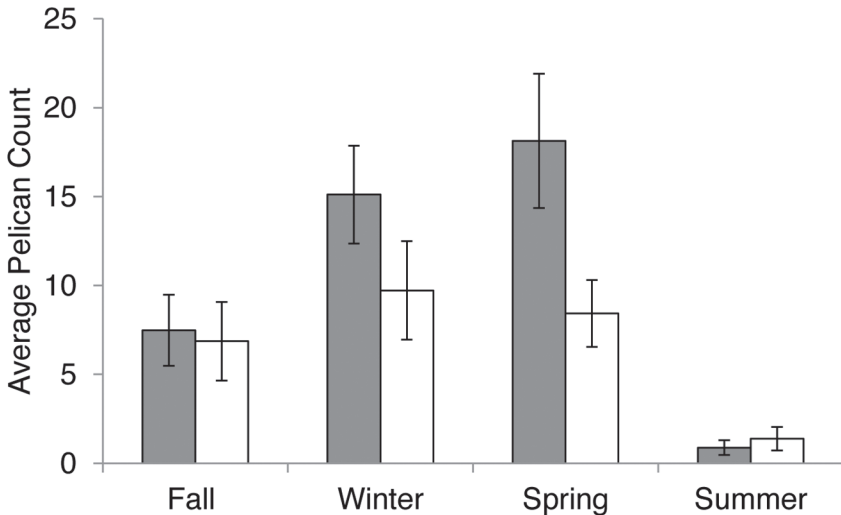


Figure 4. Average seasonal counts of adults (solid) and juvenile (open) Brown Pelicans.

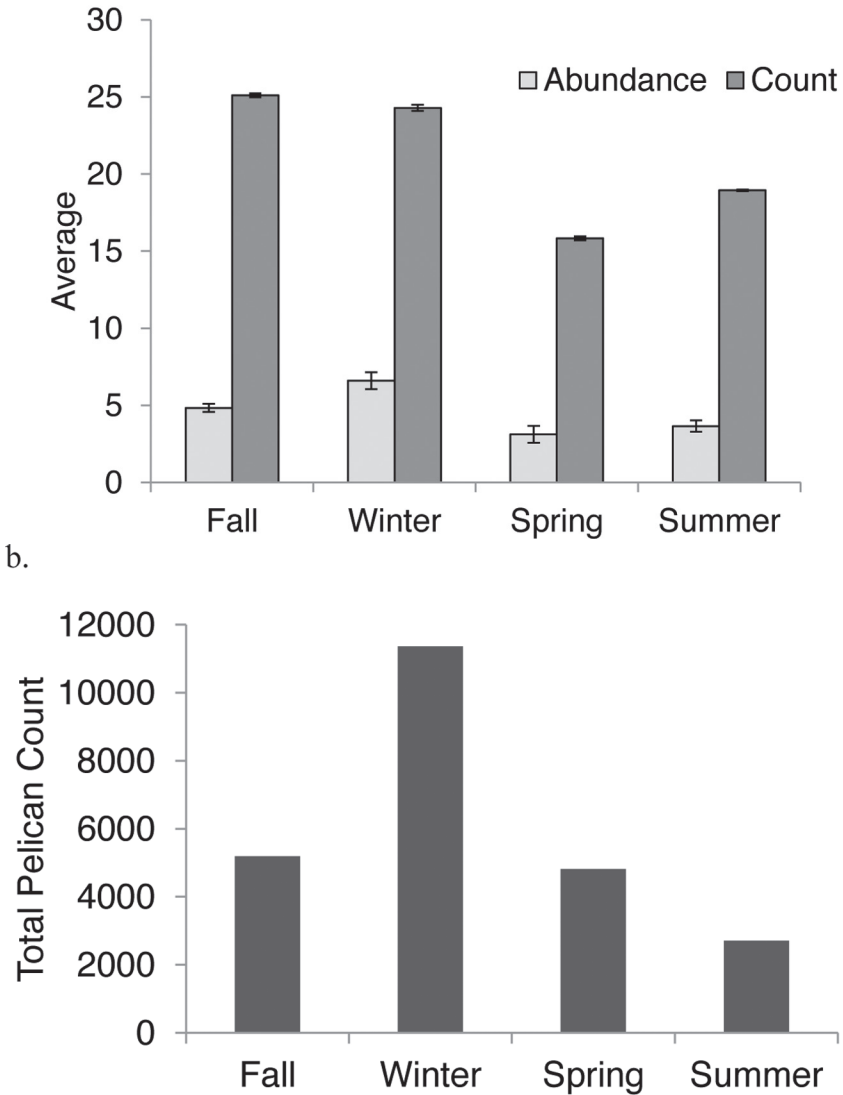


Figure 5. Seasonal trends in numbers of Brown Pelicans in Duval County, FL as reported to eBird in 2012 and 2013. a. Average abundance of pelicans counted on all eBird checklists (light bars) and average count of pelicans when detected (dark bars). b. Total numbers of pelicans reported seasonally to eBird.

closely by winter (24.29 ± 0.19), and the lowest in spring (15.83 ± 0.13). The total number of pelicans reported to eBird was highest in winter (11,369) and lowest in summer (2,709).

DISCUSSION

Northeast Florida provides an important area for non-breeding adult and juvenile Brown Pelicans. We observed seasonal differences in abundance, with counts increasing through the fall and winter, culminating with highest counts in spring. Our data suggest an influx of birds in the fall and continuing through the spring with a sharp drop off in the summer. Previous studies suggest that pelicans in the Carolinas and along the eastern U.S. migrate south to winter in Florida (Schreiber and Mock 1988). Numbers may have increased in spring due to breeding; however, breeding locations are still unknown in Jacksonville and the closest confirmed breeding area south of Jacksonville is in Volusia County at Port Orange (FWC 2003). Breeding Brown Pelicans in Florida often do not migrate, while those in more northern areas tend to migrate southward in the winter, and usually disperse no more than 250 km from their natal colony (Schreiber and Mock 1988). Therefore, it is more likely that the high counts in spring are due to migratory individuals instead of an influx of breeding individuals. Adult and juvenile birds occurred in relatively equal numbers throughout the year and at each site. While for most counts there were more adults than juveniles, these differences were not statistically significant. And as with adults, juvenile pelicans were most abundant in the spring. Other studies, mostly from Gulf of Mexico pelican populations, show extreme site fidelity, with most individuals remaining in the vicinity of their breeding colony (King et al. 2013, Walter et al. 2013b).

Brown Pelicans were most abundant at Mayport, followed by Jacksonville Beach, which are pelicans' preferred estuarine and marine habitats for foraging and roosting (Shields 2002). However the abundance of Brown Pelicans at Mayport is likely due to the presence of commercial fishing which regularly attracts pelicans throughout their range (Anderson et al. 1980, Moore et al. 2009). During the summer, pelicans were observed at Mayport while there were no sightings at the other locations. Residency at Mayport may have continued throughout the summer due to constant handouts from recreational and commercial fisherman. Juveniles may become more dependent upon handouts, which could lead to delayed development of foraging skills. Several studies indicate that juvenile pelicans are less proficient foragers than adults (Brandt 1984, Carl 1987, Arnqvist 1992) and if learning of foraging behaviors is delayed it could have detrimental effects on individuals. Regardless of age, begging and proximity to both commercial and recreational fishing can lead to injury and death, as birds become entangled in fishing equipment (Moore et al. 2009). We saw several pelicans with fishing related injuries, including hooks and

fishing line. Monofilament fishing line poses a particularly dangerous threat as it can continue to entangle other pelicans even after the initial entangled bird dies (Nesbitt 1996).

We also observed adult and juvenile pelicans in the presence of fishing boats and shrimping trawls. In South Carolina, Brown Pelicans were one of the most common birds attending shrimp trawlers (Wickliffe and Jodice 2010). Commercial fishing boats and shrimp trawlers often passed by Jacksonville University dock and Jacksonville Pier and were usually accompanied by more than 50 pelicans. Wickliffe and Jodice (2010) suggest that pelicans in South Carolina opportunistically target trawlers instead of following them for food. However, in Northeast Florida, especially along the St. Johns River, pelicans were following the fishing boats and shrimp trawlers.

Access to handouts and the presence of fishing boats and shrimp trawls may have influenced the seasonal abundance of Brown Pelicans in our survey. There were differences between our seasonal abundance data and the eBird data. While we noted higher pelican abundance in the spring, more pelicans were reported to eBird in the winter. Both our data and eBird's do indicate a lull in pelican abundance during the summer. The discrepancy between our data and eBird may be a matter of sampling effort. Data from eBird was gathered from all areas of Duval County and not limited to a few sites, all of which are in close proximity to fishing as with our study. Total observation time was higher as well with eBird.

In Florida, the Brown Pelican is currently listed as a Species of Special Concern, but in a recent status review it was suggested that the pelican be delisted (FWC 2011). The Florida population of Brown Pelicans is rising, but they still face numerous threats (FWC 2011). Future studies in northeast Florida should continue to monitor the population and determine where local Brown Pelicans immigrate from and where they go to breed.

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