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BIRD DENSITY AND PRODUCTIVITY IN AN IMPOUNDED CATTAIL MARSH

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Abstract.—In an impounded South Carolina cattail (*Typha* spp.) marsh during 1986–1988, average bird population density was 16.7 nests per ha. Productivity was 3.8 kg per ha. Boat-tailed Grackles (*Quiscalus major*) represented 71% of the population, and accounted for 60% of the productivity. Population density was about the same as that reported for cattail marshes in northeastern North America, and approached that reported for a northeastern salt marsh. Population density and productivity varied little between years, and variation was related mainly to changes in water level. With low water levels, nests became accessible to ground predators. However, productivity appeared to be little affected by predation because Boat-tailed Grackles that lost nests renested within the marsh.

DENSIDAD Y PRODUCTIVIDAD DE AVES EN UN ANEGADO DE *TYPHA* SPP.

Sinopsis.—Durante un estudio que se llevó a cabo entre 1986–1988 en un anegado de eneas (*Typha* spp.) en Carolina del Sur, se encontró una densidad poblacional promedio de 16.7 nidos de aves/hectárea. La productividad resultó ser de 3.8 kg/hectárea. *Quiscalus major* representó el 71% de la población de aves y fue responsable del 60% de la productividad. La densidad poblacional fue similar a la informada para anegados de eneas en la parte noreste de Norte América y se aproximó bastante a la informada para anegados salobres del noreste. La densidad poblacional y productividad variaron muy poco entre años; la variación se relacionó a cambios en los niveles de agua. La mayoría de los nidos se hicieron accesibles a depredadores cuando hubo niveles bajos de agua. Sin embargo, la depredación afectó muy poco la productividad, debido a que los individuos de *Q. major* que perdieron sus camadas reanidaron en el anegado.

Although cattail (*Typha* spp.) marshes and wetland impoundments are widespread on the coastal plain of southeastern North America, there are few data on the population density or productivity of birds nesting in these habitats in this region. Impoundments and similar low-salinity marshes are often managed for ducks and geese, few species of which breed in the Southeast. Because of their importance to waterfowl, impounded wetlands have been the focus of extensive research (see review by Frederickson and Taylor 1982). Other than several descriptive studies from North Carolina (Lewis 1970, Weaver 1975), little attention has been paid to species that nest in these habitats. The ecological effects of impounding salt marshes are not well known. One step toward making meaningful assessments would be to measure the density and productivity of birds nesting in impounded and open marshes.

STUDY SITE AND METHODS

We conducted the study at Magnolia Gardens, Charleston County, South Carolina, from 1986–1988. The 13-ha study site forms part of a 30.5-ha marsh. The area was created in 1954 by the impoundment of a

TABLE 1. Bird population densities in an impounded cattail marsh.

Species	Number of nests			3-yr mean (no. per ha)
	1986	1987	1988	
Pied-billed Grebe	1	0	1	0.7 (0.1)
Least Bittern	37	42	34	37.7 (2.9)
Green-backed Heron	1	0	1	0.7 (0.1)
Common Moorhen	7	14	14	11.7 (0.9)
Red-winged Blackbird	10	16	12	12.7 (1.0)
Boat-tailed Grackle	177	141	141	153.0 (11.8)
Total (# per ha)	233 (17.9)	213 (16.4)	203 (15.6)	216.5 (16.7)

salt marsh peninsula on the Ashley River. The outer part of the marsh is surrounded by a channel (≤3 m deep) that was excavated during diking. Away from this channel, water depth in open-water areas averages about 1 m. Open water covers 75% of the site, and cattails (*Typha angustifolia* and *T. domingensis*) cover the remaining 25%. Average vegetation height in early July was 124 ± 42.4 (SD) cm. Extent of vegetation and water cover was determined by measuring aerial photographs. Vegetation height was determined by tallying contacts that vegetation made with each dm of a slender metal rod placed vertically (n = 100 points).

We established a 25 × 25 m grid with numbered wooden stakes, placed over the vegetated sections of the marsh. The census was based on the number of nests found. Nests were found by searching all cattail stands as the observer poled a boat. Once nests were located, the worker walked through the cattails and searched the area for additional nests. We also located nests by following birds as we watched them from a distance through binoculars or a telescope. We marked all nests with numbered plastic flagging. In all 3 yr, the site was visited an average of five times per week, from 1 April to 1 July.

Productivity estimates are based on biomass of unsuccessful eggs and young, as well as the number of young successfully reared in the area per year. For Boat-tailed Grackles (*Quiscalus major*) and Red-winged Blackbirds (*Agelaius phoeniceus*), the estimates are based on the total number of young fledged, multiplied by the average biomass of fledglings. Fledgling weight was used because young of these species left the marsh shortly after leaving the nest. For the other species, Common Moorhen (*Gallinula chloropus*), Least Bittern (*Ixobrychus exilis*) and Green-backed Heron (*Butorides striatus*), biomass was based on adult weight because these species remained in the study area after leaving the nest. The biomass of blackbird, grackle and bittern young that did not fledge was calculated as ½ the fledgling weight.

RESULTS

For the six species listed in Table 1, we found 16.7 nests per ha. If only vegetated portions of the marsh are considered, the density per unit

TABLE 2. Avian productivity (kg/ha) in an impounded cattail marsh.

Species	1986	1987	1988	3-yr mean
Least Bittern[a]	0.592	0.566	0.939	0.699
Green-backed Heron[b]	0	0	0.047	0.016
Common Moorhen[c]	0.502	0.891	0.915	0.769
Red-winged Blackbird[d]	0.029	0.040	0.039	0.036
Boat-tailed Grackle[e]	2.301	2.921	1.704	2.309
Total	3.424	4.418	3.644	3.829

[a] Adult weight = 115.5 g (Clench and Leberman 1978); egg weight = 10.0 g (this study).
[b] Adult weight = 204.1 g (Clench and Leberman 1978).
[c] Adult weight = 332.0 g (Ripley 1977); egg weight = 23.3 g (this study).
[d] Fledgling weight = 38.3 g (Haigh 1968); egg weight = 3.9 g (Haigh 1968).
[e] Fledgling weight = 77.2 g (Bancroft 1983); egg weight = 7.7 g (this study).

area of available habitat ("ecological density"; Kale 1965) was 66.6 nests per ha.

Crude population density in the South Carolina site exceeded that of three other cattail study areas, and was exceeded by one study area, in Haldimand-Norfolk County, Ontario (McCracken 1982). However, when we computed density for only vegetated portions of the respective study areas, ecological density in the South Carolina site was 35% higher than that reported from the Ontario site (Table 3).

As noted by Bancroft (1987) in Florida cattails, nesting birds were not randomly distributed through the marsh. Nests were usually aggregated on predator-free islands or peninsulas. Nesting colonies that were invaded by rat snakes (*Elaphe obsoleta*) were usually deserted by female grackles and by Least Bitterns within 10 d. Over 95% of grackle nests were in colonies. Least Bitterns and Common Moorhens nested within the grackle colonies. The largest number of Least Bittern nests, 13, was in a Boat-tailed Grackle colony with 32 nests active at the same time.

Average annual productivity of all species was 3.8 kg per ha per year (Table 2). Production varied little between years, the greatest variation (1 kg) being 22% of the most productive year's biomass. The main factor contributing to variation in productivity was change in water level. When water levels were low, as during the drought of 1988, rat snakes and rice rats (*Oryzomys palustris*) were able to reach bird nests that were usually protected by water barriers containing American alligators (*Alligator mississippiensis*). Alligators did not appear to depredate bird nests. In several colonies, however, alligators that basked along channel edges knocked down cattails that had nests.

Avian predation was low in all 3 yr of the study, and accounted for less than 5% of nest losses. Male and female grackles mobbed Fish Crows (*Corvus ossifragus*), Black-crowned Night-Herons (*Nycticorax nycticorax*) and Northern Harriers (*Circus cyaneus*). We found no evidence that Boat-tailed Grackles took the eggs or young of their own or of other species, such as has been reported from Louisiana (McIlhenny 1937).

TABLE 3. Breeding bird densities in cattail marshes of eastern North America.

	Location of study				
	NJ[a]	NY[b]	ONT[c]	ONT[d]	SC[e]
Duration of study (yr)	2	3	1	1	3
Size of area (ha)	5.9	9.7	7.5	5.5	13.0
Size of non-water area (ha)	5.9	4.9	4.9	—[f]	3.3
No. of species	4	15.3	9	10	6
No. of territorial males or females	44.8	48.2	241.0	81.0	216.5
Crude density[g]	7.63	6.09	3.22	14.72	16.65
Ecological density[h]	7.63	12.18	49.52	—[f]	66.62

[a] Morris County, New Jersey (Laskowski 1981, 1982).
[b] St. Lawrence County, New York (Crowell 1981, 1982; Harper and Crowell 1979).
[c] Haldimand-Norfolk County, Ontario (McCracken 1982).
[d] Kent County, Ontario (Veenstra and Haggeman 1981).
[e] This study.
[f] No data.
[g] Number of breeding males or females per ha.
[h] Number of breeding males or females per ha of available habitat (water areas excluded; Kale 1965).

A secondary factor that affected productivity was heavy wind, usually that associated with storms occurring in June and July. During this period, many nests, except those of Pied-billed Grebes (*Podilymbus podiceps*), were higher than those built in April, and were usually in new vegetation. More nests built in this substrate were overturned by storms than were those built lower, in dead cattails (see also Bancroft 1987).

DISCUSSION

The population estimates that we obtained in this study are similar to those from other studies of similar habitats and are also close to population densities found in salt marshes. For example, Post (1970) found 27.6 pairs per ha in a New York salt marsh. No estimates of breeding-bird population densities are available for salt marshes in South Carolina.

The lack of annual variation in population density or in productivity may be attributable to the behavior of the most common species, the Boat-tailed Grackle. Although grackle colonies (≤36 nests) were occasionally destroyed by predators, female grackles moved to new nest sites within the marsh. Species numbers were lower in our study site than in northern cattail marshes, except for the New Jersey census. As in the South Carolina marsh, most of the others had one or two numerically dominant species. In all except the New Jersey census, these were blackbirds (Icterinae). The numerically dominant species in the New Jersey marsh was the Marsh Wren (*Cistothorus palustris*). In our census area, the most common species, Boat-tailed Grackles, made up 71% of the population. A similar pattern of dominance by Icterinae was found at the Haldimand-Norfolk County site, where the two most common species, Red-winged Blackbirds and Common Grackles (*Quiscalus quiscula*), made up 79% of the bird population.

The results of this study cannot be used as evidence that impounded wetlands are more productive of birds than are open (unimpounded) marshes. The data provided here may be viewed as a first step toward making meaningful comparisons. As species composition may differ significantly between even structurally similar fresh- and saltwater marshes, researchers should use a common currency such as biomass for comparison. Further research is needed on the avian productivity of wetlands, particularly in the Southeast. Such research should consider all species, not just waterbirds.

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