SPECIES COMPOSITION OF A CICONIIFORM ROOKERY IN NORTHCENTRAL OKLAHOMA

BY
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The 3,300-ha Great Salt Plains Reservoir in Alfalfa County, Oklahoma, was created when the United States Army Corps of Engineers dammed the Salt Fork of the Arkansas River in 1941. It is the nucleus of the Salt Plains National Wildlife Refuge (NWR). Ralston Island was created in the north end by the rising water level and encompassed about 60 ha in 1941. Since then, it has gradually eroded away until only about nine ha remained in 1966 and five ha in 1989 (Koenen et al., 1996). In 1995, we estimated that a mere 1.8 ha was still intact. Today, the island is covered with salt cedar (*Tamarix* sp.) and other low-growing woody plants (see description of vegetation in preceding paper) and supports one of the largest heron rookeries in the state.

On 26 June 1995, we circumnavigated Ralston Island in a pontoon boat about 20–30 m from shore and counted nesting birds in 20 transects placed randomly around the island. To minimize disturbances to the nesting birds, we did not go ashore to delimit transects of a uniform length; instead, we ocularly estimated shoreline transects of about 8–10 m each from the boat. Variable length transects were used because we were interested in a single estimate of species composition and not a measure of variation in nesting densities throughout the island. The survey started at 0900 on the northeastern shore of the island and continued clockwise to the northwestern end. Two individuals independently counted all incubating birds in each transect. We stopped the boat at each transect location and waited three to five minutes for birds to resettle if they had been flushed from nests. These data were averaged to calculate species composition of nesting birds.

On 5 July 1995, we conducted two wandering-quarter transects (Catana, 1963) while traversing the island from north to south. We measured distances between 50 nearest-neighbor trees (defined as a living or dead rooted stem) and counted the number of nests per tree on each transect. The wandering-quarter method results in transects of varying length because the goal is to "wander" from one tree to the nearest neighboring tree in a 90° arc ("quarter") centered on a specific direction (in this case, south) and measure the distances between them. The inverse of the mean area occupied per tree, as calculated from the mean distance between nearest-neighbor trees, provides an estimate of density.

On 7 October 1995, after all breeding birds had left the island, we made a vegetation survey using 18 west-to-east belt transects to determine composition of plants. Each transect was 2 m wide and ranged from 12 m to 110 m, for a total length of 1053 m. Transects differed in length because of the variable width of the island.

Based on the wandering-quarter method, we estimated the mean distance between trees at 2.89 m and the mean number of nests per tree at 5.25. Tree density on Ralston Island was 0.1201 trees/m^2. Assuming that the island was 18,211.5 m^2, we estimated the total number of trees at 2,187.2. This figure, multiplied by 5.25 nests/tree, yielded an estimate of 11,482.8 nests on the island. Assuming two adults per nest, we estimated the number of breeding birds on the island at 22,966 (Table 1).

A nest survey in early July of 1982 by Dr. Larry G. Talent and Laura A. Hill (1982) reported the first known breeding of Cattle Egrets (*Bubulcus ibis*) on Ralston Island (ca. 1000 birds). We estimated a breeding population of 19,199 of these birds there in 1995, or a 19-fold increase since 1982. In addition, we noted a 48-fold increase in Little Blue Herons (*Egretta caerulea*) and a 12-fold increase of Black-crowned Night-Herons (*Nycticorax nycticorax*) during this same period. There were about 200 Green Herons (*Butorides virescens*) nesting throughout the island in 1982, but none in 1995.

Because of their high visibility, species with white plumage were easier to count and their numbers may have been overestimated both in 1982 and 1995. By contrast, the darker White-faced Ibises (*Plegadis chihi*) and adult Little Blue Herons flushed easily and may not have always resettled to be counted on a transect. Therefore, we suspect that their numbers were underestimated. Black-crowned Night-Herons also may have been underrepresented because their nests were located toward the interior of dense bushes and thus were difficult to see.

The total number of ciconiiform birds on Ralston Island increased dramatically from approximately 1,240 birds in 1982 to an estimated 22,966 in 1995, despite the island's shrinking size. Population growth was most pronounced among Cattle Egrets, but Little Blue Herons and Black-crowned Night-Herons also showed appreciable gains (Table 1).

Although numbers of some species had grown dramatically since 1982, we found that overall species composition on the island had changed little(Table 1). For example, Cattle Egret composition, 81% in 1982, was 84% in 1995. The percentage of Little Blue Herons and Black-crowned Night-Herons changed from 1.6% of the total each in 1982 to 4.2% and 1.1%, respectively, in 1995.

Population estimates of Great-tailed Grackles (*Quiscalus mexicanus*) were unavailable in 1982, but they constituted less than one percent of the total birds counted in 1995. Four Great Blue Herons (*Ardea herodias*) were tabulated in 1982 and one in 1995, but no nest was discovered. Species found in 1995 but not in 1982 included Snowy Egret (*Egretta thula*), Great Egret (*Ardea alba*), White-faced Ibis and Double-crested Cormorant (*Phalacrocorax auritus*). This was the first year that breeding of the White-faced Ibis had been documented on the refuge (see preceding paper).

Our vegetation survey indicated that salt cedar was the most important species to breeding birds on Ralston Island; it accounted for 64% of the total tree species composition (Table 2). Interestingly, although about 50% of the salt cedars were dead, we found 79% of all nests in live trees. This high percentage may have been attributable to the heavy rains in August 1995 that washed nests out of dead trees more readily than from live ones. Telfair (1994) noted that the build-up of Cattle Egret numbers exacerbates guanotrophication. This process ultimately can kill vegetation, which may lead to abandonment of a rookery. Introduced into North America in the late 18th Century, *Tamarix* has spread throughout the floodplains of most southwestern rivers and reservoirs in the United States (Horton, 1977; Kerpez and Smith, 1987; Koenen et al., *op. cit.*). Specific causes of salt cedar mortality on Ralston Island and its impact on the rookery are not known.

Refuge personnel initiated erosion control measures in 1993 by placing round bales of hay on the southern tip of the island, but these were washed away by

heavy rains during the summer of 1993. More recently, a cement wall extending about 100 m to the northwest from the southern tip of the island has been built. Refuge personnel anticipate that the area will silt in, providing substrate on which vegetation can become established. Because of its attraction to immense numbers of breeding herons and egrets, we contend that additional research and aggressive erosion control on Ralston Island is warranted in the near term.

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Table 1. Proportions of breeding birds on Ralston Island, Salt Plains NWR, Oklahoma, 1982 and 1995. See text for calculations; early data from Talent and Hill, 1982.

Species	Total birds on nests (1995)	Relative % of nests (1995)	Number of adults 1982	Number of adults 1995
Cattle Egret	926	83.6	1,000	19,199
Green Heron			200	0
Snowy Egret	61	5.5	0	1,263
Great Egret	50	4.5	0	1,033
Little Blue Heron	47	4.3	20	965
Black-crowned Night-Heron	11	1.0	20	253
White-faced Ibis	8	0.7	0	161
Double-crested Cormorant	4	0.4	0	92
TOTALS			1,240	22,966

Table 2. Species composition of nest trees on Ralston Island, Salt Plains NWR, Oklahoma, 7 October 1995.

Tree Species	% Comp.	% with nests
Salt cedar (dead)	35	8
Salt cedar (live)	29	79
Sumac	29	7
Hackberry	2	4
Honey locust	2	0
Elm	1	1
Cottonwood	1	1
Red mulberry	1	0

GENERAL NOTE

Nest competition in Eastern Meadowlarks — Interspecific and intraspecific nest competition or sharing has been documented in many passerine species (e.g., Holland 1923; Raney 1939; Farber 1972), but I was unable to find any record of intraspecific nest sharing in Eastern Meadowlarks (*Sturnella magna*). Northern Bobwhite (*Colinus virginianus*) eggs have, however, been found in meadowlark nests on a few occasions (e.g., Roseberry and Klimstra 1970). Saunders (*in* Bent 1958) reported that polygyny is frequent in Eastern Meadowlarks, with about 50% of the males in his study having more than one female. Knapton (1988) reported that 66 (64.1%) of the 103 nests he studied belonged to polygynously mated females, and that their nest success was higher than for monogamously mated females. Most blackbirds in North America practice polygyny, with Red-winged Blackbirds (*Agelaius phoeniceus*), Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*), and Great-tailed Grackles (*Quiscalus mexicanus*) usually having three or more females in each male's harem (Orians 1980; Webster 1992). It would seem that polygyny might occasionally lead to intraspecific brood parasitism or nest sharing.

In 1994, I observed two apparent cases of nest sharing or competition in Eastern Meadowlarks in Osage County, northeastern Oklahoma. The first nest was found on 10 May 1994 along a county roadside about a half mile east of Foraker by Gary A. Cress, Charles L. Lamd, Greg S. Um, Yan Wu, and the author. A meadowlark that flushed from the roadside ditch prompted an immediate search for a nest. When the nest was found, a second meadowlark, presumably a female, flushed and revealed a well-domed nest containing nine eggs. Egg measurement revealed two distinct size clusters. Volumes of eggs in one cluster (five eggs) ranged from 5056 to 5594 (mean = 5286.6) mm^3, while those in the second (four eggs) ranged from 6143 to 6604 (mean = 6373.0) mm^3. Egg volume was calculated using Hoyt's (1979) formula (LxBxBx0.507). The difference in egg volume between these egg sets was significant ($t=9.195$, $df=7$, $p<0.001$). The next day, the nest contained only five eggs, and three additional ones were about one m from the nest. On 20 May, one chick had hatched and all of the remaining eggs were broken. On 24 May the nest was empty and assumed depredated. I speculate that the removal of the eggs was due to competition for the nest between the two females.

A second similar nest, with eight eggs, was located on 6 June 1994 by Lachovia C. Parrish, Stephanie R. Schmidt, Sandy L. Stevens, and the author on the Nature