BREEDING CHARADRIIFORM BIRDS OF THE GREAT SALT PLAINS

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Three charadriiform bird species — the American Avocet *(Recurvirostra americana)*, Least Tern *(Sterna albifrons)*, and Snowy Plover *(Charadrius alexandrinus)* — have long been known to nest side by side in considerable numbers, almost as if colonially, on the vast salt flats that lie west of the main reservoir (impounded Salt Fork of the Arkansas River) on the Salt Plains National Wildlife Refuge in Alfalfa County, north-central Oklahoma. All three species nest elsewhere in Oklahoma — the tern and plover on salt flats in Woods County as well as on open shores of rivers and impoundments at widely scattered localities, the avocet at two or three localities in the Panhandle. To be noted are two facts: 1. The three species represent three families — respectively the Recurvirostridae, Laridae, and Charadriidae. 2. The Killdeer *(Charadrius vociferus)*, a plover that breeds widely throughout Oklahoma, displaying great catholicity in choice of nest-sites, breeds only in small numbers on the salt flats.

From 1 May through August in 1977 and 1978, we studied the breeding ecology of the three species named in the first sentence of the above paragraph. Our objectives were to determine population size and breeding overlap; to quantify reproductive success and determine causes of nest failure; and to record the chronology of nesting activities. We especially wanted to form an opinion as to how the removal of salinity from the Arkansas River by the proposed "Arkansas-Red Rivers Basins Chloride Control Project" of the U.S. Army Corps of Engineers would affect the salt flats as a breeding habitat for the three species.

From counts made at regular intervals we determined that at least 46 pairs of American Avocets, 80 pairs of Least Terns, and 325 pairs of Snowy Plovers nested on the flats in 1977 and that 53, 135, and 260 pairs, respectively, nested there in 1978. Most nests were along streams — Clay Creek, Cottonwood Creek, and the Salt Fork of the Arkansas River. Nests were farther upstream in 1978 than in 1977, a discrepancy resulting, we believe, from the inclement weather and frequency of flooding in the early spring of 1978. The streams' channels are deeper and their water levels more constant in their upper reaches and the erratic changes of course near their mouths may have been responsible for the move back from the reservoir's shore in 1978.

As part of our study we marked 184 nest sites with wooden stakes and visited each nest at intervals of one to three days, monitoring the progress of eggs until the time of hatching or of nest failure. Nest success for all three species in 1977 was 72.8% (82.6% for the avocet, 73.1% for the tern, 64.3% for the plover), whereas in 1978 it was only 26.3% (36.6% for the tern, 16.7% for the plover), but the discrepancy may well be more apparent than real for it does not take into account the fact that we found only one avocet nest in 1978

and that in 1978 many pairs of all three species nested successfully after we had finished our work. We could not, unfortunately, continue our observations that summer to determine important facts about renesting.

In 1977 we made a point of measuring the distance between the closest two nests of the same species, the distance between the closest two nests regardless of species, and the distance between nests and water; too, we took notes on the presence or absence of debris at nests. In 1977 we found 23 avocet, 28 tern, and 53 plover nests, in 1978 one (only) avocet nest, 42 tern nests, and 37 plover nests. The closest two avocet nests in 1977 were 25 meters (82 feet) apart, the closest two tern nests 3 meters (10 feet) apart, the closest two plover nests 7 meters (23 feet) apart. In general, the avocet appeared to require the largest amount of space for successful nesting, the plover a somewhat smaller amount, the tern definitely the smallest amount. The 14 avocet nests (nine with four eggs each, one with five eggs, one with one egg, three empty) found by G. M. Sutton and P. F. Nighswonger on 15 May 1960 (Sutton, 1967, Oklahoma birds, Univ. Oklahoma Press, Norman, p. 207) were strung out along a 100-yard stretch of Clay Creek not far upstream from the point at which Clay and Cottonwood creeks join before entering the reservoir. No plover or tern nest that Sutton and Nighswonger found that day was at all close to any of the avocet nests, but some avocet nests were only a few paces apart.

Most nests that we found in 1977 and 1978 were close to driftwood or other debris. The debris may shelter the eggs from the wind or aid the bird in locating its nest in the vast monotony of the flats. We soon found that tracks of the Coyote (*Canis latrans*) often led from one piece of debris to another, especially along drift lines washed up by flooding. We expected to find that nests in drift lines were usually destroyed by the Coyotes, but during the two seasons only 69% of known Coyote depradation took place at nests associated with debris, a figure not significantly different from the 64% of nests destroyed that were not associated with debris.

Flooding and Coyote predation were the principal factors limiting reproductive success during both years. Of 116 reported cases of nest failure they accounted for 45% and 30% of the losses, respectively. Heavy rainfall and flooding on the night of 31 May 1978 destroyed almost all nests that were active at the time. In addition, many plovers were killed during the storm, presumably by hail. We found 18 adult plovers dead at or near nests. Why we found no dead terns or avocets is beyond explanation. Other factors limiting reproductive success were abandonment of eggs (for reasons not known to us), high winds blowing eggs from nests, and the inability of the incubating bird to turn over eggs that were stuck fast to salt.

Nest site data revealed the preference of all three species for nesting near water. We determined that in addition to creating a habitat for animal life that adult and young birds fed on, water aided the plover (and possibly the other species) in solving thermoregulation problems. Standing in the stream, the

plover allowed the water to shunt heat away from the body through its legs. All food sources exploited by the nesting birds were abundant in or near water. We seldom saw the birds away from the streams. The terns would fly up and down the larger streams and along the reservoir's shore, diving to catch small fish. Fish species taken by them included the Plains Killifish *(Fundulus kansae)*, Arkansas River Shiner *(Notropis girardi)*, and Mosquitofish *(Gambusia affinis)*. Seining of the streams revealed large numbers of water boatmen, small corixid insects believed by many to comprise the bulk of the American Avocet's diet. *Bledius*, a burrowing beetle that is abundant on the salt flats, is eaten by the Snowy Plovers. We often saw the plovers running from burrow to burrow, stopping briefly at each entrance to probe for its inhabitant. The plovers also consumed large numbers of the shore flies (chiefly of the genus *Ephydra*) that inhabit the banks of streams and standing pools on the flats.

Sutton (*op. cit.*, pp. 172, 207, 224) gave 13 May, 15 May, and 31 May as the earliest dates on record for nesting of the Snowy Plover, American Avocet and Least Tern, respectively, in Oklahoma; latest dates reported by him for chicks still unable to fly were 15 August (p. 172), 26 July (p. 207), and 13 August (p. 224), respectively. On 4 May 1978 we discovered a plover nest containing a

SNOWY PLOVER

Photographed on 9 July 1979 by Paul Grover, Jr. Nest was 120 meters south of Clay Creek on the Salt Plains National Wildlife Refuge in north-central Oklahoma.

complete clutch of 3 eggs in the northern part of the salt flats. It is quite possible that the first of the three was laid on or before 1 May, and certainly the nest contained one egg by 2 May. On 24 May we found the first plover chicks along Clay Creek, several miles south of the first nest discovered. Since the plover's incubation period approximates 23-24 days, it is evident that nesting on the salt flats was well underway early in May. We saw active nests of all three species on 6 August, so it is evident that unfledged chicks were still present on the refuge in late August. In light of these new early and late dates for nesting, we are justified in assuming that the three species are actively engaged in nesting on the flats from the first of May through August.

We attended public meetings of the Corps of Engineers and consulted with personnel from the U.S. Fish and Wildlife Service's Office of Ecological Services in order to keep abreast of project plans for the Salt Plains area. Plans called for diversion of all fresh water streams around the salt flats. We were forced to conclude that carrying out the project as planned would preclude future nesting by these species on the salt flats. As a result of our study, those in charge expressed willingness to consider carefully timed seasonal releases of water onto the salt flats in order to retain what the three charadriiform species needed as breeding habitat. As of this writing, the Chloride Control Project is deferred due to economic infeasibility.

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GENERAL NOTES

Ibis of Genus *Plegadis* sighted in Muskogee County, Oklahoma.—On 21 April 1982, at about 1900, I observed an ibis circling over a busy heronry 3 miles south of Muskogee, Muskogee County, east-central Oklahoma. The bird's curved bill and rapid flight made it conspicuous among the many Cattle Egrets (*Bubulcus ibis*) and Little Blue Herons (*Florida caerulea*) that were returning for the night. Using my 10 x 50 binocular, I could see that the ibis's head and neck were dark and without red-brown tinge and that there was a green shine on its back and on the upper surface of its wings. It was obviously an immature White-faced Ibis (*Plegadis chihi*) or Glossy Ibis (*P. falcinellus*), neither of which species had ever been reported from east-central Oklahoma. After circling over the area several times the ibis alighted at the north end of the heronry. I did not see it again.

Immature White-faced and Glossy ibises are indistinguishable in the field, and in the hand are difficult to tell apart; an adult Glossy collected in Johnston County on 13 May 1954 is the basis for the only wholly satisfactory Oklahoma record for that species; the easternmost sightings for either species heretofore reported have been for Tulsa, Oklahoma, Cleveland, Murray, and Choctaw counties (Sutton, 1967, Oklahoma birds, Univ. Oklahoma Press, Norman, pp. 43-44). — G. William Sallee, *Corps of Engineers, P.O. Box 61, Tulsa, Oklahoma 74121, 18 February 1982.*