GREATER SANDHILL CRANE NESTING AND PRODUCTION IN NORTHEASTERN CALIFORNIA, 1988

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The population of the Greater Sandhill Crane (*Grus canadensis tabida*) wintering in the Central Valley was listed as a sensitive species by the U.S. Fish and Wildlife Service in 1982 and as a threatened species by the state of California in 1983. Many of these cranes breed in northeastern California. In 1988, I surveyed the species' California breeding range, locating nests and following up the fate of selected pairs. Except at Modoc National Wildlife Refuge (NWR), Modoc County, little is known about the nesting biology and success of the Sandhill Crane in California. The objective of this report is to provide such information.

STUDY AREA AND METHODS

The study area included the six northeastern California counties where *G. c. tabida* is known to nest, from the Oregon and Nevada lines west to Montague, Siskiyou County, and south to Sierraville, Sierra County. I surveyed all known and potential Sandhill Crane breeding habitat within this region, examining nests in Big and Ash Creek valleys, Lassen County, and in Jess, Big, and Surprise valleys, near Likely and Alturas, and at Goose Lake, Modoc NWR, and Reservoir C, Modoc County. I counted broods at these locations and at Honey Lake Wildlife Area (WA), in and near Lassen National Forest, in Willow Creek Valley, and on the Madeline Plains, Lassen County, in Sierra and Indian valleys, Plumas County, at Lower Klamath NWR, Siskiyou County, and in and near the Modoc National Forest, Modoc County. In addition, R. Johnstone counted broods elsewhere in Siskiyou County. I did not search the Fall River Valley, in Shasta and Lassen counties, for broods, even though cranes had established territories there in the spring, as there was no water in the nesting marshes by mid-June.

Nests were located between 28 April and 19 May. After locating a nest, I recorded the surrounding vegetation type and height, water depth, and incubation stage. Incubation stage was determined by flotation (Westerskov 1950). I considered incubating cranes poorly concealed when visible at distances >75 m, fairly well concealed when visible at 10 to 75 m, and well concealed when visible only at <10 m. After the normal 30-day incubation period, I revisited the nests and determined their fates. I surveyed selected nesting areas for broods when fledged or nearly fledged young were still within or near their natal territory.

RESULTS

I found nests at eight sites in Modoc and Lassen counties, mostly in Modoc County, home of 59.2% of the 276 known pairs of *G. c. tabida* in California (Littlefield et al. 1994). The sample size was limited because

drought persisting from the previous winter continued through spring and summer 1988, resulting in many pairs' never attempting to nest (Littlefield 1989). Only in Modoc County, particularly near Alturas, did appreciable (>7 cm) rain fall, in late April and early May. This failure of Sandhill Cranes to breed in northeastern California during drought was paralleled in the late 1940s and early 1950s (Naylor et al. 1954).

Of the 56 nests I examined, 22 were on the Modoc NWR, 14 were in Big Valley (in the Ash Creek WA), 8 were in the Ash Creek Valley, 4 were in Jess Valley, 3 were near Goose Lake, 2 were near Likely, and 1 each were in the Surprise Valley, near Alturas, and adjacent to Reservoir C.

Nesting Biology and Ecology

Egg-laying began in mid-April (earliest 11 April), with most pairs laying in late April (latest 11 May). At least one pair nested later, as 6 km northwest of Likely on 9 August 1988 I found a chick under 4 weeks old. It must have hatched from an egg laid between 15 and 21 June.

Most nests were in open wet meadows. Of the 48 nests whose surrounding vegetation was recorded, 21 (44%) were in rushes (*Juncus* and *Eleocharis* spp.), 9 (19%) were in Broad-fruited Burreed (*Sparganium eurycarpum*), 5 (10%) were in grasses, 4 (8%) were in sedges (*Carex* spp.), 3 (6%) were in Hardstem Bulrush (*Scirpus acutus*), and 1 (2%) was in Common Cattail (*Typha latifolia*). The other five (10%) were in various combinations of these vegetation types. The height of the vegetation surrounding the nests averaged 29.6 cm, and water depths ranged from 0 to 33.5 cm, averaging 6.2 cm. Forty-five (80%) nests were poorly concealed, 10 (18%) were fairly well concealed, and only one (2%) was well concealed. The size of the complete clutch was determined in 42 nests, of which 36 had two eggs, five had one egg, and one had three eggs, for an average of 1.91 eggs per clutch.

Nest Success

The average nest success for all areas combined was 37.5%. Thirty clutches (54%) were destroyed by predators, Coyotes (*Canis latrans*) taking 17, Common Ravens (*Corvus corax*) taking 6, Raccoons (*Procyon lotor*) taking 5, and unknown predators taking 2. Three clutches were infertile, and two were abandoned. Success rates varied from site to site.

Modoc NWR (0.8 km S of Alturas). Modoc NWR was one of the few nesting areas having adequate water in 1988. Of the 22 nests examined on the refuge, 11 had eggs that hatched. Raccoons were the most important predator, destroying four clutches. Common Ravens and unidentified predators each destroyed two. Two clutches were infertile and one was abandoned.

Big Valley (Ash Creek WA, 4.8 km NNE of Bieber). Here the success rate was 36% (5 of 14 clutches). Lack of water probably contributed to this low success. Coyotes destroyed seven clutches, all in the southwest portion of the wildlife area; no clutches were lost in the northern portion. One clutch was destroyed by a Common Raven and another was infertile.

Ash Creek Valley (16 km W of Madeline). This valley had very little water throughout the nesting period, and all eight nests examined were unsuccessful. All were crowded into a 10-ha burreed wetland that had been grazed the previous winter by livestock. Nests were poorly concealed, being clearly visible from 1.6 km away. Water depths averaged 6.2 cm, and coyotes apparently had little difficulty in locating and destroying six of the clutches. I saw two coyotes near the nesting marsh in May, indicating a den was nearby. A Common Raven consumed one clutch and another was abandoned.

Jess Valley (14 km E of Likely). Even though all four crane nests examined in this valley were poorly concealed, two clutches hatched. The other two were destroyed by coyotes. Water depths at nest sites averaged only 1.3 cm. W. Fluorney (pers. comm.), who owns a large percentage of the valley, reported that in the past losses of crane nests were due primarily to flooding. He reported some coyotes and raccoons in the area but few ravens; I did note one pair of ravens in May and June.

Goose Lake (4.8 km WNW of Davis Creek). I found only three nests near Davis Creek in May, though an additional pair with a single chick was there in June. The three nests were within an enclosed ungrazed marsh 0.8 km south of Goose Lake on the Lakeshore Ranch. Both clutches in the two nests over water >30 cm deep hatched. The third, among rushes where water had recently receded to 2 cm, was destroyed by a coyote. Two more pairs of cranes apparently nested in the same marsh, but I could not locate their nests.

Likely (1.6 km WNW). Of the two nests I found in this region, one was over 4 cm of water and was subsequently lost to a coyote, seen within 0.4 km of the nest on the day it was discovered, 19 May. The second nest was in a stand of Hardstem Bulrush over 23 cm of water; it was eventually destroyed by a raccoon. There were four other pairs of cranes in the same area but I noted no other nesting activity. On 19 May 1988, most meadows around Likely were dry.

Surprise Valley (29 km E of Alturas). I found only one nest in the Surprise Valley in 1988, although 56 pairs of cranes occupied territories there and four of these fledged a single young each. Fifteen of these were within 3.5 km of Eagleville. The single nest was in a stand of Hardstem Bulrush over 9.5 cm of water on 17 May, but the two eggs were lost to a Common Raven in early June. Most of the Surprise Valley remained dry throughout the 1988 breeding season.

Reservoir C (22 km NW of Alturas). One pair nested 0.8 km south of the reservoir adjacent to Forest Service Road 43N18 in a small wetland among Western Junipers (*Juniperus occidentalis*). The nest was composed of rushes, situated over 20 cm of water. The pair was successful in hatching the two eggs, but neither the pair nor young was seen at this site thereafter. The family could have moved south onto the Antelope Plains, as B. Deuel (pers. comm.), during an aerial survey, saw a pair there in May.

Alturas (3.2 km E). This was the first nest located in 1988, the only one in cattails. Unfortunately, one member of the pair died after colliding with an electric transmission line before 10 May. The nest was in a small cattle-

trampled marsh with little water. The eggs were consumed by a Common Raven, seen during my follow-up visit.

Recruitment of Young

I recorded only 20 young fledged by 224 pairs, yielding a recruitment rate of 4.5%. Of 18 broods observed, two (11%) were of two chicks; 16 (89%) contained a single chick. The two-chick broods were at the Modoc and Lower Klamath national wildlife refuges. Of the 20 young, 10 were raised at Modoc NWR (C. Bloom pers. comm.), 4 were in the Surprise Valley, 1 was near Likely, 1 was in Jess Valley, 2 were at Lower Klamath NWR (J. Hainline pers. comm.), and 2 were elsewhere in Siskiyou County. In addition, a pair at Buchanan Flat, Modoc County, had two well-developed chicks in mid-July, but it was not determined if these survived to fledge.

DISCUSSION

The nest success and recruitment rate of *G. c. tabida* in northeastern California in 1988 were low, most likely as a result of drought. R. Schlorff (unpublished data) surveyed several of the cranes' nesting areas in 1987, recording 10 young in the Surprise Valley, 2 near Likely, 2 at Goose Lake, and 1 in Big Valley, for a total of 15 young at these four sites. Only five young were located at these same sites in 1988, indicating recruitment rates were considerably higher in the region in 1987. Indeed, unlike elsewhere in the Pacific states, in northeastern California Greater Sandhill Crane numbers have been increasing at least since the early 1970s (Littlefield 1982, 1989).

Although the number of nests examined was limited and observations were restricted to a single drought year, the information produced by this study will provide a basis for more detailed studies in the future. Additional data on nesting success, fledging success, predation rates, habitat preferences, disturbance factors, and brood chronology need to be gathered and analyzed, especially in relation to variation in precipitation, to enable the development of management strategies to ensure the continued survival and increase of the Greater Sandhill Crane in California.

SUMMARY

The 224 pairs of the Greater Sandhill Crane surveyed on the Modoc Plateau of northeastern California fledged only 20 young in 1988. This low rate was partially a result of drought drying the marshes where the cranes nest, giving predators (mainly coyotes) easier access to nests. Predators destroyed 30 of the 56 clutches found, and another 5 were infertile or abandoned.

Hatching success reached 50% only at the Modoc National Wildlife Refuge near Alturas, the only area receiving significant relief from drought via spring rains.

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