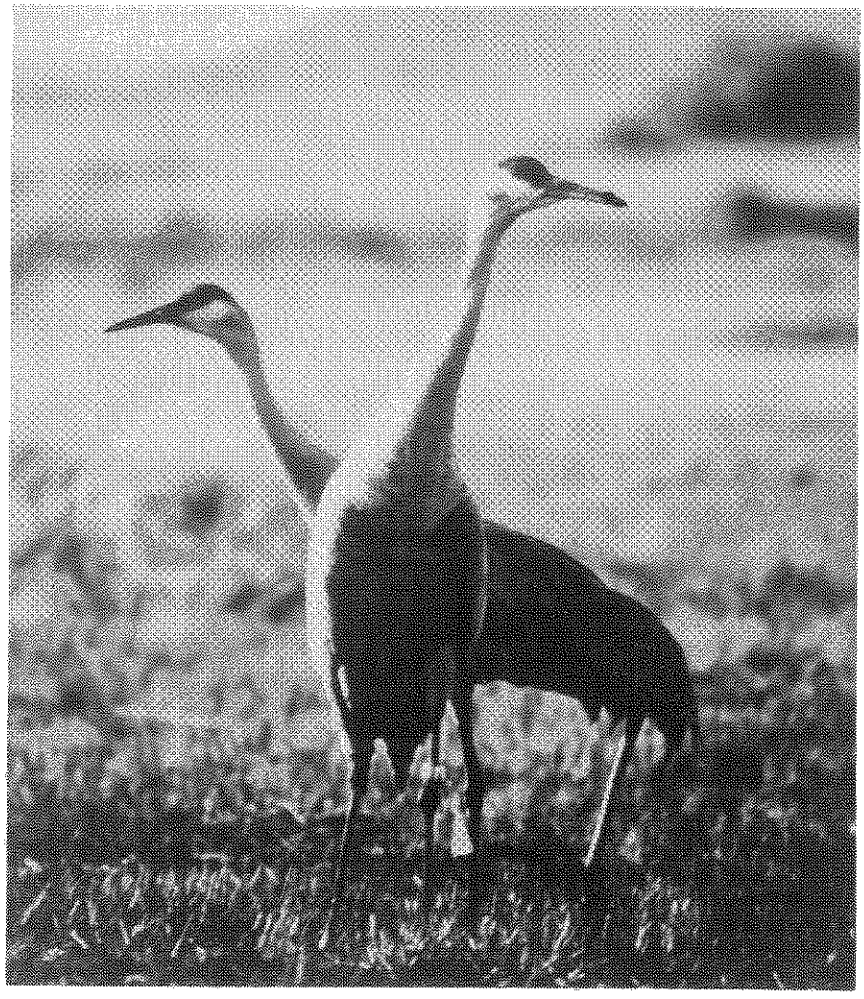
State of California
THE RESOURCES AGENCY
Department of Fish and Game

THE STATUS AND DISTRIBUTION OF GREATER SANDHILL CRANES IN CALIFORNIA, 1981

by

Carroll D. Littlefield



H. Keesler

Wildlife Management Branch

Administrative Report 82-1

January, 1982

State of California
THE RESOURCES AGENCY
Department of Fish and Game

THE STATUS AND DISTRIBUTION OF GREATER SANDHILL CRANES IN CALIFORNIA, 1981

by

Carroll D. Littlefield

ABSTRACT

The Central Valley population of Greater Sandhill Cranes (Grus canadensis tabida) nests in eastern and south-central Oregon and northern California. During the spring of 1981 surveys were conducted in California to determine the number of nesting pairs and ascertain changes in pair numbers in selected nesting regions in the past decade. A total of 191 pairs were located in the state in 1981. The largest single nesting area was in the Surprise Valley, Modoc County, where 44 pairs were located. Nesting pairs occupied suitable breeding habitat in Modoc, Lassen, Siskiyou, Shasta, and Plumas counties.

An attempt was made to compare results of this survey with that conducted in the same region in 1971. Since survey effort was greater in 1981 compared to the previous survey, the results are not directly comparable; however, in 11 areas first surveyed in 1971 then surveyed again in 1981, crane pairs increased by 15 percent from 112 pairs to 129 pairs. Reasons for this increase are not fully understood and are balanced by decreased habitat in other parts of the cranes' breeding grounds in California. Threats to cranes in California include loss of habitat to agricultural conversion, summer cattle grazing, and perhaps a certain amount of predation, although the latter appears to be less severe in California than in other parts of the Greater Sandhill Cranes' breeding range.

Of the total 191 pairs located, 79.1 percent were found on private land. Considering that there is a continuing trend toward conversion of native meadows that cranes depend on for breeding to more intensive agricultural crops, and the fact that many acres of suitable habitat are unavailable to cranes due to the levels of summer grazing, the birds may suffer a population decline in California. Monitoring of populations and agricultural practices will be necessary to determine the magnitude of threats posed to cranes nesting on private lands. Should present trends continue the Greater Sandhill Crane may be considered as a candidate for listing as a State Endangered Species. This recommendation is justified since the crane maintains a small population in the state on habitat that is threatened; and the bird also has shown low rates of recruitment in the past decade.

Wildlife Management Branch Administrative Report 82-1
Supported by Federal Aid in Wildlife Management, Nongame
Wildlife Investigations, California Department of Fish and Game, W-54-R-13

RECOMMENDATIONS

1. Conduct surveys every year at 10 major crane nesting areas in the state to monitor nesting population.

2. Conduct surveys at all crane nesting areas every 5 years to determine population trend.

3. If results of monitoring and breeding ground studies show significant decline in population, recommend listing as State Endangered Species.

4. Propose the purchase of or obtain conservation easements of major crane nesting habitat.

5. Work with other agencies to insure that cattle grazing on public lands does not pose a threat to nesting cranes in California and other portions of their range.

6. Monitor any land use activities that may be detrimental to nesting cranes and their habitats. Recommend measures to alleviate any adverse impacts.

7. Determine the feasibility and desirability of implementing predator control programs on crane nesting areas. Implement programs where justified.

8. Increase public awareness of the importance of native meadow and wetland habitats to Greater Sandhill Cranes.

9. Support any legislation that will result in increased protection of wetland habitats.

10. Resume counting of cranes on breeding grounds in conjunction with the waterfowl breeding ground aerial surveys.

INTRODUCTION

The population of Greater Sandhill Cranes (Grus canadensis tabida) that winters in the Central Valley of California consists of about 3200 individuals which nest in eastern and south-central Oregon and northeast California. Their nesting range includes an area from Cow Creek, Malheur County, Oregon in the east; north to Ladd Marsh, near LaGrande, Union County, Oregon; west to Davis Lake, Deschutes County, Oregon and Grass Valley, Siskiyou County, California; and south to Sierra Valley, Plumas County, California.

In Oregon, the subspecies nests in Baker, Deschutes, Grant, Harney, Klamath, Lake, and Malheur counties; and in California, in Lassen, Modoc, Plumas, Shasta, and Siskiyou counties. Harney and Lake counties, Oregon, and Modoc County, California, support the largest number of nesting pairs (Littlefield and Thompson 1979).

The major fall staging area is on Malheur National Wildlife Refuge (NWR), Harney County, Oregon. From Malheur NWR, cranes migrate southwest to the California Central Valley. Major winter concentrations are: 16 km (10 mi) southwest of Chico, Tehama County, California; Gray Lodge, Butte County, California; near Thornton, San Joaquin County, California; west of Modesto, Stanislaus County, California; Merced NWR, Merced County, California; and northwest of Delano, Tulare County, California. Winter concentrations occur where shallow water provides loafing and roosting sites, and agricultural areas provide food, principally cereal grains such as rice (Oryza sativa), sorghum (Sorghum ssp.), barley (Hordeum vulgare), and corn (Zea mays) (Lewis, et al. 1977).

The purpose of this study was to: (1) Determine the number and distribution of nesting Greater Sandhill Cranes in California; and (2) Compare study results with those of a 1971 study conducted in the same area.

STUDY AREA

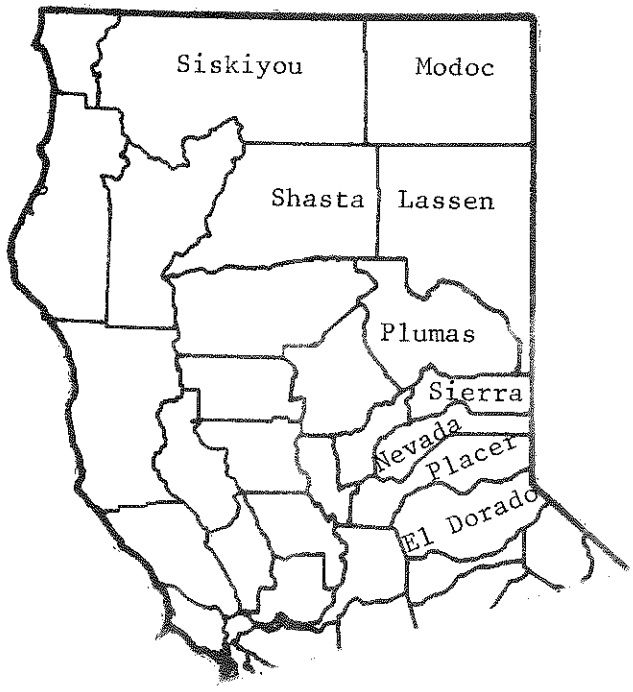
Study was concentrated in the following northern California counties: Modoc, Lassen, Siskiyou, Shasta, Plumas, Sierra, Nevada, El Dorado, and Placer (Figure 1). Study began on 28 March, 1981 and was completed by 15 May, 1981. Further details on timing and examination of individual crane nesting areas are contained in Appendix 1.

METHODS

Approximately 4800 km (3000 mi) were driven during the surveys. With the exception of Bowles Meadow and White Horse Flat, Modoc County, all areas where nesting cranes had been recorded in California were examined (Appendix 2). During surveys, any evidence of nesting cranes was ground searched using 7 x 35 binoculars and a 20x spotting scope. U. S. Forest Service maps were used to plot the crane pairs observed.

California Department of Fish and Game, U. S. Forest Service, and U. S. Fish and Wildlife Service personnel either participated in surveys or provided information on Greater Sandhill Crane distribution. This was done concurrently with the survey of breeding grounds. Information was requested from U. S. Forest Service

FIGURE 1
Greater Sandhill Crane Study Area,
Northern California, 1981



supervisors for the Klamath, Lassen, Modoc, Plumas, Shasta, and Tahoe National Forests. A former regional editor for "American Birds" was consulted during the survey period in order to obtain further information on location of nesting cranes in California.

RESULTS

Historical Distribution

Greater Sandhill Cranes have been recorded nesting in California since the mid-1800's. Many areas where cranes were found nesting in the 19th century, were also occupied in 1981 (Figure 2).

Coues (1874) reported cranes nesting in northeast Shasta County, near Fort Crook. This locality was probably in or near Fall River Valley. Two young were collected at Camp Bidwell, Modoc County, on 29 July, 1878. Henshaw (1880) and Townsend (1887) reported seeing a single crane, probably representing a nesting pair, east of Mount Lassen, Lassen County, in June, 1880 and 1887. In 1877 and 1878 cranes were believed nesting in many subalpine valleys in the state, primarily in northern California (Grinnell, et al. 1918).

By the late 1800's and early 1900's the nesting population had been drastically reduced due to widespread human settlement and subsequent habitat destruction. Dawson (1923) reported that if there were any breeding cranes left in California there were probably no more than half a dozen. Walkinshaw (1949) estimated only 3 to 5 pairs nested in California in 1944. However, this estimate was probably lower than the number actually present (Littlefield and Thompson 1979). Grinnell and Miller (1944) stated the subspecies bred in the northeastern California plateau region west to Siskiyou County, northeastern Shasta County, and south to Honey Lake. A nest was observed on 6 May, 1926 about 32 km (20 mi) from Alturas in a small patch of Scirpus sp. in a wet meadow (Hoffman 1927), and Dawson (1923) saw a pair on the shore of Goose Lake on 20 June, 1912. Dawson also found another pair unquestionably breeding near Eagleville, in Surprise Valley, on 30 June and 12 July, 1912. Mailliard (1924) found a nest and later a half-grown chick on the southern end of Middle Lake, near Eagleville on 27 May, 1924. He also reported another pair with 1 chick about 20 km (12 mi) south of the Middle Lake site in 1924, and long time residents in the valley stated that several crane pairs regularly nested there. The subspecies also was reported nesting in Jess Valley in 1931 (Grinnell and Miller 1944).

Naylor, et al. (1954) felt that cranes nested annually at scattered locations in northeast California. During aerial surveys, cranes were located in remote areas away from human interference.

McLeod (1954) reported a few cranes nested at Meiss Lake, Siskiyou County, in the early 1950's.

Beginning in the 1940's, the nesting population increased. As efficient predator control methods, related to the livestock industry, were developed, crane nesting success increased (Littlefield 1976). Aerial surveys conducted by California Department of Fish and Game personnel during the 1970's show considerable fluctuation in crane nesting in some areas. The surveys were conducted primarily to locate breeding waterfowl but cranes also were recorded (Table 2).

FIGURE 2

Pairs or single Greater Sandhill Cranes
recorded in the 1800's and early 1900's.
(▲ indicates approximate location of record.)

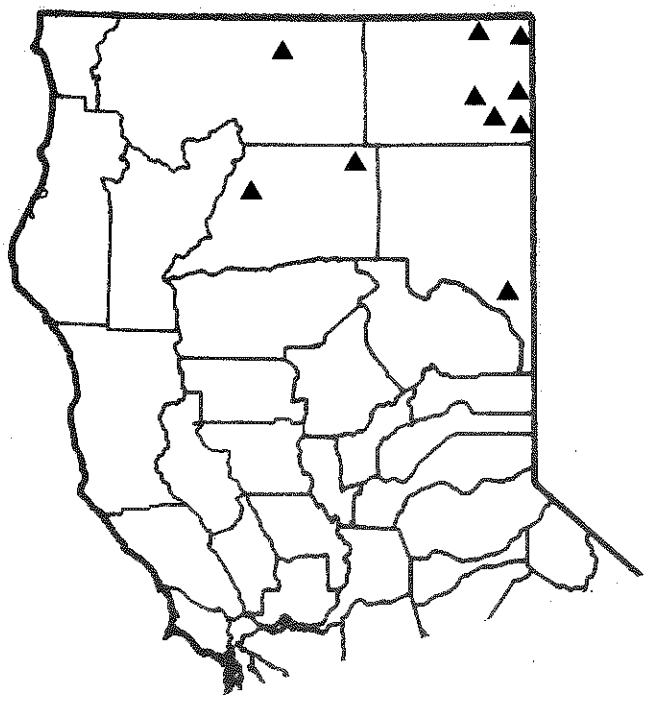


Table 2. Crane pairs observed by California Department of Fish and Game personnel, 1972-1978 on aerial surveys.

	1972	1973	1974	1975	1976	1977	1978
Surprise Valley	8	10	4	6	18	2	8
Big Valley	22	12	17	16	16	18	9
Egg Lake	2	3	--	3	--	--	1
Goose Lake	3	5	1	16	--	8	14
Grasshopper Flat	1	--	1	1	1	--	1 1/
Honey Lake	--	2	--	--	--	1	--
Jess Valley	3	3	--	1	3	2	4
Lower Klamath Marsh	1	--	--	--	--	1	--
Meiss Lake	1	--	--	--	--	--	--
Alturas to Canby	3	3	--	3	--	1	6
Alturas to Likely	12	9	3	11	8	10	7
Steele Swamp	1	--	--	--	2	--	--
White Horse Flat	1	1	--	--	1	--	--
Willow Creek Valley	4	3	1	3	1	2	1
Avanzino Reservoir	--	1	--	--	--	--	1
Boles Meadow	--	2	--	--	--	--	1
Dixie Valley	--	1	1	--	--	--	--
Horse Lake	--	1	1	1	--	--	--
Red Rock Lakes	--	1	2	--	--	1	1
Sierra Valley	--	7	3	1	1	3	1
Weed Valley	--	1	1	3	3	--	--
Fall River Valley	--	--	2	--	2	--	1
Eagle Lake	--	--	--	1	--	--	--
Almanor Lake	--	--	--	--	--	--	1
Humphrey Res.	--	--	--	--	--	1	1
Total	62	65	37	66	56	50	58

1/ Single cranes observed on the aerial surveys were considered incubating pairs.

1981 Distribution and Habitat

Statewide Summary

The Greater Sandhill Crane population still occupies most of its former nesting range (Figure 3). Information derived from surveys and questionnaires confirmed that in 1981 Greater Sandhill Cranes nested in California from Surprise Valley in the east; north to the Oregon border; west to Grass Valley, Siskiyou County; and south to Sierra Valley. The largest number of nesting pairs occurred in Modoc County. One hundred and ninety-one pairs were known to occupy territories in California in 1981 (Appendix 2).

Table 3. Number of nesting pairs of Greater Sandhill Cranes by county in California, 1981.

County	Number of Pairs
Lassen	61
Modoc	110
Plumas	6
Shasta	2
Siskiyou	12
Total	191

Modoc County contained 57.6 percent (110) of the nesting pairs; Lassen County 31.9 percent (61); Siskiyou County 6.3 percent (12); Shasta County 1.0 percent (2); and Plumas County 3.1 percent (6). The largest number of pairs was in Surprise Valley (44), Big Valley (23), Modoc NWR (21), and Ash Creek Valley (13). Other important nesting regions, but with less than 10 pairs each, include Lower Klamath NWR (6), Honey Lake WMA (6), Sierra Valley (5), Likely area (9), Jess Valley (7), Willow Creek Valley (7), Canby area (7), and Goose Lake (7). Most of the remaining birds were in isolated areas with only 1 or 2 pairs present.

Modoc County

Forty-four (40 percent) of the pairs found in Modoc County were found in Surprise Valley, east of the Warner Mountains (Figure 4). Concentrations in the valley were south and east of Ft. Bidwell (5 pairs), north and east of Lake City (17 pairs), and east of Eagleville, between Middle Alkali and Lower Lakes (16 pairs). Three pairs were near the southwest shore of Lower Lake, and 4 pairs about 8 km (5 mi) south of Cedarville.

East and west of Canby (adjacent to the Pitt River) 8 pairs occupied territories in 1981. Modoc NWR continues to be an important nesting area with 21 pairs recorded on 4 April (Figure 5). Most were feeding in grainfields and meadow habitat west of refuge headquarters, with the exception of 6 pairs that were feeding east and south of headquarters. All were on the refuge, with the exception of 1 pair which was in a meadow south of the refuge boundary on private land. South of Modoc NWR, 9 pairs occupied territories west and north of Likely. This area was characterized by flood irrigated meadows with isolated stands of

FIGURE 3

Nesting distribution (shaded area) of Greater Sandhill Cranes in California, 1981.

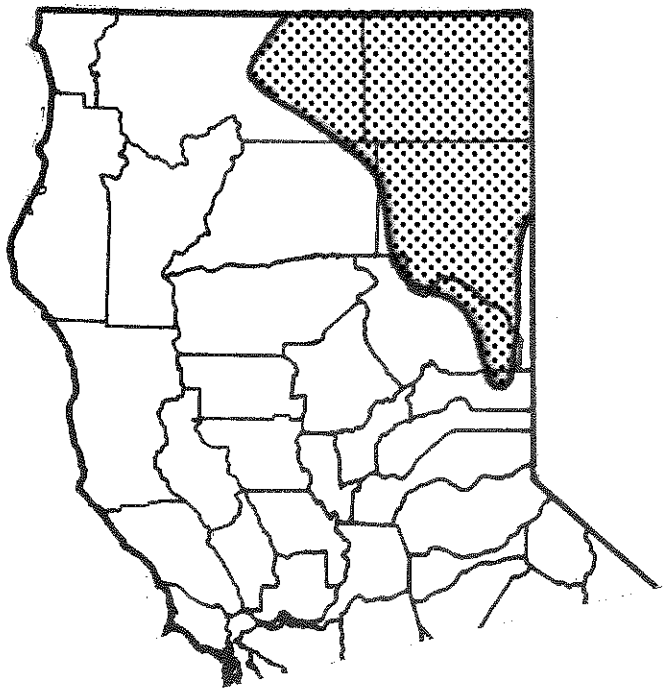


Figure 4. Greater Sandhill Crane habitat in Surprise Valley, Modoc County. The valley has the largest number of cranes nesting in California. Photos by C. D. Littlefield unless otherwise noted.

Figure 5. A Greater Sandhill Crane nest near Modoc NWR, Modoc County, California. Photo by E. L. McLaury.

broad-leafed cattail (Typha latifolia).

East of Likely, in Jess Valley, 7 pairs were seen in the southern one-half of the valley. No cranes were seen in the northern portion. North of Alturas and south of Goose Lake, 7 pairs were recorded. One pair was 12 km (7 mi) south of Davis Creek (Figure 6), while the remaining 6 pairs were north and west of Davis Creek. Most were on or near the Lakeshore Ranch; however, 1 pair had a territory about 1 km (0.6 mi) north-northwest of Davis Creek.

An important nesting region occurs partially in Modoc County, with the remainder in Lassen County. This area, between Adin and Bieber, known as Big Valley, contained 24 pairs. Most activity was concentrated in Big Swamp. Twenty pairs occupied territories in the swamp, while the remaining 4 pairs were in the vicinity of Adin and Lookout, Modoc County. Northwest of Lookout, 2 pairs were seen on 22 April at Egg Lake. These pairs were using meadow habitat south and east of the lake. Nesting habitat was extensive with large acreages of bulrush (Scirpus sp.). Two pairs were seen in Round Valley, northeast of Adin. One pair was in the southern extremity of the valley, while the other was in the northeast portion.

On 12 May an incubating bird was located in Hager Basin, north-northwest of Alturas. The nest was located in a dense stand of Baltic rush (Juncus balticus). Further north, 1 pair was recorded in Weed Valley, near the Oregon border. At least 1 or 2 other pairs were known to have occupied territories in Weed Valley in 1981 (G. L. Sprague, pers. comm.).

One pair was seen at Steele Swamp on 14 May, 1981. This was the only pair observed in a large expanse of native meadow. Steele Swamp is located approximately 8 km (5 mi) east of Clear Lake NWR, California. Although Bowles Meadow (about 16 km (10 mi) south-southeast of Steele Swamp) was not surveyed, the U. S. Forest Service reported 1 or 2 pairs normally were there in the spring (G. L. Sprague, pers. comm.).

U. S. Forest Service personnel reported a nesting pair at Beeler Reservoir in 1981. Examination of the reservoir on 14 May, 1981 yielded no cranes, and the nesting attempt was apparently unsuccessful. Cranes formerly occurred at Avanzion Reservior, but in 1981 no birds were recorded. It was not ascertained if the reservoir had been abandoned by cranes, or if the pair was not visable during the survey time.

Of the 110 crane pairs that were known to occupy territories in Modoc County, 80.9 percent were on private land, 18.2 percent on U. S. Fish and Wildlife Service land, and 0.9 percent on U. S. Forest Service land.

Lassen County

Big Valley contained the largest number of crane pairs in Lassen County. Twenty pairs were located in the southern portion of Big Swamp in Big Valley. Several pairs probably used a portion of Modoc County during their normal daily activities, but most nesting habitat was in Lassen County. Ash Creek Valley contained 13 pairs. Meadows interspersed with emergent vegetation provided ideal habitat throughout the valley.

Figure 6. Small meadows, such as this one 12 km (7 mi.) south of Davis Lake, Modoc County, provide habitat for nesting Greater Sandhill Cranes.

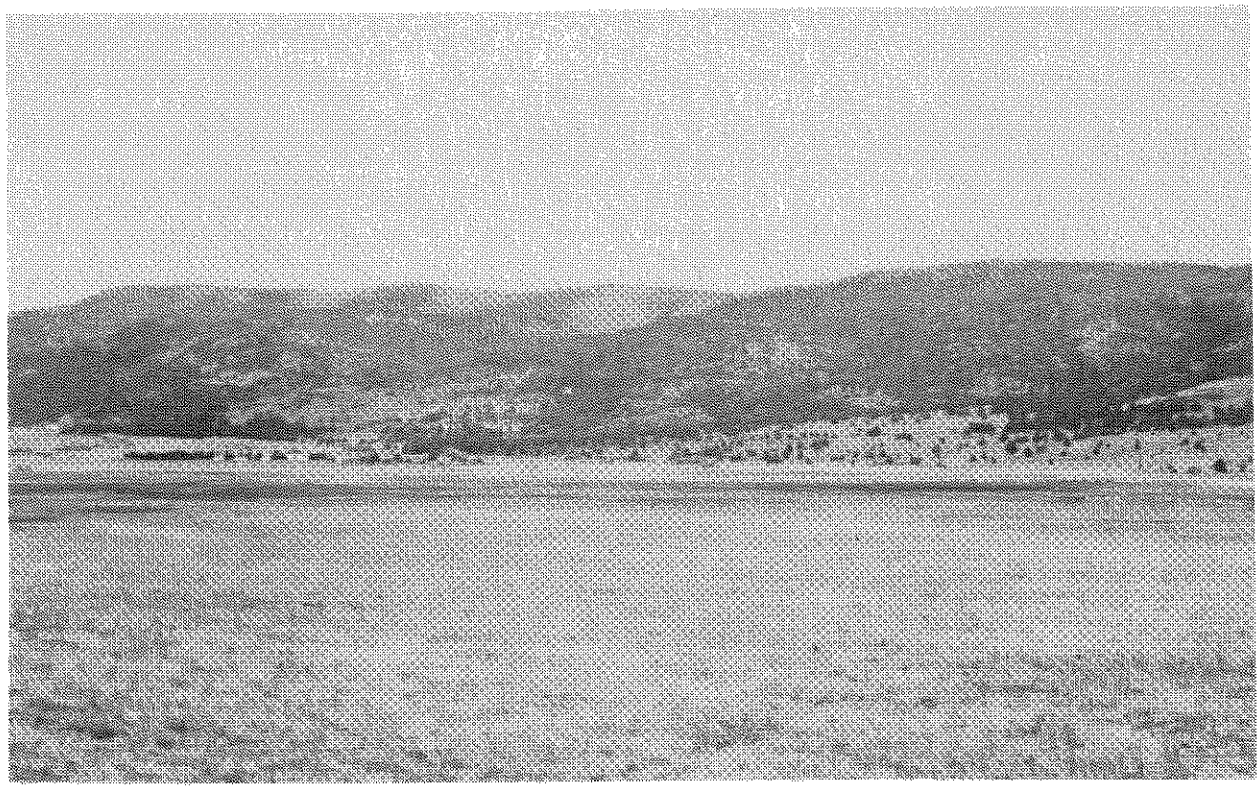


Figure 7. Fall River Valley, Shasta County, was the southwestern extremity of the Greater Sandhill Cranes nesting range in California. Two pairs occupied territories in this marsh about 8 km (5 mi.) from the Lassen County Line.

Honey Lake WMA, east of Susanville, had 5 pairs and another was located 2.5 km (1.5 mi) southwest of Honey Lake headquarters on private land. Seven pairs were seen in Willow Creek Valley, north of Susanville. The valley covers an extensive area, and more pairs could be present but were not visible during the survey.

At three separate locations, 2 pairs occupied territories in Lassen County. These were at Horse Lake, Madeline area and Red Rock Lake. Single pairs were located at Eagle Lake, Grasshopper Flat, and Dixie Valley. Dixie Valley has extensive meadows interspersed with emergent vegetation, but contained only 1 pair. On 13 May, 1981 most of the meadow habitat was occupied by cattle and this may account for the lack of crane use in the valley. In other regions where cattle were grazing, crane pairs were usually using non-grazed portions of the habitat.

Forest Service personnel, Lassen National Forest, provided additional information on 6 pairs (D. Airola and R. Gonzales, pers. comm.). One pair was reported from Papoose Meadows, near Eagle Lake in 1980, and a regular breeding area was at Ashurst Lake, west of Eagle Lake. Sightings of pairs in 1981 by Forest Service personnel also include Pine Creek Wetland, and Bullard and Feather Lakes. There were also reports of a pair at Poison Lake, northwest of Susanville. I examined the lake on 23 April, 1981 and observed no cranes and little crane habitat. However, based on U. S. Forest Service reports, a pair was included for the lake.

Of the known crane pairs nesting in Lassen County, 80.3 percent were on private land, 9.8 percent on U. S. Forest Service land, 8.2 percent on state land, and 1.7 percent on Bureau of Land Management land.

Siskiyou County

Siskiyou County was at the western extremity of the Greater Sandhill Cranes' breeding range in California. Twelve pairs were known to have occupied territories in 1980 and 1981. Six pairs were located on Lower Klamath NWR. Two pairs were in the southern portion of the refuge on 28 March, 1981, while the remaining 4 pairs occupied territories in portions of the Sheepy West Unit. Habitat consisted principally of moist meadows; however, the 2 pairs in the southern portion were in areas characterized by cattails and alkali bulrush (Scirpus paludosus). A pair first nested at Tule Lake NWR in 1980 and produced a single young. In 1981, the pair and young were again using the refuge (J. Fleischer, pers. comm.).

Two pairs were present at Grass Lake on 3 May, 1981 (S. A. Layman, pers. comm.). At least 1 pair has been present since 1979 (D. Sasse, pers. comm.). Additional pairs were located by Klamath National Forest personnel in 1980. One pair with 2 young was on Prather Ranch, northwest of Grass Valley on 14 June, 1980. Another pair was in Red Rock Valley, southeast of Macdoel on 12 March, 1980 feeding in a moist meadow.

Efforts to examine the White Horse Reservoir area, which is partially in Siskiyou County, were unsuccessful. However, one pair has been seen consistently in the past and probably still uses the area (California Dept. of Fish and Game files). Cranes also occupied Meiss Lake until at least 1972, but according to Edward O'Neil (pers. comm.) they no longer nest there. However, in June 1981, Ron Schlorff (pers. comm.) heard a crane, indicating they may still nest there.

S. A. Layman (pers. comm.) reported the possibility of 1 or 2 pairs nesting in Shasta Valley, north of Road A12 and east of Shasta River, southeast of Yreka. If pairs are nesting in Shasta Valley it would extend the nesting range westward by several km.

Of the 12 known nesting pairs in Siskiyou County, 41.7 percent were on private land, and 58.3 percent were on U. S. Fish and Wildlife Service land.

Shasta County

Only 2 pairs were known to nest in Shasta County in 1981, both within 1 km (0.6 mi) of Lassen County. Their nesting area consisted of irrigated meadows, interspersed with extensive stands of hardstem bulrush (Scirpus acutus), approximately 5 km (3 mi) northeast of McArthur (Figure 7). Both pairs nest on private land.

Plumas County

Six pairs were located in Plumas County, most in the northern portion of Sierra Valley, near Beckwourth (Figure 8). All were in meadows with cattail stands in the deeper channels. Pairs were seen from 5 km (3 mi) southeast of Beckwourth to approximately 13 km (8 mi) southeast of Beckwourth. James (1977) reported a nest 2.4 km (1.5 mi) north of Sierraville, Sierra County. I was unable to locate the pair in 1981, although crane habitat was available. These pairs represented the southern extremity of the nesting range for the Central Valley population of Greater Sandhill Cranes. On 2 April, 1981 a survey was conducted at Lake Almanor, but no cranes were seen. However, 3 separate people reported seeing a pair of adults with young in the meadows adjacent to the lake during June, 1981. All pairs in Plumas County were on private land.

Distribution of Non-breeders in 1981

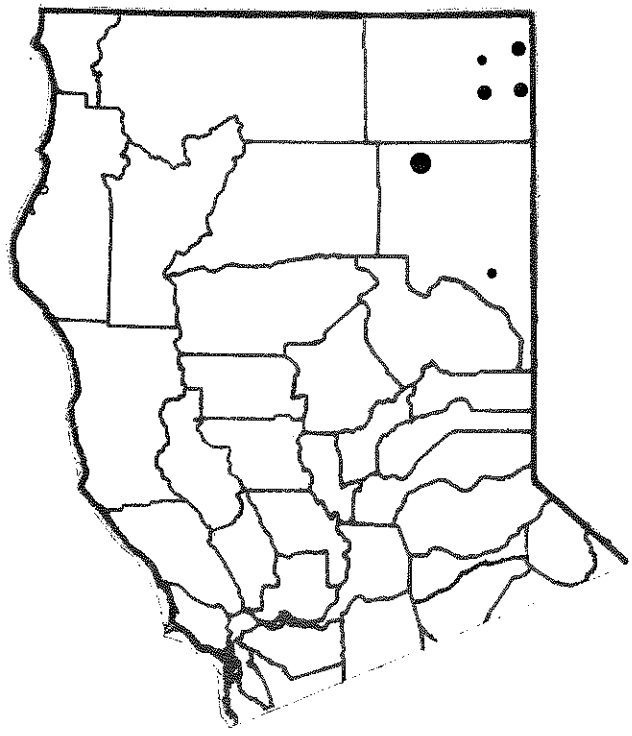
Northeastern California is an important region for non-breeding Greater Sandhill Cranes. The most important area in 1981 was Big Valley. On 29 March, 1981, 87 non-breeders were recorded. An interspersion of wet meadows, open water, and grainfields provided ideal habitat (Figure 8). Thirty-one cranes were using a grainfield about 3 km (1.9 mi) north-northeast of Nubieber, Lassen County, and 24 were field feeding 1.6 km (1 mi) north-northwest of Nubieber. The remaining birds were in small groups scattered in wet meadows near Bieber and Adin. These birds were probably "short-stopped" during spring migration, not continuing north until late spring or early summer.

Another important region for subadults was Surprise Valley. Thirty-five were seen there during the survey period. Most activity was in flooded meadows 8 km (5 mi) south of Cedarville; 13 km (8 mi) south of Ft. Bidwell; and northeast of Lake City. Grainfields on Modoc NWR, contained 28 subadults on 4 April, 1981. In addition, 8 cranes were recorded at Honey Lake WMA and 5 about 6 km (3.7 mi) south of Davis Creek on 25 April.

Northeast California was probably the most important area for non-breeding cranes within the populations nesting range in 1981. The localized areas apparently attracted cranes when they first arrived from the California Central Valley wintering regions. The attractive habitat held subadults until later in the season before they continued northward. There were six locations where non-breeders

Figure 8. Big Valley, Lassen County, had an interspersion of wetlands and upland grain fields providing Greater Sandhill Crane spring habitat for both adults and subadults.

Figure 9. Locations of subadult Greater Sandhill Cranes seen in California in 1981. Size of ● indicates relative number of cranes in area; the larger ● indicating greater number. See text for details.



were seen in 1981 (Figure 9).

Changes in the number of breeding pairs from 1971 to 1981

In March, 1971 crane pairs were surveyed in known California nesting regions. In 1981, an attempt was made to duplicate these counts on comparable days. Most were counted within a few days of the previous dates; however, Surprise Valley, Fall River Valley and Goose Lake were examined about 1 month later in 1981 (Table 4).

Data were available for 11 areas in California. In 1971, 112 pairs were recorded and in 1981, 129 pairs; a 15 percent increase. A decrease in nesting pairs was noted near Likely. Loss of habitat from converting meadows into farmland has occurred in this area. Limited habitat available was responsible for pair numbers remaining stable, not expanding, in some regions during the 10 year period (Table 5).

DISCUSSION

Results of this study indicated nesting pairs have increased in California since the 1920's and 1930's. From Dawson's (1923) estimate of 6 pairs in the early 1920's and Walkinshaw's (1949) estimate of 3 to 5 pairs in the 1940's cranes have increased and now total about 200 pairs (16 percent of the total population pairs). This survey recorded 191 pairs and several additional breeding birds probably nest in remote areas of Modoc, Siskiyou, and Lassen counties.

The reason for the initial increase of pairs in California probably reflects the efforts of the livestock industry to increase forage and livestock production. Ditching and diking to disperse water onto grasslands increased Greater Sandhill Crane habitat. Seasonally flooded meadows provided feeding habitat, while small water impoundments provided ideal nesting habitat. Increased predator control to increase livestock production has improved crane fledging success. After predator control was terminated on Malheur NWR, Oregon in 1972, fledging success declined. A similar situation had probably occurred in local California nesting areas; however, few pairs nest on public lands and the impact has not been as severe. Also, few crane pairs nest in regions where ravens are abundant. Unlike many crane nesting areas in Oregon, few rimrocks which provide nesting habitat for ravens occur in California. During the surveys only 4 ravens were seen near Ft. Bidwell and 2 in Fall River Valley.

Nesting habitat was similar to other crane regions of the western United States. It consisted of irrigated native meadows, with some local areas having stands of emergent vegetation. Emergents were most evident in portions of Surprise Valley (east of Eagleville), Dixie Valley, Egg Lake, and Lower Klamath NWR. Emergent vegetation was primarily broad-leafed cattail, hardstem bulrush, and soft-stemmed bulrush (Scirpus validus). Baltic rush was usually present in crane nesting areas and was often used as nesting material. Nests in Baltic rush were seen in Hager Basin and Horse Lake.

Grainfields near nesting localities were used extensively by cranes in March and April. Of the 21 pairs recorded at Modoc NWR, 9 were seen on 2 newly planted barley fields on 4 April, 1981. By mid-May the pairs had dispersed and were occupying their respective territories. In most of their nesting range

Table 4. Dates and locations of surveys conducted to record nesting Greater Sandhill Cranes in 1971 and 1981.

Location	1971	1981
Modoc NWR	26 March	4 April
Jess Valley	26 March	3 April
Likely	26 March	4 April
Madeline	26 March	3 April
Goose Lake	27 March	25 April
Surprise Valley	28 March	24 April
Canby	28 March	29 March
Round Valley	28 March	29 March
Big Valley	28 March	29 March
Fall River Valley	28 March	22 April
Honey Lake WMA	30 March	3 April

Table 5. Comparison of numbers of Greater Sandhill Crane nesting pairs, 1971 and 1981.

Location	Number of Nesting Pairs	
	1971	1981
Modoc NWR	16	21
Jess Valley	7	7
Likely	14	9
Madeline	1	1
Goose Lake	2	7
Surprise Valley	42	44
Canby	2	6
Round Valley	2	2
Big Valley	21	24
Fall River Valley	2	2
Honey Lake	3	6
Total	112	129

grainfields were unavailable and feeding activity was restricted to native meadows. On 4 April, 1981, 3 pairs were feeding in a flooded meadow with 10 subadults and 131 Lesser Sandhill Cranes (G. c canadensis), 8 km (5 mi) south of Cedarville. The surrounding meadows had not received water and were not being used for feeding purposes.

Although the livestock industry has contributed to increased crane nesting habitat, it was evident that crane use was reduced in areas where intense cattle grazing was in progress. Crane nesting and fledging success is reduced by livestock grazing particularly if grazing occurs during the nesting season (Braun, et al. 1978). On Malheur NWR, Oregon, nesting success has been about 20 percent higher in areas where no cattle grazed the previous winter (C. D. Littlefield, unpubl. data). Lack of crane pairs was noted at some California nesting areas. Dixie Valley contained large acreages of crane nesting habitat; however, only 1 pair was observed. Virtually the entire valley was occupied by large numbers of cattle in mid-May. By contrast, Ash Creek Valley, which was comparable in size, had few cattle present in mid-May and 13 crane pairs were recorded (Figure 10).

Of the Greater Sandhill Cranes recorded in 1981, 79.1 percent occupied nesting territories on private land. This high percentage is reason for concern. Presently, in some regions of the Central Valley population's nesting range, meadow habitat has been converted to alfalfa and cereal gains (Figure 11). Once meadows are lost, several years are required to return them back to their original condition, especially if farming activities continue for several years in succession.

Some livestock operators in Oregon have found that more forage can be produced from an acre of alfalfa than an acre of native meadow. As previosuly mentioned, mechanized sprinkler irrigation systems have provided a way to irrigate once unirrigatable land. As a result, this conversion is expected to continue. If large acreages of private meadows are converted to alfalfa in California the crane population could be severely affected, particularly since only 40 known pairs have territories on state and federal lands. Acquisition by direct purchase or easements should be implemented as soon as possible. Areas of importance include portions of Surprise Valley, Big Valley, Ash Creek Valley, Jess Valley, Likely, and Goose Lake. About 53 percent of California crane pairs nest in these 6 locations.

Certain kinds of agricultural development near crane nesting habitat have fortuitously provided ideal conditions for Greater Sandhill Cranes. A good example is Big Valley, where there is not only an important nesting area, but it is probably the most important region for subadults within the population's spring and summer range. Most cereal grains have been planted on the uplands, thus providing ideal feeding habitat. Loafing and roosting sites in Big Swamp, within the Big Valley area, are also important; however, should the marsh be ditched and drained, Big Valley would not only lose its value for cranes but other wildlife as well. Surprise Valley also has many acres of cereal grains and these are also important for both adults and subadults. At Cow Head Lake, north of Surprise Valley, cereal grains have been planted. Although no cranes were seen there in the spring of 1981, feeding groups have been recorded in the fall. Migrant flocks leaving Malheur NWR occasionally spend time in these fields before continuing southwest to wintering areas in the Central Valley of California. (Appendix 2 and 3).

Figure 10. Ash Creek Valley, Lassen County, contained 13 Greater Sandhill Crane pairs during May 1981 surveys.

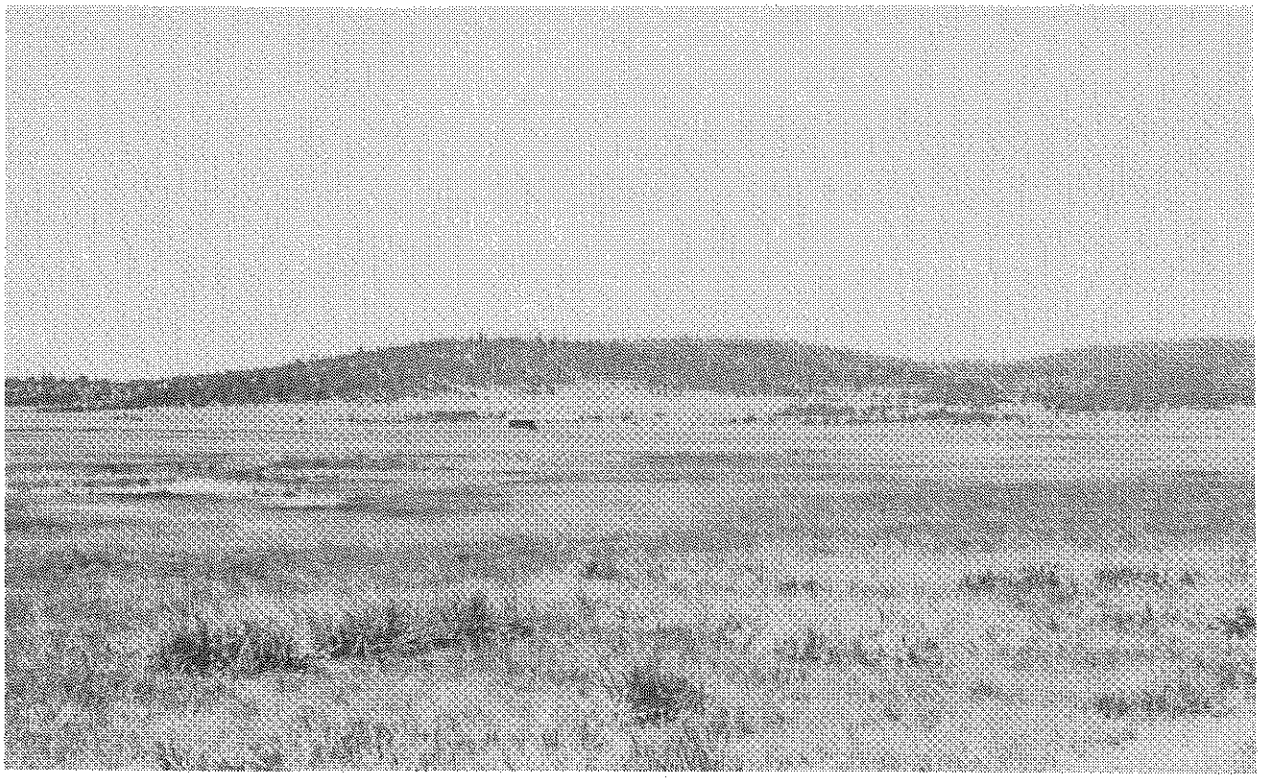


Figure 11. Fields, such as this one in Surprise Valley, Modoc County, can have detrimental effects on Greater Sandhill Crane habitat if nesting meadows are drained and replaced by alfalfa.

Other activities in nesting meadows can also be detrimental to cranes. In Jess Valley, the Modoc Peat Mining Company has destroyed several acres of valuable crane habitat. If this operation continues in the valley other areas will be lost.

Generally, a small Greater Sandhill Crane breeding population is being maintained in the state. However, pairs should continue to be monitored (Appendix 2). The critical factor is going to be habitat loss on private land, and efforts should be made to acquire important crane nesting habitat in California (Appendix 3). Presently, the subspecies should be placed on the California Endangered Species List so that proper management and protection can be afforded. This is justified since the population is small, habitat is threatened, and wintering birds in California show low rates of recruitment of young into the adult population (DFG, unpublished data).

ACKNOWLEDGEMENTS

Numerous people contributed to this study. I am particularly indebted to Ron Schlorff, California Department of Fish and Game, who initiated and supported the study and also participated in some field surveys. Without his contribution the study would not have been accomplished. Other California Department of Fish and Game personnel who provided support and information included Gordon Gould and Doug Thayer.

U. S. Forest Service personnel supplied information for Tahoe, Plumas, Lassen, Modoc, Klamath, and Shasta-Trinity National Forests. I would especially like to thank Forest Supervisors from these National Forests who circulated my request for information to their field personnel. Field personnel who provided valuable information included: Phil Detrich, West Hamilton, G. Lynn Sprague, Dan Airola, Rocardo Gonzalez, and Tom Newman. Stephen A. Layman of Klamath National Forest and former regional editor for "American Birds" provided detailed accounts of Greater Sandhill Cranes in Grass Valley.

Clark Bloom, Manager of Modoc NWR, provided information on cranes in the Alturas region and Jeff Fleischer provided support and information on cranes at Tule and Lower Klamath NWRs. Other U. S. Fish and Wildlife Service personnel who provided information and helped edit this report include Larry Ditto, Steve Thompson, Ernest Alfstad, Brad Ehlers, and David Paullin. Dianna Alfstad typed the manuscript. To these people I am indebted.

LITERATURE CITED

Braun, C. E., K. W. Harmon, J. A. Jackson, and C. D. Littlefield. 1978. Management of National Wildlife Refuges in the United States: Its impacts on birds. Wilson Bull. 90: 309-321.

Coues, E. 1874. Birds of the northwest. U.S. Geol. Surv. Terr. Misc. Publ. 3. 791 pp.

Dawson, W. L. 1923. The birds of California. South Moulton Co., San Diego, Los Angeles, San Francisco. 2121 pp.

Grinnell, J., H. C. Bryant, and T. I. Storer. 1918. The game birds of California. Univ. Calif. Press, Berkeley. 642 pp.

Grinnell, J. and A. H. Miller. 1944. The distribution of the birds of California. Cooper Ornith. Club 27. 608 pp.

Henshaw, H. W. 1880. Ornithological report from observations and collections made in portions of California, Nevada, and Oregon by Assistant H. W. Henshaw. Ann. Rept. Geol. Surv. West of the 100th Meridian by George M. Wheeler. pp. 282-335.

Hoffman, R. 1927. Nesting of the sandhill crane in Modoc County, California. Condor 24: 118.

James, A. H. 1977. Sandhill cranes breeding in Sierra Valley, California, Western Birds 8: 159-160.

Lewis, J. C. 1977. Sandhill crane (Grus canadensis). Pages 5-43. In Glen C. Sanderson (editor). Management of Migratory Shore and Upland Game Birds in North America. Int. Assoc. of Fish and Wildlife Agencies, Washington, D. C. 358 pp.

Littlefield, C. D. 1976. Productivity of Greater Sandhill Cranes on Malheur National Wildlife Refuge, Oregon. Proc. Int. Crane Workshop 1: 86-92.

_____ and S. P. Thompson. 1979. Distribution and status of the Central Valley Population of Greater Sandhill Cranes. Proc. Int. Crane Workshop 2: 113-120.

Mailliard, J. 1924. Some new records for northeastern California. Condor 26: 213-217.

McLeod, R. 1954. Sandhill crane at Meiss Lake, northern California. Condor 56: 227.

Naylor, A. E., A. W. Miller, and M. E. Foster. 1954. Observations on sandhill cranes in northeastern California. Condor 56: 224-227.

Townsend, C. H. 1887. Field notes on mammals, birds, and reptiles of northern California. Proc. U.S. Nat. Mus. 10: 159-241.

Walkinshaw, L. H. 1949. The sandhill cranes. Cranbrook Instit. Sci., Bloomfield Hills, Mich. 202 pp.

APPENDIX 1

Timing of Study at Greater Sandhill Crane
Nesting Areas in Northern California, 1981

The survey of California's Greater Sandhill Crane pairs was initiated on 28 March, 1981. On that date Lower Klamath and Tule Lake NWRs, Siskiyou County, were examined. On 29 March, Canby area and Round Valley, in Modoc County, and Big Valley in Shasta and Modoc counties were surveyed.

From Fall River Valley a trip was made to Sacramento, Sacramento County, to consult with California Department of Fish and Game personnel. On 2 April, surveys were made at Prosser Reservoir, El Dorado County; Sierra, American, Thompson and Indian valleys, and Lake Almanor, in Plumas County; and Mountain Meadows Reservoir, Lassen County. Honey Lake Wildlife Management Area (WMA), Lassen County; Grasshopper Flat, Lassen County; west of Madeline, Lassen County; and Jess Valley, Modoc NWR, a portion of Surprise Valley, Modoc County, and Cow Head Lake, Modoc County were surveyed.

Additional surveys were conducted from 22 April through 25 April, 1981. On 22 April, Beeler, Spaulding, Upper Roberts, and Lower Roberts reservoirs, and Mud and Egg Lakes, all in Modoc County, were examined. Burney, Lake Britton, Carlton, and Hat Creek valleys, in Shasta County, Poison Lake, McCoy Flat and Hog Flat reservoirs, and the Red Rock area, including Humphrey Reservoir, in Lassen County, were surveyed on 23 April. The remainder of Surprise Valley and Pitt River Valley, and Modoc County, (west of Alturas) were examined on 24 April. Surveys were made from Alturas, California to the Oregon border, including Goose Lake Valley, Modoc County, on 25 April.

On 12 May, 1981 Antelope Reservoir, Porcupine Valley, Triangle Ranch, Ingall Swamp, Avanzino Reservoir, Hager Basin, Dry and Weed valleys, Dip Spring and Buchanan Flat, all in Modoc County, were examined. The area east from Madeline to Red Rock Lakes was surveyed on 13 May. In addition Ash, Dixie and Little valleys in Lassen County, were also surveyed 13 May.

Precipitation prevented access to Bowles Meadow, Modoc County, and White Horse Reservoir. However, Buchner Swamp and Reservoir F, Modoc County, were examined. Also, Beeler Reservoir was re-examined. In the afternoon Clear Lake, Steele Swamp, a portion of the Pitt River Valley, in Modoc County, were surveyed. By 15 May, rain had changed to snow and an effort to examine valleys in the Warner Mountains, Modoc County, was unsuccessful. Excessive precipitation prevented additional surveys in California through May.

APPENDIX 2

Legal descriptions, numbers of nesting pairs, and key areas of nesting Greater Sandhill Cranes in Northern California, 1981.

MODOC COUNTY (110 pairs)

Canby area (8 pairs)

T.41N., R. 9E., Sec. 1, NW¼
T.41N., R. 9E., Sec. 2, NW¼,SE¼
T.41N., R. 9E., Sec. 10, SE¼,NE¼
T.41N., R. 9E., Sec. 11, NW¼
T.41N., R.10E., Sec. 5, NE¼,NE¼
T.42N., R.10E., Sec. 30, SW¼

Round Valley (2 pairs)

T.39N., R. 9E., Sec. 2, NW¼
T.39N., R. 9E., Sec. 10, SE¼,SE¼

*Big Valley (4 pairs)

T.39N., R. 7E., Sec. 22, NW¼,SE¼
T.39N., R. 7E., Sec. 23, SW¼,NW¼
T.39N., R. 8E., Sec. 29, SE¼,SW¼
T.39N., R. 9E., Sec. 29, NE¼,NE¼

*Jess Valley (7 pairs)

T.29N., R.14E., Sec. 11, SE¼,SE¼
T.29N., R.14E., Sec. 11, NE¼,SE¼
T.29N., R.14E., Sec. 11, SW¼,SE¼
T.29N., R.14E., Sec. 12, SW¼,SE¼
T.29N., R.14E., Sec. 12, SE¼,NW¼
T.29N., R.14E., Sec. 13, SE¼,NE¼
T.29N., R.14E., Sec. 13, NE¼,SW¼

*Likely Area (9 pairs)

T.39N., R.12E., Sec. 1, SE¼,SW¼
T.39N., R.12E., Sec. 6, SW¼,NW¼
T.39N., R.13E., Sec. 6, NE¼,NW¼
T.39N., R.13E., Sec. 7, SE¼,SE¼
T.39N., R.13E., Sec. 12, NW¼,NW¼
T.40N., R.12E., Sec. 13, NW¼,SE¼
T.40N., R.12E., Sec. 13, NW¼,NE¼
T.40N., R.12E., Sec. 24, SE¼,SE¼
T.40N., R.12E., Sec. 30, NW¼,SE¼

*Modoc NWR (21 pairs)

T.42N., R.12E., Sec. 13, SW¼,SW¼
T.42N., R.12E., Sec. 24, SW¼
T.42N., R.12E., Sec. 24, SW¼

Modoc NWR (cont.)

T.42N., R.12E., Sec. 24, SW¼
T.42N., R.12E., Sec. 24, NW¼,SE¼
T.42N., R.12E., Sec. 24, NW¼,SW¼
T.42N., R.12E., Sec. 24, NW¼,NW¼
T.42N., R.12E., Sec. 25, NW¼,SW¼
T.42N., R.12E., Sec. 25, NW¼,NW¼
T.42N., R.12E., Sec. 36, NE¼
T.42N., R.12E., Sec. 36, NE¼
T.42N., R.12E., Sec. 36, NE¼
T.42N., R.12E., Sec. 36, NE¼
T.42N., R.12E., Sec. 36, NE¼
T.42N., R.13E., Sec. 20, SE¼,SW¼
T.42N., R.13E., Sec. 20, SW¼,SW¼
T.42N., R.13E., Sec. 29, NE¼,SW¼
T.42N., R.13E., Sec. 29, NW¼,NW¼
T.42N., R.13E., Sec. 30, NE¼,SW¼
T.42N., R.13E., Sec. 32, NE¼,SW¼

*Surprise Valley (44 pairs)

T.39N., R.17E., Sec. 20, NW¼,NE¼
T.39N., R.17E., Sec. 28, NW¼,SE¼
T.39N., R.17E., Sec. 28, SW¼,SE¼
T.40N., R.16E., Sec. 12, SW¼,NE¼
T.40N., R.16E., Sec. 12, SW¼,SW¼
T.40N., R.16E., Sec. 13, NW¼,SE¼
T.40N., R.17E., Sec. 17, NW¼,SE¼
T.40N., R.17E., Sec. 18, SE¼,SE¼
T.40N., R.17E., Sec. 18, NE¼,SE¼
T.40N., R.17E., Sec. 18, SE¼,NW¼
T.40N., R.17E., Sec. 19, SW¼,NW¼
T.40N., R.17E., Sec. 19, NW¼,NW¼
T.40N., R.17E., Sec. 20, SE¼,SW¼
T.40N., R.17E., Sec. 20, NW¼,NE¼
T.40N., R.17E., Sec. 20, NW¼,NW¼
T.40N., R.17E., Sec. 29, SW¼,NE¼
T.40N., R.17E., Sec. 29, NE¼,SW¼
T.40N., R.17E., Sec. 29, NE¼,SE¼
T.40N., R.17E., Sec. 32, SW¼,NE¼
T.42N., R.16E., Sec. 27, NW¼,SW¼
T.42N., R.16E., Sec. 28, NE¼,SE¼
T.42N., R.16E., Sec. 28, SE¼,SE¼
T.42N., R.16E., Sec. 28, SE¼,SW¼
T.44N., R.15E., Sec. 12, SE¼,SE¼
T.44N., R.15E., Sec. 13, NW¼,NE¼

Surprise Valley (cont.)

T.44N., R.15E., Sec. 13, NE¼,SE¼
T.44N., R.15E., Sec. 24, NE¼,SW¼
T.44N., R.16E., Sec. 6, NW¼,SE¼
T.44N., R.16E., Sec. 18, SW¼,NW¼
T.44N., R.16E., Sec. 18, SW¼,SW¼
T.44N., R.16E., Sec. 19, NW¼,SE¼
T.44N., R.16E., Sec. 19, SE¼,NW¼
T.44N., R.16E., Sec. 29, NW¼,NW¼
T.44N., R.16E., Sec. 30, NW¼,NE¼
T.44N., R.16E., Sec. 30, SW¼,NE¼
T.44N., R.16E., Sec. 31, NW¼,NE¼
T.45N., R.16E., Sec. 30, SE¼,SW¼
T.45N., R.16E., Sec. 31, SW¼,SE¼
T.45N., R.16E., Sec. 31, SW¼,NW¼
T.46N., R.16E., Sec. 20, SE¼,SE¼
T.46N., R.16E., Sec. 20, SW¼,NE¼
T.46N., R.16E., Sec. 20, NE¼,SW¼
T.46N., R.16E., Sec. 21, SE¼,NE¼
T.46N., R.16E., Sec. 32, SW¼,SW¼

Egg Lake (2 pairs)

T.40N., R. 6E., Sec. 9, NE¼,SE¼
T.40N., R. 6E., Sec. 16, NE¼,NE¼

Pit River (2 pairs)

T.42N., R.11E., Sec. 15, NE¼,NW¼
T.42N., R.11E., Sec. 32, SE¼,NE¼

*Goose Lake (7 pairs)

T.44N., R.14E., Sec. 30, NW¼,SE¼
T.45N., R.14E., Sec. 6, SE¼,SW¼
T.45N., R.14E., Sec. 6, SW¼,NE¼
T.45N., R.14E., Sec. 7, SW¼,SE¼
T.45N., R.14E., Sec. 7, NW¼,SW¼
T.45N., R.14E., Sec. 17, SE¼,SW¼
T.46N., R.13E., Sec. 36, NE¼,SW¼

Hager Basin (1 pair)

T.46N., R.10E., Sec. 36, NE¼,SE¼

Weed Valley (2 pair)

T.48N., R.10E., Sec. 27, SE¼
T.48N., R.10E., Sec. 34, NE¼,NW¼

Steele Swamp (1 pair)

T.47N., R. 9E., Sec. 30, NE¼,NW¼

Beeler Reservoir (1 pair)

T.42N., R. 7E., Sec. 1, SE¼,NW¼

Bowles Reservoir (1 pair)

(no legal description available)

LASSEN COUNTY (61 pairs)

*Big Valley (20 pairs)

T.38N., R. 7E., Sec. 2, NE¼,NW¼
T.38N., R. 7E., Sec. 2, NE¼,SE¼
T.38N., R. 7E., Sec. 2, NW¼,SE¼
T.38N., R. 7E., Sec. 2, SE¼,NW¼
T.38N., R. 7E., Sec. 3, NE¼,SW¼
T.38N., R. 7E., Sec. 10, NW¼,SE¼
T.38N., R. 8E., Sec. 5, NW¼,SE¼
T.38N., R. 8E., Sec. 5, NE¼,SW¼
T.38N., R. 8E., Sec. 5, NE¼,SW¼
T.38N., R. 8E., Sec. 5, NW¼,NE¼
T.39N., R. 7E., Sec. 35, NW¼,SW¼
T.39N., R. 8E., Sec. 31, SE¼,SW¼
T.39N., R. 8E., Sec. 32, SE¼,SE¼
T.39N., R. 8E., Sec. 32, SW¼,NE¼
T.39N., R. 8E., Sec. 33, NE¼,NE¼
T.39N., R. 8E., Sec. 33, SE¼,NW¼
T.39N., R. 8E., Sec. 33, SW¼,NE¼
T.39N., R. 8E., Sec. 33, SW¼,SW¼
T.39N., R. 8E., Sec. 34, NW¼,NW¼
T.39N., R. 8E., Sec. 34, SW¼,NW¼

*Honey Lake (6 pairs)

T.29N., R.15E., Sec. 27, SW¼,SW¼
T.29N., R.15E., Sec. 28, SE¼,SE¼
T.29N., R.15E., Sec. 28, SW¼,NW¼
T.29N., R.15E., Sec. 28, NE¼,SW¼
T.29N., R.15E., Sec. 28, NE¼,SE¼
T.29N., R.15E., Sec. 34, SW¼,NW¼

Willow Creek (7 pairs)

T.31N., R.12E., Sec. 9, NW¼,NE¼
T.31N., R.12E., Sec. 9, NE¼,SW¼
T.31N., R.12E., Sec. 10, NW¼,SE¼
T.31N., R.12E., Sec. 14, NE¼,NE¼
T.31N., R.12E., Sec. 24, NW¼,NW¼
T.31N., R.12E., Sec. 25, NE¼,NW¼
T.31N., R.12E., Sec. 25, NE¼,NE¼

Eagle Lake (1 pair)

T.32N., R.13E., Sec. 7, NE¼,NE¼

Grasshopper Flat (1 pair)

T.34N., R.11E., Sec. 22, NW¼,NE¼

Madeline Area (2 pairs)

T.37N., R.12E., Sec. 13, NE¼,NW¼
T.37N., R.13E., Sec. 15, NW¼,NE¼

Red Rock Lake (2 pairs)

T.37N., R.15E., Sec. 24, SW¼,NW¼
T.37N., R.16E., Sec. 30, NE¼,SW¼

*Ash Creek Valley (13 pairs)

T.37N., R.11E., Sec. 2, SW¼,SE¼
T.37N., R.11E., Sec. 2, SW¼,NW¼
T.37N., R.11E., Sec. 2, NW¼,SW¼
T.37N., R.11E., Sec. 2, NW¼,NW¼
T.37N., R.11E., Sec. 2, NE¼,NW¼
T.37N., R.11E., Sec. 3, NW¼,NW¼
T.37N., R.11E., Sec. 10, NE¼,NE¼
T.37N., R.11E., Sec. 13, NW¼,NE¼
T.37N., R.11E., Sec. 14, NE¼,NE¼
T.37N., R.11E., Sec. 14, NE¼,NW¼
T.38N., R.11E., Sec. 31, NW¼,SE¼
T.38N., R.11E., Sec. 33, SE¼,SW¼
T.38N., R.11E., Sec. 33, SW¼,SE¼

Dixie Valley (1 pair)

T.35N., R. 8E., Sec. 23, SW¼,NE¼

Papoose Meadows (1 pair)

T.31N., R. 7E., Sec. 29

Ashurst Lake (1 pair)

T.33N., R. 9E., Sec. 4, SE¼

Poison Lake (1 pair)

T.32N., R. 7E., Sec. 4, NE¼

Feather Lake (1 pair)

T.31N., R. 8E., Sec. 24, NE¼

Bullard Lake (1 pair)

T.34N., R.10E., Sec. 30, SW¼

Pine Creek Watershed (1 pair)

T.32N., R. 9E., Sec. 28, NE¼

Horse Lake (2 pair)

(no legal description available)

SISKIYOU COUNTY (12 pairs)

Lower Klamath NWR (6 pairs)

T.47N., R. 2E., Sec. 2, SE¼,NW¼
T.47N., R. 2E., Sec. 2, NW¼
T.47N., R. 2E., Sec. 2, NW¼
T.48N., R. 2E., Sec. 29, SE1/8
T.48N., R. 2E., Sec. 31, SE¼
T.48N., R. 2E., Sec. 35, NE¼

Tule Lake NWR (1 pair)

T.46N., R. 4E., Sec. 2, S½

Grass Valley (2 pairs)

T.44N., R. 3W., Sec. 22, SE¼
T.44N., R. 3W., Sec. 22, SW¼

Prather Ranch (1 pair)

T.45N., R. 2W., Sec. 34

Red Rock Valley (1 pair)

T.45N., R. 1E., Sec. 9

White Horse Lake (1 pair)

(no legal description available)

PLUMAS COUNTY (6 pairs)

*Sierra Valley (5 pairs)

T.22E., R.15E., Sec. 6, SE¼,SW¼
T.22E., R.15E., Sec. 7, SE¼,NE¼
T.22E., R.15E., Sec. 17, SW¼,NW¼
T.22E., R.15E., Sec. 29, NE¼,SE¼
T.22E., R.15E., Sec. 33, NE¼,SW¼

Lake Almanor (1 pair)

T.29N., R. 7E., Sec. 29

SHASTA COUNTY (2 pairs)

*Fall River Valley (2 pairs)

T.38N., R. 5E., Sec. 25, SE¼,SE¼
T.38N., R. 5E., Sec. 36, SE¼,NW¼

*Key Sandhill Crane nesting areas to be monitored periodically.

APPENDIX 3

Key habitat areas essential to nesting Greater Sandhill Cranes.

Surprise Valley, Modoc County

South and east of Ft. Bidwell
T.46N., R.16E., Sec. 20
T.46N., R.16E., Sec. 21

North and east of Lake City
T.44N., R.16E., Sec. 30, W½
T.44N., R.16E., Sec. 19
T.44N., R.16E., Sec. 18, SW¼
T.44N., R.15E., Sec. 13, NE¼

East of Eagleville
T.40N., R.17E., Sec. 19, W½
T.40N., R.17E., Sec. 20, NW¼
T.40N., R.17E., Sec. 17, SW¼
T.40N., R.17E., Sec. 18, E½

Egg Lake, Modoc County

T.40N., R. 6E., Sec. 9
T.40N., R. 6E., Sec. 16, N½

Big Valley, Lassen County

T.38N., R. 8E., Sec. 5, N½
T.38N., R. 8E., Sec. 6, N½
T.39N., R. 8E., Sec. 32
T.39N., R. 8E., Sec. 31
T.39N., R. 8E., Sec. 33

Ash Creek Valley, Lassen County

T.37N., R.11E., Sec. 2, W½
T.37N., R.11E., Sec. 14, NE¼
T.37N., R.11E., Sec. 3, NW¼
T.37N., R.11E., Sec. 13, NW¼
T.37N., R.11E., Sec. 33, S½