

California Department of Fish and Game
Job Final Report

Project Number: W-65-R-4 Project Title: Nongame Wildlife Investigations

Job Number: III-11 Job Title: Sandhill Crane Research and Management

Period Covered: July 1, 1986 - June 30, 1987

Summary:

During 1987, a total of 117 breeding pairs of Greater Sandhill Cranes (Grus canadensis tabida) was located at 6 major nesting areas in Modoc and Lassen counties. An additional 10 pairs were found at 4 other sites in Lassen and Modoc counties. Two sites were surveyed that produced no nesting cranes. Fourteen young were observed at all sites checked. A combined age-ratio of 6.5 young per 214 cranes was obtained. Non-breeders numbered at least 96 birds. Efforts were continued by staff at Modoc NWR to capture and color-mark a sample of Greater Sandhill Cranes.

Age-ratio data were obtained at Thornton wintering area. The 7.3 recruitment rate may be below what is needed to maintain a stable population. Thirty-five color-marked Greater Sandhill Cranes were observed at the Thornton and Butte Sink areas. Aerial and ground surveys were conducted at roosts in the Central Valley.

Background:

In 1978, an interagency task force lead by the U.S. Fish and Wildlife Service, developed management plans for populations of Sandhill Cranes breeding and wintering in the Pacific Coastal region of the United States and Canada.

Based on recommendations contained in the Pacific Flyway Management Plan and the fact that a study of cranes breeding in California was conducted in 1971, surveys were conducted during spring, 1981 to determine the number of nesting pairs and ascertain if any changes had occurred at selected nesting areas since 1971 (Littlefield 1982). A total of 191 pairs was located. Modoc County contained 110 nesting pairs, more than any other county. The largest single concentration of nesting birds occurred in Surprise Valley, Modoc County, where 44 pairs were counted. Nesting pairs also were found in Lassen, Siskiyou, Shasta, and Plumas counties.

During 1982, a total of 83 pairs of nesting Sandhill Cranes was located at five key breeding areas in northeastern California. The five areas were among 11 considered important to the breeding population in California and had been surveyed during 1971 and 1981. Since 79 percent of the nesting pairs were on private land in 1981, the possibility of habitat loss through land conversion exists. Littlefield (1982) recommended that Greater Sandhill Cranes be placed on the California Department of Fish and Game's Endangered Species list if habitat loss causes a population decline. It also was recommended that

monitoring continue in order to determine population trends. Listing of the Greater Sandhill Crane as a State Threatened bird took place in early 1983 and a monitoring program is being implemented.

During the past decade, the Department has made counts of Greater Sandhill Cranes on breeding grounds during waterfowl census. Total counts in breeding and wintering grounds can provide a means to determine population trends.

In summer, monitoring has occurred at six key breeding areas in northeastern California. These are: In Modoc County - Surprise Valley, Modoc National Wildlife Refuge, Goose Lake, Jess Valley, Ash Valley, and part of the Big Valley; in Lassen County - Big Valley (part). The six areas are vital to the breeding population in California because they support 60% of the breeding population. These areas also have been surveyed previously, during during 1971 and 1981-86. In 1986, a total of 214 adults (107 pairs) apparently made up the breeding population in the areas surveyed (Figure 1). An additional 59 birds either had not attempted breeding or attempted and failed. Of the 24 chicks located, 14 were found in the Surprise Valley, Modoc County.

Greater and Lesser Sandhill Cranes traditionally winter in the Central Valley of California. The greatest concentrations of wintering Greater Sandhill Cranes are found in the Sacramento Delta and Butte Sink areas. The Department has conducted age-ratio counts (a measure of recruitment rate of young into adult population) of wintering Greater Sandhill Cranes since 1979 (Table 1).

Banding and color marking studies are identified as priority research objectives in the Pacific Flyway Technical Committee Management Plan for Greater Sandhill Cranes (Schlorff, et al. 1983). These studies are deemed necessary to determine location of breeding and wintering grounds, migration routes, and important stopover and staging areas for Sandhill Cranes throughout the Pacific Flyway. During November, 1982 to mid-March 1983, five Lesser Sandhill Cranes were trapped, color-banded, collared and released at Merced National Wildlife Refuge (NWR), Merced County. Two of three attempts to capture cranes were unsuccessful. Only 5 of 30 birds trapped were retained; the rest escaped capture.

Objectives:

The objective is to ensure the survival of Sandhill Crane breeding and wintering populations in California.

Procedures:

Surveys of breeding populations were conducted by visiting native meadow and wetland habitats in northeastern California known to support breeding Greater Sandhill Cranes. Information was gathered on nesting pairs present, habitat association, land ownership, and impacts that may be detrimental to nesting cranes and their habitat. Data on the use of the areas surveyed by non-breeding, sub-adult cranes also were gathered.

Survey personnel included student assistant J. Estep, wildlife biologists R. Schlorff and B. Deuel, and Department pilots K. McBride and R. Anthes.

During winter 1979, known concentration areas of Sandhill Cranes were chosen to make age-ratio counts; the same areas have been visited during subsequent survey periods. Large flocks of birds are located and numbers of adult and juvenile Greater Sandhill Cranes and Lesser Sandhill Cranes are tabulated.

Wintering surveys include roost counts in which both subspecies of cranes are counted as they leave or return to winter roost sites. Winter surveys may include aerial reconnaissance to locate radio-marked birds. The location, behavior and habitat association of color-banded cranes are recorded during winter surveys.

Findings:

BREEDING GROUND SURVEYS

The results of 1987 Greater Sandhill Crane breeding ground surveys are listed according to the areas surveyed within the breeding range in California (Figure 1).

Surprise Valley - Surprise Valley, east of the Warner Mountains in north-eastern Modoc County, has the densest concentration of breeding Greater Sandhill Cranes in the State. The native meadow habitats are found in the area bounded on the west by State Highway 81 and on the east by the shorelines of Lower Lake, Middle Alkali Lake and Upper Lake. Several creeks drain the east slope of Warner Mountains and flow into the Alkali lakes. In addition, there are flowing wells close to the lake shores. This moisture regime provides ideal growth of meadow grass, sedges, and rushes that are suitable for nesting Sandhill Cranes. During June, 1987, 54 breeding pairs of cranes were located. Six pairs had one chick each, 2 pairs had 2. The age-ratio for the area was 7.1% young per 112 total cranes (young plus breeders), down from 13.7% in 1986. A number of non-breeders or adults that failed in their nesting attempts were found. These cranes were in flocks ranging from 4 to 15 birds with a total of 45 birds. Conversion of native meadow to irrigated alfalfa fields has slowed due to dropping alfalfa prices. Nest destruction due to trampling of cattle continues to be a problem on the remaining meadow. Cattle grazing probably constitutes the greatest threat to nesting cranes. Mowing of native meadows, while also known to destroy nests and young, is probably less significant since meadows are not mowed until mid-July, after most young have left the nest.

Modoc National Wildlife Refuge - Refuge personnel report 28 active nests in 1987. Information on reproductive success has not yet been received. Nine juvenile cranes were banded and color-marked. Plans have been made for radiotelemetry studies at the refuge.

Likely Area - The Likely Area breeding ground consists of a series of meadows west of irrigation channels that run north and south along highway 395 from an area south of Modoc NWR south to the town of Likely, Modoc County. This area has supported as many as 14 breeding territories in 1981 (Figure 1). Two pairs were found in 1986. One pair had 1 young. This year 6 pairs were found. One pair had 2 young.

Jess Valley - Jess Valley is an isolated valley consisting of a single land holding on the west slope of the south Warner Mountains about 15 miles east of Likely. The area's meadows normally support about five to seven breeding pairs of cranes (Figure 1). In 1987, eight pairs of adults were found in the area. No young were observed.

Goose Lake Area - The south shore of Goose Lake, in the area west of Highway 395 and east of the bridge across Goose Lake from the southwestern shore to McGinty point, supports habitat suitable for nesting Sandhill Cranes. The area supported seven pairs in recent years (Figure 1). During 1987, five pairs were located. Two pairs had 1 young. Cattle continue to be excluded from the shoreline nesting habitat due to a conservation easement between the Department of Fish and Game and the landowner.

Big Valley Area - The Big Valley Area consists of wetland (Big Swamp) and upland habitats between the towns of Adin on the east and Bieber on the west near the Modoc/Lassen county line. Ash Creek and the Pit River provide the water source for the wetland and moist meadow habitats. In the recent past, there was yearly degradation through land conversion and heavy cattle grazing of this area. However, some suitable crane breeding habitat still remains, especially at the west end of the Big Swamp area on the east and west side of the county road between Bieber and Lookout. Landownership changed during 1983 and access was restricted. This resulted in only an incomplete survey for 1984. In 1985, because of inaccessibility on the ground, aerial survey data were collected.

There were plans to severely alter the condition of the Big Swamp by digging a series of drainage ditches to drain a major portion of the area where Greater Sandhill Cranes have nested previously. Much of the area adjacent to Big Swamp, particularly on the south side, has been graded, and as of July 1985 was totally denuded of vegetation. This was done apparently in preparation for alfalfa farming. Also, during the aerial survey, several drainage ditches were observed cutting through the swamp area. This would reduce the amount of breeding habitat for cranes in this area. Responding to this threat, the Wildlife Conservation Board was successful in acquiring 11,525 acres of this habitat for about 6 million dollars in late summer 1985. The area is now managed by DFG as Ash Creek State Wildlife Area. Protection of crane nesting areas is a major management goal.

In 1987, 13 pairs were located on the Ash Creek State Wildlife Area. One pair had 1 young. In addition, 19 non-breeding cranes were found on the area. Only 2 other pairs of Greater Sandhill Cranes were located in Big Valley; one just west of the wildlife area, and one near the town of Bieber.

Ash Valley - Ash Valley is located midway between Adin and Madeline on Lassen County route 527. The valley consists of meadows and wetlands on a few large cattle ranches. Most vegetation is still in a natural state and very little land conversion has taken place. The main detriment to cranes is heavy cattle grazing of native meadow habitat. Nine pairs were found. None had young.

Several other sites were surveyed from the ground. Crowder Ranch had a group of 29 non-breeding Greater Sandhill Cranes. Warm Springs Valley had 2 pairs and 1 individual. Madeline Plain had 2 pairs, and Canby Area had none.

WINTERING GROUND SURVEYS

Age-ratio counts of Greater Sandhill Cranes were made at several locales in the Thornton area of the wintering ground (Table 1). There was a 32.9% increase from 1985-86 in this area. However, data since 1979 do not indicate an increasing trend in age-ratio (Table 1).

Department personnel located 35 color-marked birds. Sightings were made in the Thornton area (Table 2). Twelve (34%) were banded at Modoc NWR in California. Nineteen (54%) were banded at Malheur NWR in Oregon. Four (11%) were banded at other Oregon locales.

Winter roost counts were made on 7 occasions to determine the level of use at Woodbridge Ecological Reserve (Table 3). Large numbers of Greater Sandhill Cranes used the reserve as a roost site from October 1986 to February 1, 1987. Similar numbers were recorded for 1985-86 (Table 3).

Analysis:

Although there continues to be a small and apparently stable breeding population of Greater Sandhill Cranes existing in portions of northeastern California, it is increasingly evident that agricultural trends of the area may affect nesting birds on private lands. These lands are threatened with conversion from native meadow to intensive agriculture. While no quantitative data has been collected on the amount of crane breeding habitat lost through agricultural conversion, this has been the pattern since the 1971 survey and has been especially evident since the 1981 survey.

Habitat acquisition such as at Big Valley, must continue so as to prevent continued loss of the breeding population on private lands. The birds now nesting on public lands may represent the core of what will be the remaining Sandhill Crane population in the next decade. Improved management on public land might offset some of the loss on private lands. However, there is evidence this will not occur on those public lands that are heavily grazed.

In some instances, habitat conditions may be improved on both public and private lands simply by restricting grazing by livestock. Cranes avoid using pastures or meadows that are heavily grazed by cattle. In some instances, cranes may have established a breeding territory in a meadow prior to cattle grazing, and, as has been observed, nest failures may result when cattle are turned out in summer and disrupt crane breeding activities, trample nests and eggs, or reduce the protective cover of grasses by overgrazing. A study is proposed for 1988 to re-evaluate the status of breeding populations and habitat of Greater Sandhill Cranes in California.

Littlefield (pers. comm.) has theorized that a minimum of 12.0% recruitment (percent young observed in the sample of adults and young) is required to maintain crane population stability. However, there has been only one year in the last 15, that a 12.0 (13.8%) or greater rate (age ratio) has been attained. Still, the California population has remained essentially stable leading to the possibility that the 12.0% figure may be high for the state. Additional studies will be required to verify the actual minimum recruitment rate (age ratio) necessary to maintain a viable population.

Littlefield has noted a small but steady decline in the number of birds nesting at Malheur NWR since 1971. We have noted loss of nesting habitat in Northeastern California in just the past 5 years, although the breeding population appears to be stable. Clearly there are conditions that result in depressed recruitment, and we have identified the major concerns to be habitat destruction, disturbance during the nesting season, mower mortality, and predation. To date however, we have been unable to significantly affect, let alone turn around the current land-use related trends in crane breeding areas.

Literature Cited:

Littlefield, C. D. 1982. The Status and Distribution of Greater Sandhill Cranes in California, 1981. State of California, Department of Fish and Game, Wildlife Management Branch, Admin. Rep. 82-1, 27 pp.

Schlorff, R., G. Herron, G. Kaiser, C. Kebbe, G. Kramer, and C. D. Littlefield, 1983. Pacific Flyway Management Plan for the Central Valley Population of Greater Sandhill Cranes. 28 pp.

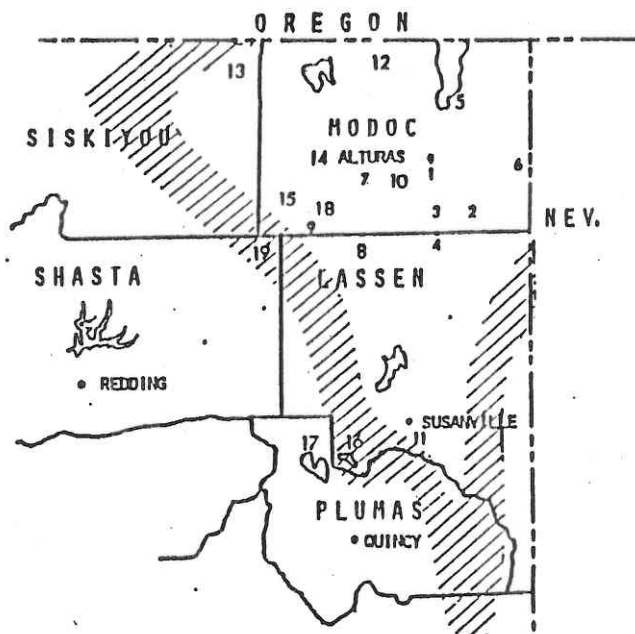
Recommendations:

1. Periodically re-evaluate the breeding and habitat status of Greater Sandhill Cranes in California.
2. Continue winter age-ratio counts of all populations of Sandhill Cranes wintering in California.
3. Implement management programs designed to improve survivorship of young cranes on breeding grounds in California.
4. Implement management programs to protect habitat on breeding and wintering ground.
5. Coordinate efforts with other agencies to improve recruitment rates of all crane populations in Pacific Flyway.
6. Continue to enforce laws protecting cranes to reduce mortality on migration routes, wintering areas and breeding grounds.
7. Continue Sandhill Crane banding, color-marking and radio-tagging studies to mark a large sample of Greater Sandhill Cranes on breeding areas.
8. Coordinate efforts with other agencies and researchers to accumulate information on cranes marked on wintering or breeding areas in the Pacific Flyway.

Prepared by: Ronald W. Schlorff Reviewed by: Kent A. Smith
Ronald W. Schlorff Kent A. Smith, Coordinator
Wildlife Biologist Nongame Bird and Mammal Section

Approved by: Eldridge D. Smith Date: 11/17/87

Figure 1. Comparison of Numbers of Greater Sandhill Crane Nesting Pairs, 1971, 1981-87



Numbers of Nesting Pairs

<u>Location</u>	<u>1971</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
1. Modoc NWR	16	21	19	26	15	30 ³	32	28
2. Jess Valley	7	7	5	0	6	7	4	8
3. Likely	14	9	NC ¹	4	NC	2	2	6
4. Madeline	1	1	NC	NC	0	1	1	2
5. Goose Lake	2	7	7	3	9	5	6	5
6. Surprise Valley	42	44	34	50	34	39	44	52
7. Canby	2	6	NC	NC	0	1	0	0
8. Ash Valley	NC	NC	NC	12	13	6	4	9
9. Big Valley	21	24	18	14	10 ²	13	9	15
10. Warm Springs Valley	NC	NC	NC	NC	NC	3	2	2
11. Honey Lake	3	6	NC	NC	NC	2	0	NC
12. Wild Horse Res.	NC	NC	NC	NC	NC	1	NC	NC
13. Butte Valley	NC	NC	NC	NC	NC	1	1	NC
14. Sapaulling Res.	NC	NC	NC	NC	NC	1	1	NC
15. Egg Lake	NC	2	NC	NC	1	4	0	NC
16. Mnt. Meadows	NC	NC	NC	NC	NC	1	1	NC
17. Lake Almanor	NC	1	NC	NC	NC	1	NC	NC
18. Round Valley	2	2	NC	NC	NC	NC	NC	NC
19. Fall River	2	2	NC	NC	NC	NC	NC	NC
TOTALS	112	132	83	98	88	118	107	127

¹ NC = Not checked

² Incomplete count due to restriction on access to private land.

³ Figure may be high due to lack of information on actual nesting pairs.

Table 1. Summary of age-ratio count results for wintering Greater Sandhill
Cranes, 1979 - 1987

Sample Area	Year	n ¹	No. Juv.	No. of Juv. & Adults	Age Ratio	SE ²	95% C.I. ³
Thornton	79-80		118	1784	00.066		
Butte Sink	79-80		52	663	00.078		
Thornton	80-81		55	904	00.061		
Butte Sink	80-81		14	450	00.030		
Thornton	81-82		115	2509	00.046		
Thornton	82-83		43	936	00.046		
Thornton	83-84	125	137	1599	0.086	0.008	0.071-0.101
Butte Sink	83-84	35	66	829	0.080	0.011	0.058-0.101
Thornton	84-85	59	83	1645	0.051	0.007	0.037-0.064
Butte Sink	84-85	43	41	1205	0.034	0.005	0.025-0.043
Thornton	85-86	14	74	1845	0.040		
Butte Sink	85-86	2	13	264	0.049		
Thornton	86-87	13	152	2089	0.073		

¹ Sample size; groups aged

² Standard Error of the ratio

³ 95% Confidence Interval

Table 2. Greater Sandhill Crane Band Sightings, 1986-87

Band No./Color	Sighting Location	Date	Remarks	Banding Location	Date	Observer
L R Fed. Fed.	West Staten Island	10-21-86	Flooded corn field - group of 30 cranes	Malheur NWR, OR 2.1 mi. SW H.Q.	Pre-1969	Schlорff/ Estep
R R Fed. 599-01421	West Staten Island	10-21-86	"Joe"	Malheur NWR, OR	8-21-73	Schlорff/ Estep
Tall R G P041 BL	West Staten Island	10-21-86	Juvenile crane with parents	Modoc NWR	Summer 1986	Schlорff/ Estep
G R Tall W R	West Staten Island	10-21-86	Flooded corn field - group of 30 cranes	Malheur NWR, OR		Schlорff/ Estep
Tall W G BR	West Staten Island	10-21-86	Flooded corn field - Group of 30 cranes	Malheur NWR, OR		Schlорff/ Estep
Tall W W BR	West Staten Island	10-21-86	Flooded Johnson grass	Malheur NWR, OR		Schlорff/ Estep
Fed. Y O R	West Staten Island	10-21-86	Flooded Johnson grass	Sycan Marsh, OR		Schlорff/ Estep
R Y Tall W Fed.	Woodbridge Road near W.E.R.	12-11-86	In plowed field - group of 30	Malheur NWR, OR		Schlорff/ Estep

Table 2. Greater Sandhill Crane Band Sightings, 1986-87 (cont'd.)

Band No./Color	Sighting Location	Date	Remarks	Banding Location	Date	Observer
L R						
Tall W O A27 Fed. BL	Woodbridge Road	12-4-86	In plowed field - group of 30	Modoc NWR	6-28-85	Snowden
BL Tall W G R Fed.	Staten Island	12-4-86	In plowed field - group of 200	Malheur NWR, OR		Schlorff/ Estep
BL Tall W R Fed.	Staten Island	12-4-86	In plowed field - group of 200	Malheur NWR, OR		Schlorff/ Estep
BL R W Fed. BL	Staten Island	12-9-86	Group of 3			Schlorff/ Estep
Tall W Y A28 O Fed. 599-01492 Fed.	Staten Island	12-4-86	Group of 19 "Tom"	Malheur NWR, OR	4-11-84	Schlorff/ Estep
Fed.	Staten Island North	12-16-86				Schlorff/
W Fed. P030 G Tall R 559-36512	Staten Island North	12-16-86		Modoc NWR	4-28-85	Schlorff/ Estep
Tall W W x57 O Fed.	Staten Island North	12-16-86	Flooded Johnson grass - group of 100	Malheur NWR, OR		Schlorff/ Estep

Table 2. Greater Sandhill Crane Band Sightings, 1986-87 (cont'd.)

Band No./Color	Sighting Location	Date	Remarks	Banding Location	Date	Observer
L R						
Y Tall R Fed. G 599-36510	Staten Island North	12-16-86	Flooded Johnson grass - group of 100	Modoc NWR	4-27-85	Schlорff/ Estep
W Tall R	Staten Island North	12-16-86	Flooded Johnson grass - group of 100	Modoc NWR, OR		Schlорff/ Estep
W Tall O R Fed.	Staten Island North	12-16-86	Probably X-10 599-01359 4-6-84	Malheur NWR, OR		Schlорff/ Estep
O Fed. G 599-36507 Tall R P027	Staten Island North	12-16-86	Along levee - group group of 1000	Modoc NWR	8-20-84	Schlорff/ Estep
G Fed. O 599-36521 Tall R P017	Staten Island North	12-16-86	Flooded cornfields	Modoc NWR	5-23-85	Schlорff/ Estep
Y Fed. R 599-36527 Tall R P010	Staten Island North	12-16-86	Flooded cornfields	Modoc NWR	6-20-85	Schlорff/ Estep

Table 2. Greater Sandhill Crane Band Sightings, 1986-87 (cont'd.)

Band No./Color	Sighting Location	Date	Remarks	Banding Location	Date	Observer
L R						
Tall W G Fed. R	Staten Island North	12-16-86	Flooded cornfields	Malheur NWR, OR		Schlорff/ Estep
O Tall R P021 Y Fed. 599-36501	Staten Island North	12-16-86	Flooded cornfields	Modoc NWR	8-6-84	Schlорff/ Estep
Y Tall BL G w/3 white stripes Y Fed.	Canal Ranch	12-16-86 1-15-87		Malheur NWR, OR		Schlорff/ Estep
O W W G O Fed. 599-45815	Staten Island North	12-16-86		Canas Prairie Lake Co., OR - E. of Lake- view	7-18-84	Schlорff/ Estep
Y Fed. 599-36510 G Tall R P028	Staten Island North	12-16-86	Along levee - group of 100 "Bruno"	Modoc NWR	4-27-85	Schlорff/ Estep
G Tall G	Staten Island North	12-16-86	Along levee - group of 1000			Schlорff/ Estep

Table 2. Greater Sandhill Crane Band Sightings, 1986-87 (cont'd.)

Band No./Color	Sighting Location	Date	Remarks	Banding Location	Date	Observer
R L						
W Fed. 599-36525	Staten Island North	12-16-86	Along levee - group of 1000	Modoc NWR	6-10-85	Schlорff/ Estep
R Tall R P012						
G Fed. 599-36526	Staten Island North	12-16-86	Along levee - group of 1000	Modoc NWR	6-10-85	Schlорff/ Estep
R Tall R P011						
Tall W R R Y	Woodbridge Ecological Reserve	1-15-87		Malheur NWR, OR		Schlорff/ Estep
R Tall W A01 BL Fed. 599-01491	Woodbridge Ecological Reserve	1-15-87		Malheur NWR, OR	4-11-83	Schlорff/ Estep
R Tall W G	Woodbridge Ecological Reserve	1-15-87		Malheur NWR, OR		Schlорff/ Estep
Tall W A55 Fed. 599-01494	Woodbridge Ecological Reserve	1-15-87	"Leslie"	Malheur NWR, OR	5-1-83	Schlорff/ Estep

Table 2. Greater Sandhill Crane Band Sightings, 1986-87 (cont'd.)

Band No./Color	Sighting Location	Date	Remarks	Banding Location	Date	Observer
R L						
Tall G W x30 W Fed. R 599-01362	Cortopassi Farms	1-16-86	"Daisy"	Malheur NWR, 2 mi. SW of HQ	4-13-84	Schlорff/Estep
Tall W R "Q" B Y Fed.	Cortopassi Farms	1-16-86	"Quincy"	2 mi. SW of Malheur NWR H.Q.	3-31-84	Schlорff/Estep

Table 3. Winter Roost Counts, 1985-86, 1986-87

<u>Roost</u>	<u>Date</u>	<u>Times</u>	<u>Arriving</u>	<u>Leaving</u>	<u>No. Cranes</u>
Woodbridge Ecol. Res.	10-24-85	1754-1840	X		1824
Woodbridge Ecol. Res.	10-24-85	1648-1740	X		2824
Woodbridge Ecol. Res.	11-14-85	1646-1727	X		171
Woodbridge Ecol. Res.	11-26-85	1632-1711	X		344
Woodbridge Ecol. Res.	1-7-86	1626-1742	X		3580
Woodbridge Ecol. Res.	1-16-86	1606-1738	X		3237
Woodbridge Ecol. Res.	1-28-86	1606-1706	X		2054
Woodbridge Ecol. Res.	2-1-86	1650-1801	X		2852
Woodbridge Ecol. Res.	2-4-86	1704-1826	X		3428
Woodbridge Ecol. Res.	2-6-86	1701-1810	X		3500+
Woodbridge Ecol. Res.	10-10-86	1735-1909	X		3101
Woodbridge Ecol. Res.	11-3-86	1653-1725	X		4859
Woodbridge Ecol. Res.	11-10-86	1655-1732	X		2441
Woodbridge Ecol. Res.	11-26-86	1628-1724	X		8368
Woodbridge Ecol. Res.	1-5-87	1640-1741	X		1553
Woodbridge Ecol. Res.	1-15-87	1620-1745	X		2397
Woodbridge Ecol. Res.	2-25-87	1702-1815	X		522