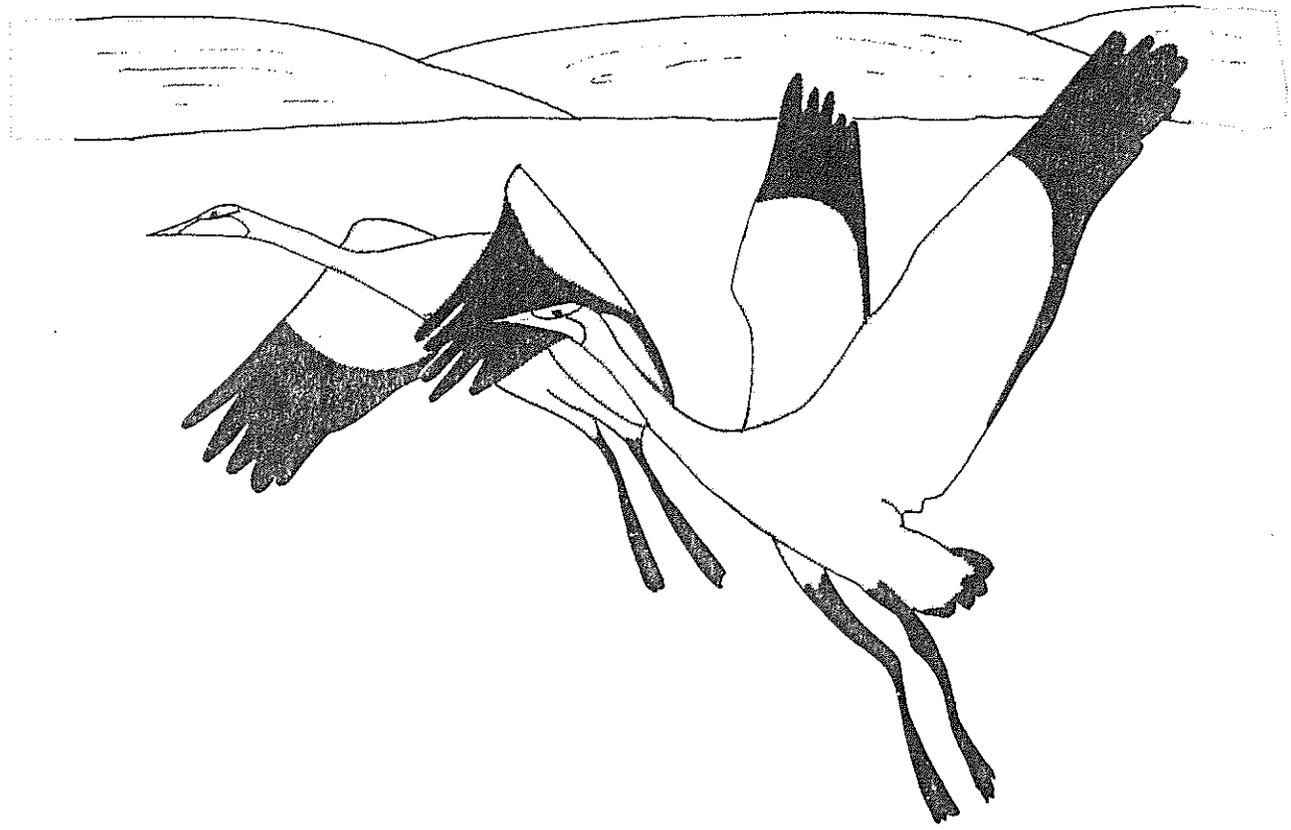


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TRAPPING TECHNIQUES FOR SANDHILL CRANE STUDIES IN THE PLATTE RIVER VALLEY



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

TRAPPING TECHNIQUES FOR SANDHILL CRANE STUDIES IN THE PLATTE RIVER VALLEY

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Game Management Agent Robert Wheeler and his Labrador retriever.

Foreword

This report describes the development of techniques by Robert H. Wheeler for trapping sandhill cranes for scientific purposes. Information on these techniques, included in progress reports, had not been put into a final report before Mr. Wheeler's untimely death. The report has been completed here with the assistance of James C. Lewis.

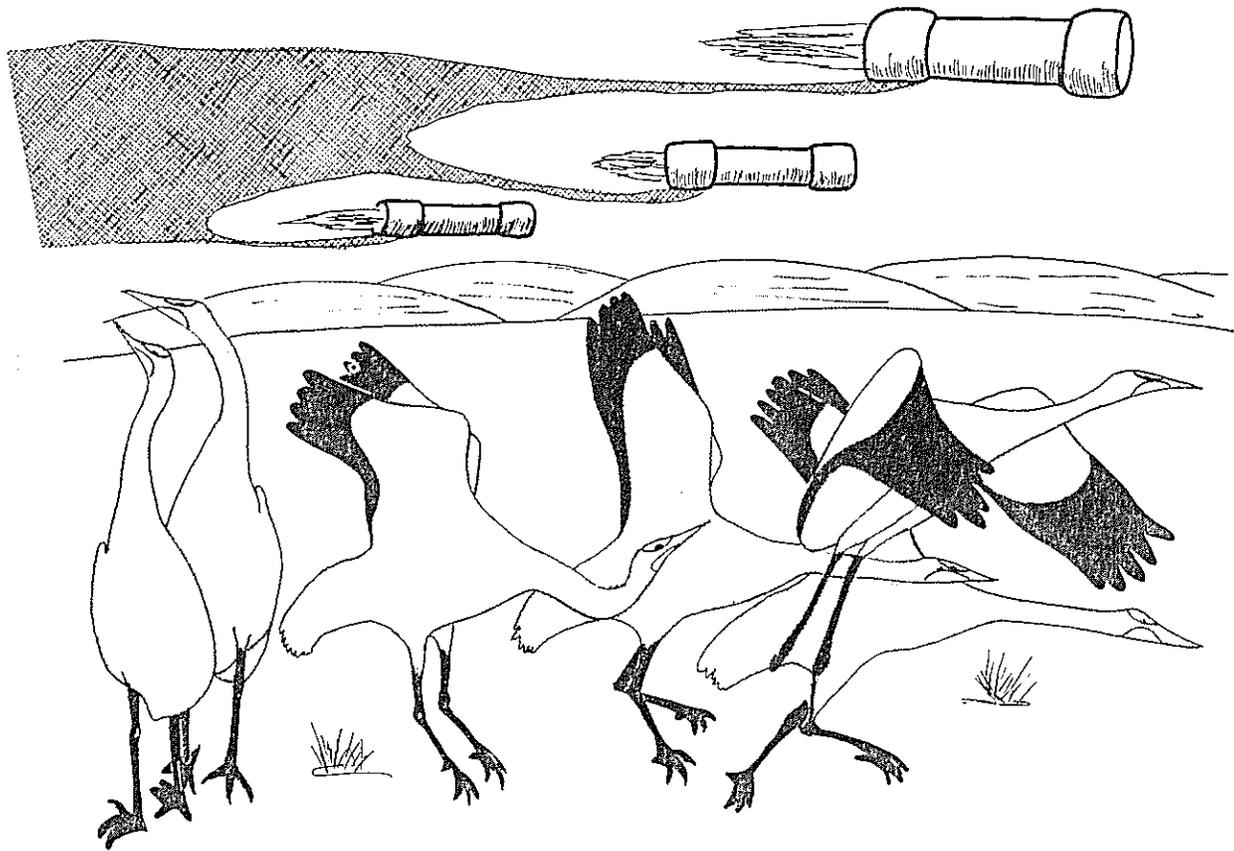
Robert H. Wheeler, U.S. Game Management Agent of the Bureau of Sport Fisheries and Wildlife, died on September 5, 1968, at the age of 47.

Mr. Wheeler was born in Cambridge, Ohio, on October 19, 1921. After serving three years with the U.S. Army, he attended Ohio State University and was awarded the degree of Bachelor of Science in Wildlife Conservation. After graduation in 1951, he was employed as a Wildlife Management Agent and later as Assistant Law Enforcement Supervisor with the Ohio Division of Wildlife.

Mr. Wheeler left his home state of Ohio in 1957 to assume duties as U.S. Game Management Agent, Division of Management and Enforcement of the Bureau of Sport Fisheries and Wildlife. He worked in several mid-western States. During his employment with the Bureau in Nebraska, he became interested in sandhill cranes and aware of how little was known about them. When he undertook the difficult task of devising a method to capture and band these wary birds for study, he received little encouragement from those who had previously attempted this feat. In addition to long, hard hours of work, he gave to this project a special ingenuity, perhaps explained by a comment he made when asked to what he attributed his success. Smiling, he replied: "You've gotta think like a crane."

Mr. Wheeler's personal and professional attributes gained him the deepest respect and admiration of friends and coworkers. He was a dedicated conservationist and was recipient of a Special Act Award from the Bureau of Sport Fisheries and Wildlife for his work in wildlife management. He possessed the desired human qualities of an outstanding personality and a keen sense of humor and honesty.

The springtime trill of migrating sandhill cranes across Nebraska will remind us of one who is, and will be, greatly missed.



Sandhill cranes trying to escape from the rocket net trap, by Robert Wheeler.

Introduction

Between 1916 and 1961, sandhill cranes (*Grus canadensis*) were protected by a closed season in the United States and Canada, primarily because conservationists felt that there was not a sufficient surplus for harvest by hunters (Boeker, Aldrich, and Huey, 1961). After the Second World War, sentiment for legalized hunting of sandhill cranes increased because of evidence of substantial increases in crane populations (Auk, 1944) and because of crop depredations both in Canada (Munro, 1950; Stephen, 1967) and in the United States (Smith and Boeker, 1958; Timmerman, 1958). As information on abundance, timing of migration, and winter distribution of various subspecies of cranes accumulated, it became apparent that a hunting season on the lesser sandhill crane (*G.c. canadensis*) in some areas would not threaten the endangered whooping crane (*Grus americana*) or the rare greater sandhill subspecies (*G.c. tabida*).

Sandhill cranes have been hunted in Mexico for years (Leopold, 1959). Since 1959, farmers in Saskatchewan have been permitted to shoot cranes under general crop depredation orders (Blue Jay, 1960). In the United States, hunting was authorized in 1961 in eastern New Mexico, western Texas, and Alaska. Thereafter other States in the Central Flyway requested hunting seasons for sandhill cranes (Buller, 1967). Crane hunting was legalized in the Canadian Provinces of Saskatchewan and Manitoba in 1964.

Hunting this bird intensified the need for information on mortality and migration patterns. Large numbers of cranes must be trapped and banded to acquire such information. Recovery of bands would provide data on longevity, survival, migration patterns, and distribution and size of harvest. Capture techniques for sandhill cranes were still in the experimental stage.

Large numbers of sandhill cranes were first captured on the Bosque del Apache and Bitter Lake National Wildlife Refuges in New Mexico,

in a cooperative venture by the New Mexico Department of Game and Fish and the U.S. Bureau of Sport Fisheries and Wildlife. One hundred and two, principally greater sandhills, were captured at Bosque del Apache, and 84 lesser sandhills were captured at Bitter Lake in the period 1959-62 (Huey, 1965). These wintering birds were captured from November to January; mainly cannon net traps were used, with corn and other small grains as bait (Huey, 1960).

This report describes the development of techniques for trapping migrating sandhill cranes during March and April, from 1955 through 1958, on the Platte River Valley staging area in south-central Nebraska. Robert Wheeler was the pioneer in developing trapping techniques for these sandhill cranes and captured and banded more cranes than anyone else. His work provides encouragement and knowledge for crane banding programs in other States and Provinces. Unfortunately his observations have been unpublished until now because of his untimely death. The object of this report is to make his observations available to others and to recognize the contributions he made. This report is chiefly a compilation of Agent Wheeler's annual progress reports. The junior author conducted studies on sandhill cranes in Nebraska in the springs of 1969 and 1970. His contribution to this report has consisted chiefly in summarizing Robert Wheeler's progress reports. Any errors in interpretation are those of the junior author. Wheeler's original narration has been used wherever possible.

Wheeler faced a formidable task when he began trapping attempts in 1965. The sandhill crane is one of the wariest birds of North America, as a number of persons have verified after attempting to catch or collect them:

Both Dr. R. S. Miller and I have attempted to capture and mark sandhill crane at Last Mountain Lake during August and September during the years

1961, 1962, 1963, and 1964. The total success was 12 birds banded. Various devices, including cannon-nets, muskrat traps with padded jaws placed both on roosting areas and in grain fields, and powerful portable lights on roosts at night were tested for capturing. I attribute the lack of success to the wariness of sandhill cranes as well as the abundance of alternate feeding and roosting areas. [Letter from W.J.D. Stephen, Canadian Wildlife Service, 1968.]

Unfortunately, sandhill cranes are extremely difficult to trap, and I confess little optimism for your trapping program. [Letter from Bill J. Van Tries, Biologist, U. S. Bureau of Sport Fisheries and Wildlife, 1968.]

It is impossible to approach feeding cranes closely; long before one reaches the neighborhood of a feeding flock, their quiet is broken by a warning cry, which startles the entire flock into flight. [Walk-inshaw, 1949.]

Although there was no trouble in locating the birds and their nests, the adults proved too wary to be collected. [Aldrich and Burleigh, 1958.]

In the manner he used in his 1966 Progress Report, Robert Wheeler would want to acknowledge the many individuals who assisted him during the trapping periods: "We worked long, hard hours and learned a lot. All crew members worked with a spirit of determination, cooperation, and ingenuity." They were Loren J. Bonde, Raymond J. Buller, Ivan Harjahousen, Gerald Pospichal, R. David Purinton, Henry M. Reeves, George Shieldman, Ralph Town, and Cleveland Vaughn from the Bureau of Sport Fisheries and Wildlife; and Frank Deatrich, Ed Greving, Roger Guenther, Nick Lyman, Karl Menzel, George Nason, Robert Patrick, Ken Robertson, John Sweet, Dan Timm, and Robert Wood of the Nebraska Game and Parks Commission. All worked under Wheeler's guidance. Dean Cruise made his workshop available for construction of decoys and assisted in other ways.

Those who helped complete this report and provided photographs were Dr. Thomas Baskett, Loren Bonde, George Brakhage, Ray Buller, Nick Lyman, George Nason, Dave Purinton, H. M. Reeves, Dr. John Rogers, and Dan Timm. Mrs. Robert Wheeler provided photographs and assistance throughout its preparation.

Materials and Methods

Each spring the Platte River Valley, between

the towns of Lewellen and Grand Island, Nebraska, contains the largest concentration of sandhill cranes in the world. These concentrations of cranes provided a logical place to develop capture techniques and to band sufficient numbers of cranes to allow calculation of mortality rates.

A prerequisite to any successful trapping program is a thorough knowledge of the behavior of the birds to be trapped. The situation on Nebraska's Platte River was unique and had not previously been thoroughly described. Countless hours of observing, especially during the few hours just after dawn and before sunset, were required to develop this knowledge on cranes that stop along the Platte during spring migration. Some of these observations are presented later to give the readers a better understanding of how sandhill cranes behave on this spring staging area.

Most of this study was conducted near Overton, Elm Creek, and Bertrand, in central Nebraska. Some trapping was also conducted at Hershey, Nebraska, about 14 miles west of the town of North Platte. The trapping periods were March 22 to April 1, 1965, March 8 to March 29, 1966, March 11 to April 4, 1967, and March 12 to March 29, 1968.

A number of capture methods, including cannon- and rocket-projected net traps, mist nets, snares, and spotlighting, were tested. Cannon nets of 2- and 3-inch mesh when stretched were tried with and without skirts (pockets along the bottom which prevent birds from running from beneath the net). Cannon net traps were set as described by Herbert Dill and William Thornsberry (1950) and Dill (no date). From one to six cannon nets were used at a single site. The 30- by 60-foot nets were set back to back for firing in opposite directions or were set facing each other, separated far enough so the extended nets would almost touch.

Shelled yellow corn, wheat, disked and mowed strips, portions of fields with the snow removed, and full-bodied styrofoam silhouette and taxidermy-mount decoys were the attractants tested. Decoys seemed worthy of testing because cranes would readily alight in a field or river roost where a few cranes were already present.

Scarecrows, uncamouflaged nets, lights, vehicles, and harassment by men, were used to

frighten cranes toward the capture site. Hay, native grasses and weeds, cane, cannon "booties," dummy net sets, and lawn cuttings were used for camouflage. Although one capture attempt was made in the morning, most trapping was conducted in the late evening.

Trapping sites included secondary roosts in cornfields, hayfields, and pastures and primary roosts on islands and sandbars. Blinds or other observation sites were located in farm buildings, among hay bales, in willow and plum thickets, in an old duckblind and in a tree. Existing structures and vegetation were used for blinds to avoid frightening cranes with new structures or unnatural objects in areas they were frequenting.

Some cranes were color-marked with 2½-inch yellow vinyl flagging material laced into the size 8 standard North American bird band attached above the ankle joint. On some of these cranes, two yellow plastic poultry bands were placed on the opposite leg in a similar manner.

Results

DISTRIBUTION AND POPULATIONS

In mild winters, a few cranes overwinter in the Platte Valley (Shickley, 1965), but generally they are absent during the winter months. They begin arriving from southern wintering areas in February, and most have departed for their nesting areas by late April. Dates on which cranes were first observed in the Platte River Valley were February 25, 1963, February 29, 1964, February 11, 1967, and February 11, 1968 (Annual Spring Sandhill Crane Inventories, 1957-1970, Bureau of Sport Fisheries and Wildlife Files, Minneapolis, Minnesota). The spring departure and arrival dates vary with the weather and probably with the abundance of food in the area. Migrating cranes stop along the Platte during the fall from October 1 to November 15 but in much smaller numbers (Walkinshaw, 1956) than in the spring.

Data for the year 1967 characterizes the arrival in spring, the increase, peak, and subsequent decline in numbers near Overton, Nebraska. The first cranes were seen on February 11; subsequently there was a slow, steady buildup until March 2 when thousands arrived. Between 12 and 14 thousand cranes had arrived by March

TABLE 1.—*Spring populations of sandhill cranes in the Platte River Valley in Nebraska, 1957 to 1970*

Inventory time	Number of cranes
March 28-29, 1957	180,000
April 7-8, 1958	240,800
March 21-22, 1959	147,496
April 4, 1960	125,870
March 21, 1961	136,276
March 21, 1962	142,830
March 21, 1963	101,925
March 30, 1964	156,028
March 30-31, 1965	80,315
March 24-25, 1966	123,087
March 22-23, 1967	126,043
March 22, 1968	169,194
April 2, 1969	154,978
March 26-27, 1970	193,600

10. More than half of these remained until April 4, 1967.

The Bureau of Sport Fisheries and Wildlife annually conducts an aerial census of sandhill cranes in the area between Central City and Lewellen, Nebraska. This survey covers all the areas in Nebraska which receive significant use by cranes. In the areas with dense crane populations, north-south transects are flown at 1-mile intervals, and cranes are counted in half-mile-wide strips on each side of a transect. Where cranes are sparsely distributed, a zigzag pattern is flown across the Platte River Valley.

These aerial surveys indicate the peak numbers of cranes using the Platte River Valley (table 1). This inventory is made when the survey crew believes the numbers of cranes using the area has reached a peak. However, bad flying weather in some years delayed the survey until after the probable peak period.

Cranes are not distributed uniformly throughout the Platte River Valley. They use three distinct areas (fig. 1) which are separated by river bottom unoccupied by sandhill cranes. The largest area is along the Platte River from the town of Grand Island westward 75 miles to Lexington. It includes several roosts and usually contains 80 to 100 thousand cranes. In 1968, there were 114,000 cranes or an average of 1,520 cranes per lineal mile of river.

Next in size is the area between the towns of North Platte and Sutherland, where the North and South Platte Rivers share a common valley. This distance of 18 miles includes several roosts on the North Platte River. These roosts normally contain 35 to 45 thousand cranes and in 1968

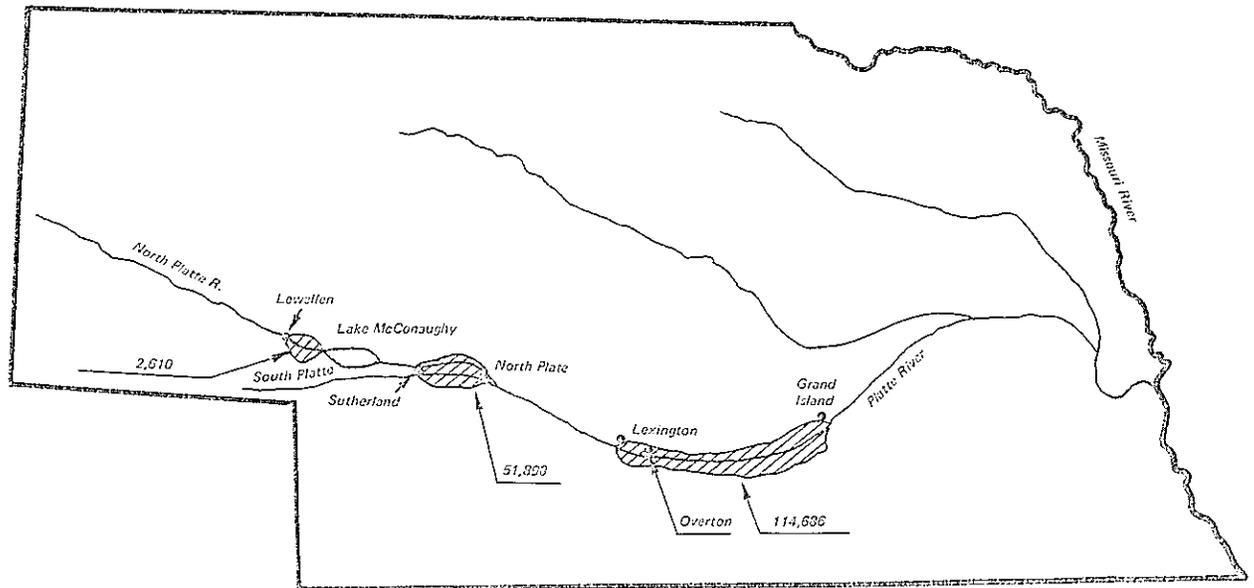


Figure 1.—Population distribution of sandhill cranes along the Platte River in Nebraska, March 21, 1968.

held approximately 52,000 or 1,733 cranes per lineal mile.

The third area is between the west end of Lake McConaughy and the town of Lewellen. This is within the North Platte River Valley and usually contains slightly more than two thousand cranes. In 1968, 2,610 or 522 per lineal mile of river were counted.

One of the larger roosts, about 4 miles long, is located south of Overton (fig. 1). The 25 cranes captured there in 1965 were measured and weighed (table 2). Dr. John W. Aldrich, Research Staff Specialist of the Bureau of Sport Fisheries and Wildlife, stationed in the U.S. National Museum, Washington, D.C., examined the data from these measurements. He concluded that, without knowledge of the sex of these birds, on the basis of their size all might belong to the lesser sandhill subspecies. All but six of the 618 cranes captured in this study were trapped near Overton. Presumably they were predominantly the lesser sandhill, and the behavioral characteristics reported here are of that subspecies.

HABITAT AND BEHAVIOR

The water flow in the Platte River is regulated by upstream reservoirs. This causes a fluctuating water level which sometimes creates a problem when trapping on sandbars. The flow is largely

controlled at Kingsley Dam on the North Platte River west of Keystone, Nebraska. Water is diverted and returned to the Platte River at several locations along the river basin for irrigation of 100,000 acres between North Platte and Kearney. The water is also used for generation of power, fishing, recreation, and dilution and transportation of sewage. Some poorly drained river bottom areas are still vegetated with grass or woodland.

Cranes roost in shallow water along unvegetated sandbars. Between the roosts are stretches of river containing narrow channels and heavily vegetated islands and sandbars which are not suitable roost habitat. Cranes stand all night on the river roosts, which Wheeler termed the "primary roosts."

The cranes leave their primary roosts at sunrise and alight on fields which Wheeler termed "secondary roosts" or staging areas. These secondary roosts are used just after daybreak and just before sunset for resting, preening, dancing, and some feeding. Secondary roosts are pastures or hayfields which are half a mile or less from the primary roost. In the mornings the cranes use these secondary roosts for 15 minutes to 2 hours. The length of time seems to be governed by the brightness of the morning. Bright skies lead to brief stays, while foggy or overcast mornings cause prolonged use. Cranes fly to their

TABLE 2.—Measurements from sandhill cranes captured near Overton, Nebraska, in March 1965

Specimen or band number	Wing chord (mm)	Tarsus (mm)	Midtoe without claw (mm)	Culmen from posterior end of nostril (mm)	Weight (lb.-oz.)
Specimen 1	508	182	66	71	8- 3
Specimen 2	461	190	72	74	6- 2
Specimen 3	528	203	74	77	7- 9
Specimen 4	488	173	68	70	6-13
Specimen 5	468	172	68	75	6- 3
Specimen 6	492	181	68	67	7- 6
Specimen 7	495	180	63	79	7- 8
578-47601	505	188	77	82	8- 1
578-47602	483	172	68	66	6- 1
578-47603	468	180	70	76	6-14
578-47604	442	158	63	65	5- 9
578-47605	466	185	67	70	6-13
578-47606	496	178	68	71	9- 9
578-47607	524	189	73	88	9- 2
578-47608	505	208	74	89	9-12
578-47609	483	191	66	80	6-13
578-47610	516	195	71	74	8- 2
578-47611	502	188	71	69	9-13
578-47612	509	173	68	70	7-11
578-47613	506	209	66	80	8- 9
578-47614	525	191	77	82	9- 1
578-47615	458	179	66	70	6-15
578-47616	500	183	69	70	7-11
578-47617	471	164	70	105	6- 2
578-47618	474	177	65	72	8- 3



Sandhill cranes on secondary roost in early morning with birds still arriving from the primary roost. (Photo by James Lewis)



Sandhill crane feeding area in pasture and cornfield. (Photo by James Lewis)



Sandhill cranes on pasture feeding area in the Platte River Valley in Nebraska.
(Photo by James Lewis)

feeding areas as individuals or pairs or in groups containing up to 1,000 birds. A few birds fly directly from the primary roost to the feeding fields.

The river valley adjacent to these roost areas varies in width from 4 to 7 miles. Grains grown in the valley are principally corn and sorghum. Cranes feed extensively in harvested cornfields. Croplands produce feed grains, silage, alfalfa, soybeans, and potatoes. Hayfields are common in lowland areas where wet conditions discourage the planting of row crops. Livestock feeding and dairying are the primary farm operations.

Early in the spring, most of the cranes feed within 3 miles of the river. As spring plowing progresses, the feeding pattern extends to 7 or 8 miles from the river. The rate of this spring plowing may be one factor influencing the date when cranes depart northward.

Cranes were observed in pastures probing for and eating earthworms. They may prefer larvae and worms to corn; this was suggested by their scratching and probing around corn seed with no apparent attempt to eat it.

There were many grass fires in the dry spring

of 1967. During the survey that year, cranes were frequently seen feeding or loafing on burned fields. Cranes also preferred old pastures with cow chips, which they tear up in search of insect larvae or undigested seeds. Walkinshaw (1949) mentions this as common behavior for sandhill cranes.

The cranes first depart from their feeding areas about an hour before sunset. Then, in groups of 5,000 to 20,000 birds, they congregate on secondary roosts where they rest, preen, dance (a display activity), and do a little feeding. They usually move from secondary roosts en masse shortly after sunset, although on some occasions they leave in small flocks. From here they fly to the river (primary) roost, sometimes directly and sometimes after flying back and forth for awhile before alighting. The presence or absence of cranes already on the primary roost appears to influence their willingness to alight there. Once a few land, the rest follow.

Some cranes, especially the late arrivals from the feeding fields, go directly to the river roost instead of stopping at the secondary roost. The first birds to arrive on the river roost land and

TABLE 3.—Trap location, bait, camouflage, and use of decoys in relation to trap success, Platte River Valley, Nebraska, 1965 to 1968

Trap location	Number of days traps present	Number of days nets fired	Number of birds captured	Bait	Type of camouflage	Decoys used
1965:						
Feeding area	6	1	17	Corn	None	None.
Secondary roost	10	1	8	Wheat, corn	None	None.
Secondary roost	3	0		Wheat, corn	None	None.
Secondary roost	7	0		None	None	None.
1966:						
Secondary roost	4	0		None	None	None.
Feed field	9	1	2	Corn	Cornstalks	None.
Primary roost	3	1	34	None	None	None.
Secondary roost	10	1	70	None	Cornstalks	None.
1967:						
Secondary roost	13	7	121	None	Hay	Styrofoam.
Primary roost	3	0		None	Grass	6 silhouettes.
Primary roost	1	1	1	None	Grass	Styrofoam.
Secondary roost	8	1		None	Hay	None.
Primary roost	2	1	5	None	Grass	None.
1968:						
Secondary roost	2	1		None	Grass	Taxidermy.
Secondary roost	16	10	360	None	Grass	Taxidermy.
Subtotals:				Average catch		Catch per day
Feeding fields	15	2	19	9.5		1.2
Secondary roosts	73	21	559	26.6		7.6
Primary roosts	9	3	40	13.3		4.4
Total, all sites	97	26	618	23.7		6.3

walk about on sandbars and sandy beaches of the islands. Large flocks often arrive as late as an hour after sunset. As it becomes dark, the cranes walk into the shallow water where they stand until daybreak.

DEVELOPMENT OF CAPTURE TECHNIQUES

The first tests of bait as an attractant to cranes were in 1965 when wheat and shelled corn (table 3) were placed in front of cannon net traps in two areas: a pasture and a site adjacent to a cornfield. Both fields had been heavily used by cranes, but they were avoided for the next few days. After 5 days, 17 cranes were captured in

the pasture. In this case, the attraction for the cranes may have been the bait or several puddles which the cranes frequented before the trap was set.

On March 25, at 9 a.m., a farmer cleared snow from an area measuring 30 by 90 feet between two corn stubble fields. By 10 a.m., the cleared space was completely filled with cranes. On the following morning, a cannon net trap was set on this clearing and baited with cracked corn. Cranes landed in an adjacent stubble field and gradually worked their way to the trap site. Eight cranes were captured. After the nets were fired, the cranes would not use either of the two trap sites just described.



The "landing strip" is just right of center in this picture; the firing-observation site is near the tall trees in the woods behind; the Platte River is in the right foreground. This field is a typical staging area. (Photo by Robert Wheeler)

Several pastures and hayfields, which were often used by cranes, were prebaited with shelled corn in 1966. In some fields the corn was placed in neat piles in order to determine consumption, while on others it was scattered. Three weeks later, the cranes finally used one of the sites. Little or no corn was eaten although enough cranes had been present to consume it all. Much scratching and probing in the soil was evident.

In 1966 a strip was cleared in a cornfield, and two cranes were captured there. For the remainder of the season cranes did not use that site. In 1968, a strip 100 by 300 feet was mowed and raked in a weedy pasture near an alfalfa field. This site, called the "landing strip," was

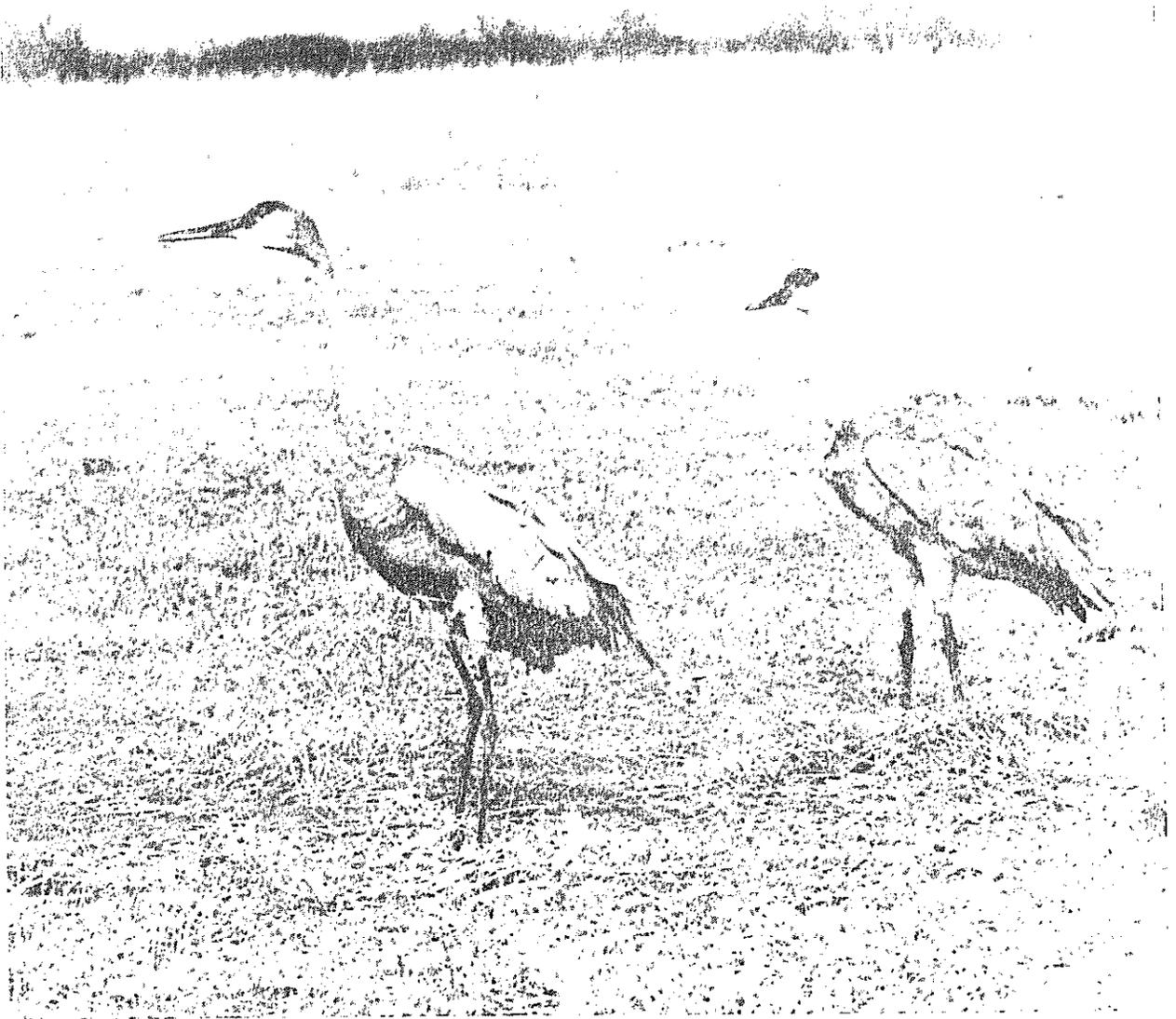
heavily used by cranes for 15 days. The nets were fired there on 10 occasions, and 360 cranes were captured. Corn and wheat, used as bait, did not appear to be attractive to cranes. Cleared "landing strips," consisting of areas mowed or cleaned first birds to arrive on the river roost land and of snow, seemed to attract cranes and made good trapping sites.

Decoys

Full-bodied life-sized decoys and silhouettes were tested during 1967 (table 3). Six silhouettes were placed about 20 yards south of a trap site established on a secondary roost. Several small



Sandhill cranes alighting near decoys on the sandbar site. The decoys are third and fourth from the right, among the birds that have already alighted. (Photo by Russ Bauer, North Platte Telegraph)



Mounted sandhill crane decoys on the landing strip site.
(Photo by Robert Wheeler)

flocks flew low over the field but flared as they approached the silhouettes. The following day, the silhouettes were moved to another field for use as scare devices. On the next day, 10 cranes were seen standing near the silhouettes.

A single full-bodied styrofoam decoy was tested in an open field. Late in the afternoon, six cranes landed about 20 yards away; they were joined shortly by 200 others. None approached

the decoy closer than 20 yards, and they showed little interest in it. These cranes were not necessarily attracted by the decoy, because the vicinity was a common loafing site; but they at least tolerated the decoy and continued to use the spot.

Two full-bodied styrofoam decoys were then placed at a river roost. Soon there were numerous small flocks flying up and down the river.

Many of these set their wings as if to land, but when they saw the decoys they flew away. At about 6:30 p.m., a few cranes landed about 100 yards away in the middle of the river. By 7:15 many cranes were on the sandbar, but none were near the trap. Several approached cautiously to within 10 feet of the decoys and then moved away. The silhouettes and full-bodied decoys apparently were not realistic enough to fool the sandhill cranes.

Taxidermy mounts were used as decoys for the first time in 1968. These were made from skins salvaged from cranes that died during earlier trapping operations. Two were placed between parallel sets of rocket nets. Groups of eight and three cranes landed almost immediately but did not remain within reach of the trap, perhaps because they were wary of the poorly camouflaged net set.

The next day, the same decoys were moved to a weedy pasture where the 100- by 300-foot "landing strip" mentioned earlier had been mowed. The taxidermy decoys and traps were placed near the center of the mowed strip. At 7 p.m. several cranes alighted, and they were rapidly followed by others until there were about 2,000 on the field; about 200 were on the "landing strip." The rockets were fired, and 25 cranes were captured. The 360 cranes captured in 1968 were taken with the aid of the taxidermy decoys.

Wheeler felt that the use of the taxidermy mounts for decoys was the most important factor contributing to success in 1968. Furthermore, he believed that six or more decoys would increase the attractiveness of the trap site by appealing to the strong gregariousness of the cranes. The two decoys were attractive only to small flocks of up to seven or eight birds. As more cranes accumulated on the site, they attracted larger and larger flocks. When a large flock was present, smaller groups already on the ground tended to join it. Therefore, if a good concentration could be started on the trap site early in the evening, it would usually attract most of the cranes using the area.

Attempts to divert or herd cranes

A variety of devices were used to frighten cranes from nearby secondary and/or primary roosts and move them to the trap site. A scare-

crow, constructed of sticks and white grainsacks, was used to divert cranes from one secondary roost. On other occasions, aluminum pie plates on strings were tied to a swivel fastened to the top of a stake. The plates would rotate in the wind, and their flashing would frighten the cranes. Burlap bags were placed on stakes for the same purpose. Sometimes, crew members harassed cranes from other fields.

On another occasion a dummy net set was made about 50 yards north of the real trap. This dummy trap set consisted of an uncamouflaged net and rusty tin cans to simulate cannons. Even though the real net set was elaborately camouflaged, most cranes avoided the entire field. Scare devices were effective in frightening cranes, but there was no assurance that the cranes would be diverted to the trapping site.

A frustrating problem was the frequent presence of cranes in the field but not within range of the net. These birds tended to decoy others away from the trap. The first attempt to herd birds into the net site was on March 18, 1966, when a crew member drove a car along a road bordering the field where the cranes were congregated. This attempt was unsuccessful. At dusk on March 29, an auto with the headlights turned off was again used in an attempt to herd cranes. The cranes flew before they got close to the net. On another occasion, a white plastic jug, with fishing line attached, was placed on the field border. The intention was to pull the jug slowly across the field in order to move the cranes into the net site, however they flew as soon as the line was pulled taut. The accumulated field experience indicates that it is not possible to herd sandhill cranes into the trapping areas.

Net trap equipment

The nets were 30 feet wide by 60 feet long. Three rockets were required to fire each net. From one to six nets were used at each trap site. In 1968, three to six nets were used at each trap site. Nets were projected 45 times that year for an average catch of eight cranes per net firing. The nets were placed in two parallel rows directed toward each other and were only 15 to 40 feet apart after projection. A problem encountered with setting the nets to fire toward each other was that many cranes were reluctant to walk across the nets to enter the capture area.

However, others would examine the net and then fly across it to enter the trapping area. The firing of several nets simultaneously, added to the capture efficiency of the trapping program.

Initially the cannons were aimed at a 30° angle from the ground surface. However, after several cranes were injured by the leading edge of the net, the cannons were aimed at a 45° angle. This still gave good net projection and capture success, and reduced the chance of injuring cranes.

In 1967 the cannons were replaced with recoilless rockets. The rockets were more versatile and easier to set on field conditions which varied from sandbars to hayfields. Also they were much easier to transport when making a set in some remote part of the river, because they could be assembled and carried as one solid piece. One man can carry six rockets easily, but only two of the conventional cannons with difficulty, because of the sliding barrels and bulky backing blocks. Furthermore, the rockets required no excavation, an asset on some of the sandbars where water was only 3 inches below the surface.

On March 26, 1968, twenty-one cranes escaped from beneath a net before it could be secured. Some cranes had escaped after previous shots, but they had not been counted. On March 27, another special effort was made to count the cranes which escaped from under the projected nets. Fifty-one escaped before the nets could be secured. This was 43 percent of the number banded and released on this occasion, and was particularly discouraging because cranes were so difficult to catch.

In an effort to prevent cranes from escaping the nets, five hooked wire stakes about a foot long and painted dull gray were made. These were pushed into the ground near the outer edge of the net projection until only about 4 inches protruded. Theoretically the falling net would be penetrated by these rods, and the hooks would bind it to the ground and prevent the escape of any cranes. After one test, the wires were removed. Although they did serve to anchor the net in several places, they prevented an accumulation of a substantial number of birds on the trap site, because the cranes seemed to trip over the wires or were frightened by them. A 6-inch infolding of the net, called a skirt, was useful in preventing captured cranes from running from

beneath the net. Wheeler recommended that this skirt be lengthened to 36 inches because of the greater height of the cranes over waterfowl, for which the 6-inch skirt was designed.

For the first 2 years, a net with a 3-inch stretch mesh was used. On one occasion, two nets were fired simultaneously, and 70 birds were captured. Almost every crane had both wings extended through the mesh in a flexed position with the wrist joint at the apex. Both wings had to be removed simultaneously because the body and wings could not be bent or stretched excessively. Many birds had rotated several times and had entangled their toe nails in the twisted mesh.

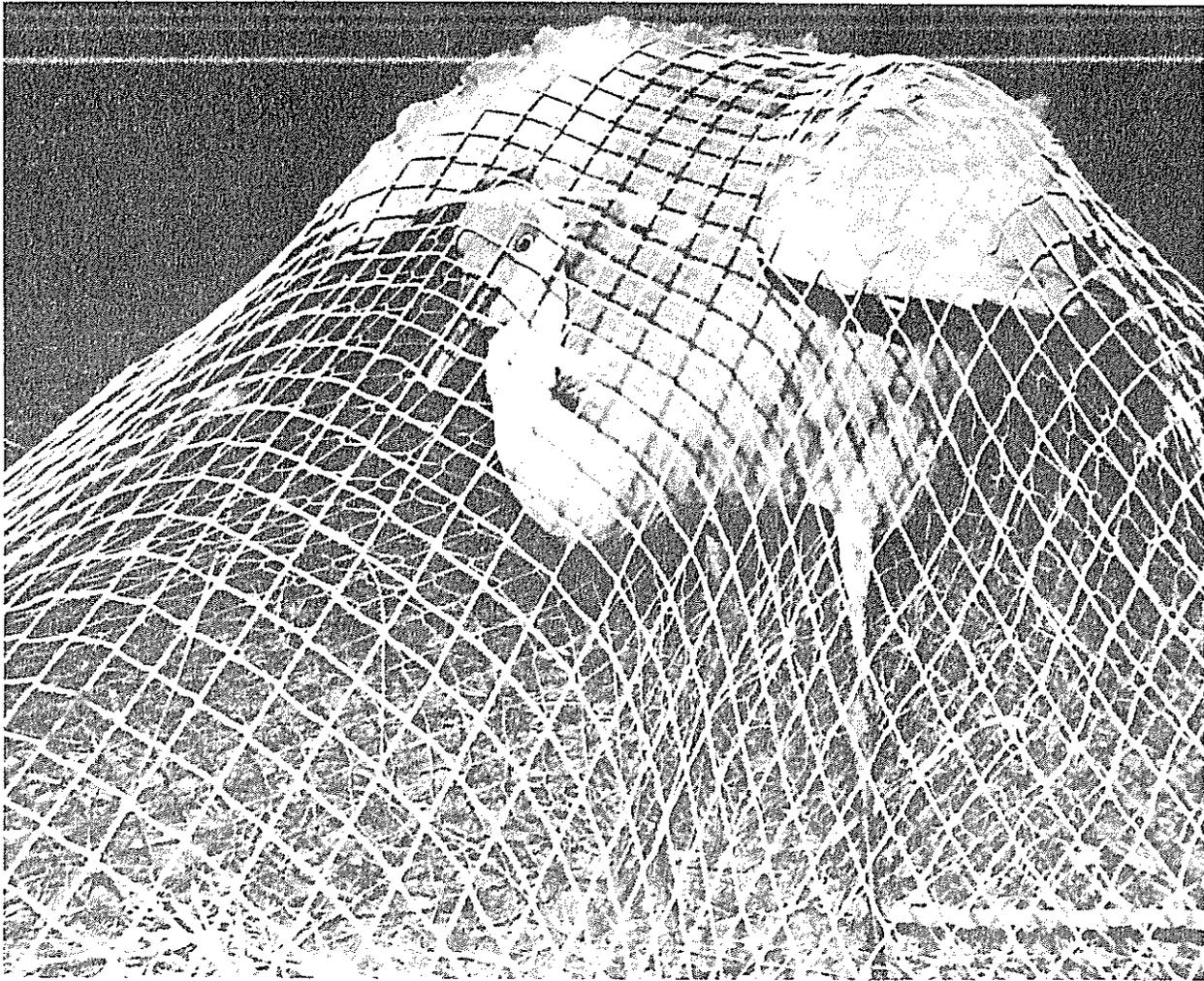
Each crane in the net was a tangled puzzle, and required the cooperation of at least two men to free it. Since all the crane's heads were through the net and fiercely pecking anything within range, a third man was often required to hold several nearby cranes so that the other men could work safely. It required 1 hour to remove cranes from the first net. One bird was unable to stand when released. By then the cranes in the second net presented a nightmare of entanglement, and it required 2 hours to remove these birds. Seven of them were unable to stand or fly after release. The bird's disability may have been due to shock or their constant struggling against the net. Clearly, improvements had to be made. In 1967, new netting was purchased with a smaller mesh (2 inches stretched). It was better to work with because the cranes did not become so badly entangled.

The anchor ropes which are attached to the rockets became frayed from repeated tying. The problem was solved by using heavy removable chain links to tie the anchor ropes to the nets. Five-eighth inch nylon rope is recommended for attachment of the rockets to the net.

The size of the trapping crew varied, but in 1968 six men were generally used. The rockets were fired at dusk, and usually it took 1 to 2 hours to process the captured birds. The nets would be reset the next morning. Six nets could be reset and camouflaged in about 5 hours.

Camouflage

Cranes appear to be extremely perceptive to changes in their environment. They had no fear of objects such as cultivators, haystacks, or



Sandhill crane under net. (Photo by Game Management Agent Dave Purinton)

small farm buildings as long as these were present when the cranes first arrived from the wintering grounds.

The net and cannons were not camouflaged during the 1965 trapping attempts, and this was undoubtedly one reason for the low capture success in that year. On one occasion, three cannon nets were spread in the center of a large pasture being heavily used as a secondary roost. These were not camouflaged because Wheeler wanted to observe the cranes' reaction to them. The reaction was profound; the cranes simply avoided this field for the remainder of the season.

In 1966, cannons were camouflaged with cornstalks, and some hay chaff was scattered over the net (table 3). Cranes were also captured at some traps which were not camouflaged. In 1967,

dummy nets were used to accustom cranes to seeing nets in a field. Salvaged fish nets were placed out for this purpose on February 11. Thirty days later, they were replaced with camouflaged rocket nets. A total of 58 cranes were subsequently captured there in three consecutive trapping attempts.

The degree of care in camouflaging the traps gradually increased as experience emphasized the importance of concealing capture equipment. The nets were placed in a shallow slanting ditch (about 14 inches wide), which tapered from ground level on the front edge to about 4 inches deep at the back. Detonating wire near the net was buried.

Twice cranes were observed as they crossed uncovered portions of the detonating wire. Only

two strands of this wire, less than a sixteenth of an inch in diameter and lead gray in color, ran from the observation blind to within 20 feet of the net; from that point on it was underground. Most of the cranes stopped and scrutinized it closely. Some shied away, some jumped over it, and others flew over it. Sometimes six or seven cranes were lined up in a row, scrutinizing the wire. Occasionally cranes would walk over the wire without showing concern. Cranes were also noted flying over the wire in a landing approach; they appeared to flare when sunlight reflected from the detonating wire.

Dry lawn clippings were ideal for camouflaging the nets. They were easy to spread and did not interfere with good net projection. Once applied, the clippings could be raked up and used repeatedly.

Burlap "booties" were made for camouflaging the portions of rockets protruding above the ground. Holes were dug just large enough to hide the rockets. They tapered from ground level on the front to about 2 feet deep at the back, making the angle of aim about 45 degrees. Once the rockets were armed and in place, the hole was filled with a wadding of course weeds. Lawn clippings were then sprinkled over the net until it blended with the rest of the field.

Camouflage amounts to more than color and texture. A high profile is very conspicuous on a flat surface, especially to a bird only 3 feet in height. Vehicles were driven over the nets, both before and after the grass was placed on them, to lower the profile. Although a few cranes were captured at uncamouflaged trap sites, careful camouflaging greatly increased the capture success.

Blinds and trap location

Blinds were located from 20 to 400 (generally over 50) yards from the trapping site. Any site was suitable as long as the observer was well concealed from cranes in the air and on the ground. Existing vegetation or man-made structures already in place were used because the cranes were accustomed to those features of the landscape. Two or more blinds were sometimes used, and radio contact was maintained between observers in each blind. Observations from several points permitted more accurate determina-

tion of the number of cranes within range of the net.

The traps were set at a feeding or roosting site, where from several hundred to several thousand cranes were seen regularly. In 1965, cranes were captured at a secondary roost and a feeding area. In 1966, all but two cranes were captured at primary roosts. In 1967, all but six were captured at secondary roost sites. In 1966, net firings on primary roosts eliminated that spot as a trapping site for several weeks. In 1967, cranes were captured on one secondary roost for three consecutive evenings, and after a 6-day rest period, the same field was trapped for three more consecutive evenings. In 1968, all trapping sites were situated on secondary roosts. At one such area, cranes were captured in a mowed strip in weedy pasture on nine consecutive evenings.

The capture success was greater at secondary roosts (table 3), and the same site could be trapped repeatedly. These roosts were also more accessible than the primary roosts; this is an important consideration when transporting the traps and other equipment.

Adequate camouflaging of the trap was also more difficult on the sandbars of the primary roosts and on the feeding fields. Because of the fluctuating water level, cranes captured on the primary roost were likely to become wet while entangled in the net. For example, on one occasion in 1966 a trap was set on a sandbar. After the net was set, the stream level rose about 6 inches, and water covered one-third of the net site. Some birds were inadvertently captured in the water and were among those birds which were described earlier as being unable to fly after release. Wet cranes are probably more susceptible to shock. Thus the cranes captured at primary roosts were more susceptible to injury and death.

Color marking

Yellow markers were placed on 161 sandhill cranes in 1966 and in 1967 to help collect information on local movements, migration, and behavior of cranes following trapping.

On March 14, 1967, Henry M. Reeves saw single color-marked cranes in two adjacent loafing flocks. Later, he and David R. Purinton observed a color-marked crane in a road ditch. This bird was not acting in a normal manner



Game Management Agent Dave Purinton, Nebraska Waterfowl Biologist Nick Lyman, and Game Management Agent Robert Wheeler banding sandhill cranes.
(Photo by Clyde Taylor)

and showed little fear, and they were able to approach within 10 feet of it. On March 16, another solitary color-marked crane was seen on a river sandbar. It is unusual to see cranes on the river during the day. This crane called to each flock of cranes passing over, but made no attempt to join them.

On March 18, Wheeler and Reeves floated a 2-mile stretch of the Platte River east of the Overton bridge. Four or possibly five (one may have been a duplicate sighting) solitary color-marked cranes were observed. These birds acted abnormally and would run, swim, or hide rather than fly. They flew only when closely pursued. On this same evening, a solitary color-marked

crane was observed flying over an observation blind. It was calling continuously.

Marking has been known to cause behavioral changes in other birds. Light green neckbands inhibited reproduction in black brant (Lensink, 1968), and yellow head markers disrupted pair bonds in mourning doves (Goforth and Baskett, 1965).

These observations by Wheeler and Reeves suggested that color-marked cranes avoided, or were avoided by, other cranes. At this time of year, sandhill cranes participate in their dancing displays. Dancing might make the color marker more conspicuous. There was also the possibility that banded cranes, color-marked or not, would

have difficulty in finding their own group for a few days. When the net was fired, it created confusion for a good part of the night. At any rate, color-marking was terminated. Further efforts to locate color-marked birds were unsuccessful.

Wheeler wrote to the only person that had recovered a color-marked crane—Mr. W. Wirtz of Wadena, Saskatchewan—who replied that the crane was shot while flying with a flock of about 20 and that the yellow marker was in place and in good condition. This did not support the suspicion that other cranes might attack or avoid color-marked birds. However, the color-marked cranes might be shunned initially until the other cranes become accustomed to the bright marker. Birds of different social rank within the flock might also be affected differently. For example, an immature bird which suddenly appears with bright markings might not be tolerated as well as one of the older flock members with similar markings.

Unusual behavior was noted also in cranes that were banded only with the metal leg bands. Some would spend several days standing on the river sandbars. They could fly, but would do so only when approached closely. This had an adverse effect on the trapping success because they became effective decoys and lured other cranes away from the trapping sites. In retrospect it appears that the behavior of some captured cranes is altered for a few days, regardless of whether the bird is color marked or not.

Lovett Williams has placed green patagial tags on sandhill cranes in Florida for a number of years. He has observed marked and unmarked birds keeping company, feeding, flying, and walking together. Some marked birds mated and raised young while wearing tags. He does not feel that sandhill cranes are very sensitive to markers, but he noted that they will cover a patagial marker with red clay (correspondence to Lewis, 1970).

Other capture techniques attempted

Mist nets were tested in hopes that the cranes would entangle their feet in them. The nets were laid horizontally, staked loosely, and elevated slightly above the ground. Cranes walked all over them without becoming entangled.

Frank Ligas of the National Audubon Society

provided several raptor snare traps made of 1- by 2-inch welded wire in 1- by 2-foot pieces. About 30 monofilament loops made of 100-pound-test line were attached to each platform. They were placed on the ground and camouflaged in fields heavily used by cranes, but none were captured.

Several attempts were also made to capture cranes at night with lights. A variety of waterfowl and upland game birds have been captured at night by blinding them with a bright light and capturing them with long-handled nets (Drewien et al., 1967; Cummings and Hewitt, 1964; Labisky, 1959). The cranes' reaction to the lights at night was tested in March 1966. One hour after sunset, a large group of cranes on a river roost were approached with flashlights. The birds flew soon after the lights were visible. Another attempt was made in April of 1967. By 8 p.m. the night was very dark because of a good cloud cover. About 95 percent of the cranes flew away when the light shone on them. Birds on the ground seemed to be easily mesmerized by the light, although they only remained in this state until the observers were about 10 feet from them. Some cranes probably could have been captured that night with a long-handled net.

TRAPPING RESULTS AND BAND RECOVERIES

Six hundred and eighteen cranes were captured in the four trapping seasons. Five hundred and forty-two were banded and released (table 4). Forty-three died and 33 were donated to zoos and Federal salvage permittees.

Trapping mortality varied from year to year. In 1965, 8 percent succumbed. In 1966, 6 percent died, and an additional 8 percent were severely injured and were donated to a Federal salvage permittee. In 1967, the losses were only 2 percent. Early in the 1968 season the losses amounted to 9.6 percent of the catch, but this was reduced to 6.5 percent later in the season as techniques were improved further.

Cranes, with their long legs, long wings, and long necks, are extremely fragile birds. Trapping injuries and deaths have been reduced by elevating the rockets to a 45° angle from the ground, reducing the net mesh size, avoiding trapping in wet areas, and promptly banding and releasing the captured birds.

TABLE 4.—Successful sandhill crane capture attempts, Platte River, Nebraska, 1965 to 1968

Date	Trap Site	Number of nets fired	Number of cranes captured	Trapping deaths	Banded and released	Gifts to zoos and sal. perm.
1965						
Mar.	26 feeding area	1	8	0	2	6
	27 secondary roost	1	17	2	15	0
	1965 subtotal	2	25	2	17	6
1966						
Mar.	16 primary roost	1	34	2	32	0
	18 feeding area	3	2	0	2	0
	28 primary roost	2	70	5	57	8
	1966 subtotal	8	106	7	91	8
1967						
Mar.	11 secondary roost	2	9	1	8	0
	12 do	1	18	0	14	4
	13 do	2	31	0	31	0
	20 do	2	28	0	28	0
	21 do	2	11	0	11	0
	22 primary roost	2	24	2	22	0
	28 do	1	1	0	1	0
Apr.	4 do	2	5	0	5	0
	1967 subtotal	14	127	3	120	4
1968						
Mar.	14 secondary roost	3	25	12	9	4
	21 do	3	16	0	12	4
	22 do	3	56	2	53	1
	23 do	3	32	2	30	0
	24 do	3	43	5	38	0
	25 do	3	38	1	37	0
	26 do	6	18	1	17	0
	27 do	6	71	2	68	1
	28 do	3	12	0	8	4
	29 do	6	49	6	42	1
	1968 subtotal	39	360	31	314	15
	1965-68 total	63	618	43	542	33
	Percentage	—	100.0	6.9	87.7	5.3

TABLE 5.—Recoveries of sandhill cranes banded along the Platte River, Nebraska, from 1965 to 1968

Date		Location	
Banded	Recovered	Banded	Recovered
Mar. 28, 1966	Sept. 5, 1966	Overton	4 miles southwest of Wadena, Saskatchewan, Canada.
26, 1968	Nov. 9, 1968	Elm Creek	Madera, Chihuahua, Mexico.
25, 1968	Nov. 8, 1968	Elm Creek	15 miles southwest of Littlefield, Texas.
20, 1967	Sept. 16, 1968	Bertrand	Delta Junction, Alaska.
22, 1968	Nov. 9, 1968	Elm Creek	8 miles west of Littlefield, Texas.
21, 1968	June ?, 1968	Elm Creek	Tuktoyaktuk, Northwest Territories, Canada.
25, 1968	Nov. 16, 1968	Elm Creek	10 miles east of Bula, Texas.
24, 1968	Dec. 15, 1968	Elm Creek	32 miles northwest of Big Spring, Texas.
24, 1968	Winter, 1968	Elm Creek	Chihuahua, Mexico.
24, 1968	Nov. ?, 1969	Elm Creek	Chihuahua, Mexico.
21, 1967	Nov. 3, 1969	Bertrand	Roswell, New Mexico.
27, 1968	Nov. 11, 1969	Elm Creek	Littlefield, Texas.



Figure 2.—Recovery points for sandhill cranes banded along the Platte River from 1965 to 1968 and recovered from 1966 to 1970.

Fourteen banded cranes have been reported since the initiation of trapping efforts along the Platte River (table 5 and fig. 2). Two cranes were found dead near the trapping areas. The other 12 were shot by hunters, and their recoveries indicate migration routes, wintering areas, or nesting areas for cranes that roost near Overton, Nebraska, during the spring migration. The cranes killed in September at Wadena, Saskatchewan, and Delta Junction, Alaska, may have been migrating from nesting areas. The crane killed in June in Northwest Territories, Canada, must certainly have been on its nesting grounds. The nine cranes taken in western Texas, eastern New Mexico, and Mexico in November and December were presumably at

or near their wintering areas. It appears that many of the cranes which use the Overton area winter near Littlefield, Texas, and Chihuahua, Mexico.

Summary

This study documents how sandhill cranes can be captured at their spring staging area along the Platte River, Nebraska. A crew of six men was needed to set up and camouflage six rocket-net traps and quickly process the captured cranes. The nets used were 30 feet wide by 60 feet long, and the mesh size should not be larger than 2 inches when stretched. Secondary roosts,

in hayfields and pastures, were preferred trapping sites, because of accessibility and success. Areas mowed or cleared of snow were especially attractive to cranes.

Full-bodied taxidermy mounts were used as decoys; they greatly improved the chances of attracting large numbers of cranes to the trap site. Nets and rockets were set in the morning, and the trap site was manned at dusk when the cranes returned to their secondary roosts before flying to their river roosts. Crew members, scarecrows, flashing pie pans, and other scare devices were used to frighten cranes from nearby secondary roosts. These efforts were designed to increase the chances for an early buildup in the number of cranes using the secondary roost at the trap site.

Careful camouflaging proved to be an extremely important aspect of trap preparation. Nets were placed in two parallel rows directed toward each other with the projected edges 15 to 40 feet apart. Nets were fired simultaneously with the rockets aimed at a 45° angle from the ground surface. This angle gave good net projection and capture success, and it reduced the chance of injuring cranes. A 36-inch skirt on the net is recommended to eliminate the problem of birds escaping from beneath the net.

By the techniques described in this report, sandhill cranes can be trapped in large numbers during their migration stopover in Nebraska in spring.

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