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GREATER SANDHILL CRANE NESTING SUCCESS AND RECRUITMENT IN NORTHWEST COLORADO

OCTOBER 1995



PREPARED BY:
COLORADO DIVISION OF WILDLIFE
TERRESTRIAL WILDLIFE SECTION
GRAND JUNCTION, COLORADO

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Van K. Graham, Wildlife Biologist

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TABLE OF CONTENTS

Introduction 1

Methods 4

Results

Population and Distribution 7

Nesting Success 7

Nests by Concentration Area 14

California Park 14

Steamboat Lake 15

Lake Windmere 17

Other concentration areas 17

Terminology 20

Map 23

Map of study area 25

Map of study area 32

Roosting 33

Adults 34

Discussion 36

Literature Cited 41

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TABLE OF CONTENTS

Introduction 1

Methods 4

Results

 Population and Distribution 7

 Nesting Success 7

 Nests by Concentration Area 14

 California Park 14

 Steamboat Lake 15

 Lake Windemere 17

 Other concentration areas 17

 Territories 20

 Banded Birds (breeding areas) 25

 Staging Grounds 25

 Banded Birds 32

 Roosting 33

 Additional Crane Data 34

Discussion 36

Literature Cited 41

INTRODUCTION

The sandhill crane (*Grus canadensis*) is thought to be the oldest living bird species, existing as much as nine million years ago (Walkinshaw 1973). The greater sandhill crane (*G. c. tabida*) is one of six subspecies that occurs in North America. They weigh an average of 5.4 kg and stand 101.6 to 121.8 cm tall (Graham 1992). The adults are generally a slate gray color with a bright red skin patch on their forehead.

There are four recognized populations of the greater sandhill crane. The Rocky Mountain Population occurs in west-central Montana, eastern Idaho, western and central Wyoming, northern Utah, and northwest Colorado. The small breeding population in northwestern Colorado is the subject of this study.

Historically, these cranes nested over a large portion of western Colorado, but by the 1950's they had been reduced to a small remnant population of about 25 breeding pairs in northern Routt County (Bailey and Niedrach 1965). In the mid-1970's, the Colorado Division of Wildlife began to address the cranes' decline and in 1973 the greater sandhill crane was placed on the Colorado endangered species list.

From 1974 until 1981 CDOW conducted intensive annual studies to assess distribution and nesting numbers in northwestern Colorado. In 1985, work on a recovery plan was initiated to create management practices that would ensure and enhance a long-term, self-sustaining breeding population. This recovery plan has been documented in its final form (Graham 1992), and the practices followed to date. The plan set forth specific objectives to be met in order to change the cranes' classification status. Intensive inventories of sandhill crane nesting habitat were to be performed in order to determine whether sufficient nesting and recruitment were occurring for declassification. The United States Forest Service was also enlisted to work cooperatively with the CDOW in pursuit of these objectives. One of the USFS management contributions in 1982 was to close off California Park (a vital nesting area) to all motorized vehicles until July 1 of every year.

Sufficient funds were allocated in 1989 for an intensive study to be conducted through 1992. The objectives of these studies were:

- 1) Determine number of active nests by aerial and ground surveys.
- 2) Monitor nesting success in selected areas of interest.
- 3) Track movements of Colorado cranes through a juvenile banding program.
- 4) Conduct classification counts on fall staging grounds in order to determine recruitment rate (percentage of juveniles in total population) for the Colorado crane population.

The results of these studies can be found in a series of annual reports (Renner et al. 1989, 1990, 1991) and a summary report (Renner et al. 1992).

In 1993, only enough funds were allocated to conduct the fall staging ground counts at Hayden and a small banding program around the Hayden/Steamboat Springs area. These results were compiled into a summary report, including any accounts of nesting cranes from that year (Renner and Graham 1994). Again in 1995, sufficient funds were allowed to conduct an intensive inventory similar to the studies done from 1989 to 1992. The objectives remained similar except no juvenile banding was conducted, and further work was done to determine territory size in nesting habitats and the location of roosting sites at the fall staging grounds.

Colorado Sandhill Migratory Pattern

Each spring (late March-early April) migrating Colorado sandhill cranes begin arriving at the staging grounds near Hayden and the Elk River. (A staging ground is an area within the summer range where the birds congregate before dispersing and after leaving the breeding area). In Colorado, the staging grounds consist of wheat and hay fields in close proximity to the river, which they use for roosting. The wheat stubble may provide the bulk of their diet, while insects, earthworms, and amphibians from the hay meadows may supplement the nutritional protein needs for migration and breeding (Grooms).

The birds begin dispersing to nesting areas as the snow recedes in April and early May (Reckling 1979, Renner et al., 1992). Nesting pairs of sandhill cranes are very territorial and will commonly return to the same breeding territory and even the same nest each year.

Nesting habitat in Colorado consists primarily of undisturbed willow-lined drainages surrounded by open meadows or sagebrush parks, found between 1880 and 2690 m in elevation. This type of habitat occurs mostly in Routt and eastern Moffat counties, however, there are small areas in Jackson, Grand, Rio Blanco, and Mesa Counties known to be used by nesting cranes. Nest building and incubation generally occur from mid-May through June (Bieniasz 1978). The nests are usually built from vegetation or sticks and placed in or close to standing or slow-moving water. Renner et al. (1989) found that beaver lodges and hummocks of beaver ponds were commonly chosen nesting sites. In addition to nest building, the adults also spend several hours preening their feathers with a red mud or old vegetation in order to turn them a dark orange color. Ferric oxide was found by Taverner (1929), to be the agent responsible for the color change. It is believed that this process may aid in camouflaging the adults while they are nesting. (Grooms) The stained plumage is replaced again by gray feathers, as the cranes molt in the fall.

Sandhill cranes mate for life and both sexes share the nest building and incubation responsibilities. After the nest is built two eggs are typically laid, though the clutch size can be one and more rarely three. The incubation period is 30 days with the chicks hatching out from May to June. The family will feed close to the nest site for the first few days and may then move as much as 2 km away, depending on the amount of disturbance. If

undisturbed, the pair may stay within a few hundred meters of the nest site all summer.

Adult sandhill cranes have few predators. The eggs and chicks, on the other hand have many. Common predators of sandhill eggs and chicks in Colorado are raccoons, skunks, red foxes, coyotes, hawks, and golden eagles. Coyotes may be the most detrimental natural predator to the sandhill crane chick (Renner et al. 1992). Human and livestock disturbance (Bieniasz 1978) can also be cause for nest abandonment and chick loss. Sandhill cranes are very defensive and may go to great extent to protect their young. Parents show varying responses to a threat. Sometimes one adult may call and perform some form of a distraction display, even moving closer to the intruder, while the other walks away with the chick. Other parents may alarm call having the chick lie flat while they walk or fly away, possibly in an attempt to make the intruder think there are no young. And still other adults may run at and attack the intruder.

The family will often feed out in the open during morning and evening and will then move into the aspens or willows to roost during the heat of the day and at night. The sandhill has a very wide food range including; insects, earthworms, amphibians, small reptiles, and even small rodents. Even though the young are nidifugous and can obtain their own food, they will often beg from the adults throughout the summer. They have even occasionally been observed begging from parents on the staging grounds, though they are quite capable of feeding themselves.

Chicks fledge about 70 days after hatching and will remain with the adults for several more months following that. The family will leave for the fall staging grounds between mid-August and early-September. They will spend 2-4 weeks at the staging grounds before they make their migration south. It is believed that besides the nutritional importance of moving to these fields, fall staging may also play an important social function. Staging appears to initiate flocking and gregariousness, which contributes to education of the young and inexperienced birds (Melvin and Temple 1981).

Near the end of September the sandhill cranes gather in flocks, using the thermals to gain heights of as much as 6000 m, to begin their migration south. They winter in southwestern New Mexico and northeastern Mexico. The Colorado cranes make one significant stopover, joining almost all of the Rocky Mountain Population of greater sandhills in the San Luis Valley, in southcentral Colorado. The cranes will remain in this area, in and around the Monte Vista National Wildlife Refuge, into early November. From there they will continue the migration southward to the wintering grounds along the Rio Grande River.

METHODS

A sandhill crane census was conducted by helicopter between June 6 and June 10, 1995. This was about two weeks later than inventories had been done in previous years (1989-1992) due to the very late spring Colorado was experiencing. Snow conditions were about 250% of normal during the period censused. The flight route was also modified somewhat, expecting that more birds may have nested at lower elevations because of the late snowmelt.

The helicopter carried two observers and the pilot, with nine different CDOW personnel participating. Funds allowed for 25 hours of flight time. About five hours were spent in the North Park region and another 23.7 hours in concentration areas in Routt and Moffat Counties. The 23.7 hours included about four hours of ferry time for refueling so, actual flight time was 19.7 hours, with a total for the whole inventory being 24.7 hours.

As much area as available fuel and time would allow for were covered. The flight started on June 6 along the Yampa River from Craig to Hayden, then moved north over Morgan Creek and the Dry Fork of Elkhead Creek. The Aigner Mountain, Hole-in-the-Wall, California Park, Slater Park, Tunnel Creek, and the southern part of South Fork Park were also covered throughout the day. Due to the lack of fuel and time, the Buck Point/Wilderness Ranches area, northern part of South Fork Park, and the Little Snake River concentration areas were not surveyed.

The following day the Steamboat Springs, Yampa River between Morgan Bottom and Steamboat, Elk River, Steamboat and Pearl Lakes, and Independence Creek concentration areas were flown. Time did not allow for the Williams Fork or Dunkley areas to be covered. The Middle Park region was flown on June 8 and North Park on June 10. No flight time was spent in Rio Blanco or Mesa Counties.

Nests were located by flying along drainages at an altitude of 20-30 m. Particular attention was rendered to probable locations like; beaver dams, lodges, hummocks, willow thickets, and historic sites. Since a nesting crane can be very inconspicuous, most locations were found when the incubating adult flushed from the nest. All sightings of nests, breeding pairs (pairs with chicks in which no nest was located), non-breeding pairs, and bachelor groups were recorded on a datasheet including location and habitat. The exact locations of these sightings were then transferred to United States Geological Survey 7.5 minute topographic maps using the UTM coordinate system. All coordinates were located in UTM zone 13.

All active and possible active nest sites were assigned numbers based on the USGS map on which they were located; e.g. the third nest on the Hayden quadrangle is #H3. Possible active nests were sightings that no nest or chicks were seen, but nesting was very likely due to the adults behavior and/or it was a historical site with a pair of adults present. All historic sites used again this year were given their assigned number from previous years (1989-1992). All new nests were assigned new numbers also corresponding to the quadrangle on which they were located. They

were then grouped by geographic concentration areas for easier reference (Table 2).

Monitoring the nests by ground began June 21 by a temporary CDOW employee. Due to lack of time and accessibility most ground efforts were concentrated in the California Park (35 km north of Hayden) and Steamboat Lake (40 km north of Steamboat Springs) areas. These areas generally have a high concentration of nests and much of the land is public, so is easily accessed. California Park and Steamboat Lake have been the focus of studies in previous years (Bieniasz 1976, 1978; Caulfield and Lytle 1980; Lytle and Pye 1981; Ellis et al. 1982; Renner et al. 1989, 1990, 1991, 1992) and so there was also a great deal of data for comparison with this year's findings. Permission was also granted to monitor Lake Windemere, private property 3.6 km north of Hwy 40 near the Elk River, where five pairs of cranes had nested unusually close together on a small reservoir. This was an interesting situation that may be helpful for future management purposes, and development of crane habitat.

Ground monitoring involved locating the nesting pairs of cranes found with the aerial surveys by foot or vehicle and making observations about their nesting and rearing status. This was done by watching the birds through 7 x 35 binoculars and/or a 15x-45x power spotting scope mounted on a tripod at reasonable enough distance to avoid detection. The birds were watched in early morning and late afternoon, while they were the most active. The nesting areas were observed regularly to determine hatching success and date, number of chicks, chick survival, territory size, and departure for the staging grounds.

Ground work was also done to try to confirm any pairs listed as possible nesters and to locate any new nests in areas that were not covered by the helicopter. Regions of historic nesting were checked and information from landowners used to determine if there were any pairs nesting in those areas this year. Another priority was locating and identifying any cranes that had been leg-banded in previous study years.

Hatching success was determined by either seeing the young or observing the nest for signs of successful incubation. The nest was deemed triumphant if there were eggshell fragments and downy feathers in it or the eggshell and membranes could be located nearby. Drewien (1973) found that adults will commonly remove the eggshell and membrane after hatching and place it in the water or vegetation several meters from the nest. A pair was concluded to have lost their young if they could no longer be found in their territory or were seen in their territory without the chick(s).

The first fall staging ground count at Hayden was conducted on August 16. From August 21 through September 5 they were conducted once daily in the evenings. From September 6-24 they were conducted twice daily whenever possible, in the morning between 0700 and 1000 hours and again in the evening between 1700 and 1900.

In previous years, three separate staging grounds used by the Colorado sandhills had been identified. The largest is the Hayden Staging Area, which consists of wheat fields near the Hayden Airport and Power Plant and Morgan Bottom, a ranching area along

the Yampa River, 5 km east of Hayden. Even though these fields are 4.5 km apart the cranes use the same roosting area and will use the fields interchangeably, so both locations are considered as only one staging ground. The second staging ground is located 11 km west of Steamboat Springs along the Elk River. The fields used in this staging area could not be seen from the county road and the property owner refuses access to them, so classifications could only be made from the public road by counting the number of cranes flying to and from the fields at feeding periods. Only three counts were conducted at this staging ground, since this was not a very accurate classification method and the number of juveniles could not be determined. The third staging ground used in previous years was near the airport at Dixon, Wyoming. There are no longer wheat fields in this area, therefore, no counts were conducted this year.

Staging ground classifications were conducted using a 15x-60x power spotting scope and a Meade high-power spotting scope on a window mount attached to the vehicle. A total count of birds was taken using a clicker counter and then another count was made identifying each bird as an adult or a juvenile. Juveniles can be identified by a difference in their head markings, body plumage, size, and behavior described in Miller and Hatfield (1974). These numbers were recorded and then used to calculate the annual recruitment rate. Recruitment rate is the percentage of juveniles in the total population.

All the cranes on the staging grounds at Hayden were checked for Colorado leg-bands or any form of band from other states. Any bands that could be located were then identified by the number or color-markings and recorded.

A small amount of time was also allowed this year to determine where the sandhill cranes were roosting at the staging area. The birds were observed as they left the wheat fields in the morning and in the evening. They were then observed at the areas along the river where they were known to go after leaving the fields.

Two areas were identified as possible nesting sites. One area was confirmed nesting sites. Five hatched successfully, three failed before hatching, and the status of one could never be determined. In the Steamboat Lake concentration area there were 14 confirmed and two are possible nest sites located. Two of the sightings, H415 and SP37, are considered together since they are a pair of adults with a chick seen within 1 km of an empty nest. Three of the known nests failed, four hatched successfully, and the status of seven could not be determined.

Combining the two concentration areas, the hatching success was calculated using the 15 nests in which the status could be determined. Nine of the 15 nests hatched at least one chick for a success rate of 60%. This rate was similar to the hatching success of 1980 and 1981 (Beemer et al. summary 1982).

In California Park, no chicks were found to survive to fledging. This area has always had an unusually low production rate, but this was the first year of study since 1982 that no fledged chicks could be confirmed. There was one sighting of three birds flying across Elkhead Creek on August 25 near a nest site.

RESULTS

POPULATION and DISTRIBUTION

A minimum of 355 adult greater sandhill cranes were located in Routt, Moffat, Jackson, Grand, Rio Blanco, and Mesa Counties by helicopter and ground. Of these, 82 pairs were actively nesting and another 17 pairs were very likely nesting within Routt, Moffat, and Jackson Counties (Table 1). There were no nest sites located in Grand, Rio Blanco, or Mesa Counties this year. Nesting areas in Rio Blanco and Mesa Counties were not flown with the helicopter and only checked by ground late in the nesting season, so the potential for nests in these areas is a good possibility, even though none could be confirmed. All of the active and possible active nests found for 1995 are depicted on a regional map (Fig.6).

All verified nests occurred at elevations between 1840 and 2560 m with most nests located at about 2360 m in the California Park and Steamboat Lake concentration areas. The mean clutch size was 1.74 eggs per active nest (94 eggs in 54 nests).

Two new breeding areas were found since the last intensive study was conducted in 1992. The first was the movement of nesting west along the Little Snake River near the Wyoming border (TM12), and the second was a very likely nesting pair reported on Harrison Creek near Vega Reservoir in Mesa County. The pair on Harrison Creek has been there since 1993 and are believed to be nesting though no young can ever be confirmed. The nest on the Little Snake River is probably not a new breeding range, but just an extension of the already known breeding range from further east on the Little Snake River.

NESTING SUCCESS

Nesting success was monitored most intensively in the two previously selected concentration areas of California Park and Steamboat Lake. In the California Park concentration area there were nine active nests and one more possible site. Of the nine confirmed nesting sites, five hatched successfully, three failed before hatching, and the status of one could never be determined. In the Steamboat Lake concentration area there were 14 confirmed and two more possible nest sites located. (Two of the sightings, HP15 and HP37, are considered together since they are a pair of adults with a chick seen within 1 km of an empty nest.) Three of the known nests failed, four hatched successfully, and the status of seven could not be determined.

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TABLE 1. SUMMARY OF ACTIVE AND POSSIBLE ACTIVE SANDHILL CRANE NESTS IN NORTHWEST COLORADO, 1995.

NEST NAME	NEST ID	DRAINAGE	CONC AREA	HABITAT TYPE	OBS DATE	EGGS	CHICKS	ADULTS	ELEV	COMMENTS	
BEARS EARS #21	BE21	ELKHEAD CREEK	CP	GRASS/WILLOWS	06/06/95	2		1	2380	HISTORIC SITE USED '92, BOTH CHICKS HATCHED 7/1, NOT SEEN AGAIN, FLT#57	
BEARS EARS #30	BE30	STUKEY CREEK	CP	BEAVER PONDS	06/06/95			1	2420	POSSIBLE NEST IN ASPENS, FLT#50	
BEARS EARS #31	BE31	JOKODOWSKI CREEK	CP	HUMMOCK/BEAVER POND	06/06/95	2		1	2335	NEW NEST, NO CHICKS SEEN, NEST DID NOT APPEAR TO HAVE HATCHED, FLT#51	
BEARS EARS #36	BE36	CIRCLE CREEK	CP	STICK/WILLOWS	06/24/95	2		2	2360	NEW NEST, HATCHED 7/7, CHICKS WERE NEVER SEEN, COYOTE WAS PRESENT IN AREA 7/17, OBS#158	
MEADEN PEAK #1	MP1	TORSO CREEK	CP	HUMMOCK/BEAVER POND	06/06/95	1		2	2480	HISTORIC SITE USED SINCE 1980'S, ADULTS BEHAVIOR INDICATED LIKELY CHICK, PAIR SEEN W/O CHICK 7/26, FLT#56	
PILOT KNOB #4	PK4	ARMSTRONG CREEK	CP	GRASS/WILLOWS	06/06/95	2		1	2335	HISTORIC SITE, BOTH CHICKS HATCHED 6/25, NOT SEEN AFTER 7/4, PAIR W/O CHICKS SEEN 0.75 KM N. OF NEST 8/95, FLT#55	
PILOT KNOB #9	PK9	FIRST CREEK	CP	STICK/BEAVER DAM	06/06/95	2		1	2370	NEW NEST, COULD NOT BE LOCATED TO DETERMINE IF HATCHED, PAIR SEEN W/O CHICKS 0.5 KM S. OF NEST 8/1, FLT#45	
QUAKER MOUNTAIN #13	QM13	ELKHEAD CREEK	CP	STICK/ OLD OXBOW	06/06/95	1			2325	HISTORIC SITE USED '90, '91, NO INDICATION OF NEST HATCHING, FLT#54	
QUAKER MOUNTAIN #24	QM24	SECOND CREEK	CP	STICK/BEAVER LODGE	06/06/95	2		0	2360	HISTORIC SITE USED '91, EGGS WERE FOUND BROKEN OPEN ON HELICOPTER FLIGHT, PREDATOR MOST LIKELY, NO ADULTS PRESENT, FLT#46	
QUAKER MOUNTAIN #38	QM38	ELKHEAD CREEK	CP	WILLOWS	06/06/95		1	1	2315	NEW NEST, CHICK 1 WEEK OLD, NEVER SEEN AGAIN, FLT#48	
HOOKER MOUNTAIN #6	HM6	DRY FK-ELKHEAD	EHR	SAGE/ISLAND	06/06/95	2			1960	HISTORIC SITE USED '91, '92, NOT MUCH OF A NEST, FLT#21	
HOOKER MOUNTAIN #7	HM7	DRY FK-ELKHEAD	EHR	SAGE	06/06/95			U	2	1960	POSS. NESTING PAIR, NO CHICKS OBS, BUT PAIR WAS RELUCTANT TO FLY, FLT#24
HOOKER MOUNTAIN #10	HM10	MORGAN CREEK	EHR	GRASS/CATTAILS	06/06/95	2		1	2090	NEW NEST, NW OF POND, PAIR SEEN W/O CHICKS 7/30, FLT#83	
HOOKER MOUNTAIN #11	HM11	MORGAN CREEK	EHR	HUMMOCK/CREEK	06/06/95			U	2	2075	NEW NEST, 25 YDS FROM CR80, 1 FLEDGLING SEEN 8/95, FLT#84
QUAKER MOUNTAIN #32	QM32	DRY FK-ELKHEAD	EHR	GRASS/SAGE/WILLOW	06/06/95	2		1	2020	NEW NEST, TWO 1 1/2 MONTH OLD CHICKS SEEN 7/26, FLT#25	
QUAKER MOUNTAIN #33	QM33	DRY FK-ELKHEAD	EHR	WILLOWS/MEANDER	06/06/95	1			2040	NEW NEST, NEST VERY NEAR HIGH WATER, PAIR SEEN W/O CHICKS 7/26, FLT#27	
CLARK #3	C3	ELK RIVER	ER	GRASS/BRUSH	08/09/95		1	2	2125	HISTORIC SITE USED '89-'92, FLEDGLING LAST SEEN 8/24, OBS#164	
CLARK #4	C4	DUTCH GULCH	ER	BEAVER LODGE	06/07/95	1			2315	HISTORIC SITE USED '90, '91, FLT#125	
CLARK #10	C10	ELK RIVER	ER	HUMMOCK	06/07/95	0		2	2045	POSS. NEST, HISTORIC SITE USED '92, PAIR WAS NEAR EMPTY NEST, MAY HAVE HIDDEN CHICK(S), FLT#119 & #120	
CLARK #11	C11	DEEP CREEK	ER	MEADOW	06/07/95		1	2	2055	HISTORIC SITE USED '92, FLT#121	
CLARK #12	C12	DUTCH GULCH	ER	BEAVER LODGE	06/07/95	2		1	2325	NEW NEST, FLT#124	
CLARK #13	C13	DUTCH GULCH	ER	GRASS/HUMMOCK	06/07/95	1		1	2290	NEW NEST, FLT#126	
MAD CREEK #4	MC4	ELK RIVER	ER	MEADOW	06/07/95			4	2030	POSS. NEST, HISTORIC SITE, FLT#118	
WOLF MOUNTAIN #5	WM5	SALT CREEK-TRIB	ER	GRASS	06/07/95	0		0	2100	EMPTY NEST, NO BIRDS OBS. NEARBY, NOT KNOWN IF USED, FLT#114	
WOLF MOUNTAIN #6	WM6	DEEP CREEK	ER	NEST UNK.	06/07/95			2	2150	POSS. NESTERS, PAIR DISPLAYED DEFENSE POSTURES, BUT NO CHICKS COULD BE LOCATED, FLT#122	
WOLF MOUNTAIN #7	WM7	DEEP CREEK	ER	NEST UNK.	06/07/95			2	2170	POSS. NESTERS, NO NEST OR CHICKS OBS., FLT#123	

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NEST NAME	NEST ID	DRAINAGE	CONC AREA	HABITAT TYPE	OBS DATE	EGGS	CHICKS	ADULTS	ELEV	COMMENTS
QUAKER MOUNTAIN #6	QM6	ELKHEAD CRK-TRIB	HW	BEAVER POND	06/16/95	1	2	2275		HISTORIC NEST, SURVIVAL OF CHICK UNK., OBS#166
QUAKER MOUNTAIN #8	QM8	ELKHEAD CREEK	HW	STICK/BEAVER POND	07/06/95	0	0	2290		HISTORIC NEST USED '92, NO SIGN OF BIRDS, ONLY DOWNY FEATHERS IN NEST, OBS#161
QUAKER MOUNTAIN #16	QM16	BIG CANYON CREEK	HW	HUMMOCK	06/06/95	2		2465		HISTORIC SITE USED '90, '91, '92, FLT#40
QUAKER MOUNTAIN #34	QM34	CALF CREEK	HW	OLD BEAVER LODGE	06/06/95	1	1	2180		NEW NEST, NOT MUCH OF A NEST, FLT#29
QUAKER MOUNTAIN #35	QM35	CALF CREEK	HW	BEAVER LODGE	06/06/95	4		2180		NEW NEST, ONE EGG AN ODD COLOR, BUT OUR FIRST RECORD OF FOUR EGGS BEING LAID, FLT#30
QUAKER MOUNTAIN #36	QM36	SLUMP	HW	NEST UNK	06/06/95		2	2185		POSS. NESTERS, CHICKS VERY LIKELY, ONE ADULT WOULD NOT FLY, FLT#32
QUAKER MOUNTAIN #37	QM37	SLUMP	HW	GRASS/BEAVER DAMS	06/06/95	2		2290		NEW NEST NEAR SMALL DRAINAGE, FLT#35
QUAKER MOUNTAIN #39	QM39	ELKHEAD CRK-TRIB	HW	HUMMOCK	05/25/95	0	0	2135		NEW NEST, WAS WASHED OUT BY HIGH WATER IN EARLY JUNE, OBS#165
SLIDE MOUNTAIN #2	SLW2	N FK ELKHEAD CRK	HW	GRASS	06/06/95	2	2	2100		HISTORIC SITE USED '91, '92, NEST NOT LOCATED, BUT CHICKS SEEN BY J. SUNDBERG 6/15, FLT#38
SLIDE MOUNTAIN #3	SLW3	ELKHEAD CREEK	HW	GRASS	06/06/95	1	2	2230		NEW NEST, NEST WAS NOT LOCATED, BUT J. SUNDBERG SAW ONE CHICK ON 6/15, FLT#37
ELKHORN MOUNTAIN #10	EM10	INDEPENDENCE CREEK	IC	WILLOW/BEAVER POND	07/28/95	0	0	2480		NEW NEST, NO SIGN OF BIRDS OR A SUCCESSFUL HATCH, OBS#162
ELKHORN MOUNTAIN #12	EM12	BOX CREEK	IC	HUMMOCK/BEAVER POND	06/07/95	2	1	2300		HISTORIC SITE USED '89, '92, FLT#154
ELKHORN MOUNTAIN #13	EM13	SUMMIT CREEK	IC	STICK/HUMMOCK/BVR POND	06/07/95	2	1	2305		NEW NEST, FLT#150
ELKHORN MOUNTAIN #14	EM14	INDEPENDENCE CREEK	IC	GRASS/CREEK	06/07/95	1	1	2285		NEW NEST, FLT#151
SHIELD MOUNTAIN #4	SM4	DUDLEY CREEK	IC	HUMMOCK/BEAVER POND	06/07/95	1	4	2265		HISTORIC SITE USED '90, '91, NEST VERY LIKELY HATCHED, PAIR WAS SEEN W/O CHICK 7/28, FLT#153
SHIELD MOUNTAIN #9	SM9	LITTLE SNAKE RIVER	LSR	POSS. IN MARSH/MEADOW	06/27/95	1	2	2060		HISTORIC SITE USED '91, '92, NEW PAIR USING TERRITORY, ONE ADULT W/ CO LEG BAND, # WAS NOT OBTAINED, OBS#159
TUMBLE MOUNTAIN #12	TM12	LITTLE SNAKE RIVER	LSR	NEST UNK.	07/05/95	2	2	1995		NEW NEST, CHICKS HATCHED 7/1, BOTH FLEDGED, OBS#160
TEAL LAKE #1	TL1	L. GRIZZLY CREEK	NP	HUMMOCK	06/10/95	2	1	2480		HISTORIC SITE USED '91, FLT#178
TEAL LAKE #3	TL3	L. GRIZZLY CREEK	NP	WILLOWS	06/10/95		1	2425		POSS. NESTERS, HISTORIC SITE, FLT#179
TEAL LAKE #5	TL5	NEWCOMB CREEK	NP	HUMMOCK	06/10/95	0	0	2560		EMPTY NEST, NOT SURE IF USED THIS YEAR, FLT#181
WEST FORK LAKE #1	WFL1	ENCAMPMENT RIVER	NP	HUMMOCK/RUSHES	06/10/95	1	1	2560		HISTORIC SITE USED '91, FLT#182
MEADEN PEAK #11	MP11	S FK LITTLE SNAKE	SFP	HUMMOCK/BEAVER POND	06/06/95	2	1	2465		HISTORIC SITE USED '90, '91, '92, FLT#79
SHIELD MOUNTAIN #15	SM15	S FK LITTLE SNAKE	SFP	GRASS/POND	07/31/95	2	2	2350		NEW NEST, HATCHED 7/20, ONE DEAD CHICK WAS FOUND AT EDGE OF NEST IN WATER, OTHER CHICK LAST SEEN 8/17, OBS#163
HAHNS PEAK #8	HP8	WAYS GULCH	SL	WILLOWS	06/07/95		2	2390		POSS. NEST AT HISTORIC SITE, FLT#137
HAHNS PEAK #9	HP9	WAYS GULCH	SL	WILLOWS	06/07/95		2	2390		POSS. NEST AT HISTORIC SITE, FLT#136
HAHNS PEAK #12	HP12	BEAVER CREEK	SL	WILLOW/HUMMOCK/BVR POND	06/07/95	2	1	2405		HISTORIC SITE USED '90, '91, '92, FLT#138

TABLE 1. SUMMARY OF ACTIVE AND POSSIBLE ACTIVE SANDHILL CRANE NESTS IN NORTHWEST COLORADO, 1995.

NEST NAME	NEST ID	DRAINAGE	CONC AREA	HABITAT TYPE	OBS DATE	EGGS	CHICKS	ADULTS	ELEV	COMMENTS
HAHNS PEAK #15	HP15	BEAVER CREEK	SL	WILLOWS	06/07/95	0	0	0	2335	HISTORIC SITE USED '90, '91, '92, FOUND NEST ONLY, NO BIRDS, FLT#143
HAHNS PEAK #16	HP16	RED CREEK-TRIB	SL	BEAVER LODGE	06/07/95	1	2	2	2390	HISTORIC SITE, FLT#127
HAHNS PEAK #17	HP17	MILL CREEK	SL	GRASS	06/07/95	2	0	0	2370	HISTORIC SITE, NEST ABANDONED DUE TO DISTURBANCE FROM FISHERMEN, PARKS REMOVED EGGS PRIOR TO FLIGHT, FLT#148
HAHNS PEAK #19	HP19	DEEP CREEK	SL	WILLOW/HUMMOCK	06/07/95	2	1	1	2395	HISTORIC SITE USED '90, '91, '92, ONE CHICK WAS KNOWN TO HATCH ~6/20, IT FLEDGED AND WAS LAST SEEN 9/4, FLT#145
HAHNS PEAK #21	HP21	RED CREEK	SL	WILLOWS	06/07/95	2	1	1	2370	HISTORIC SITE USED '91, NEST COULD NOT BE LOCATED TO DETERMINE IF HATCHED, NO BIRDS OBSERVED IN AREA, FLT#133
HAHNS PEAK #32	HP32	WILLOW CREEK	SL	GRASS	06/07/95	2	0	0	2350	NEW NEST, 0.75 KM BELOW DAM, SUCCESS UNKNOWN, BIRDS COULD NOT BE LOCATED, FLT#130
HAHNS PEAK #33	HP33	WILLOW CREEK	SL	PERCHED POND	06/07/95	2	2	2	2350	NEW NEST 100 YDS FROM CREEK, SUCCESS UNKNOWN, BIRDS COULD NOT BE LOCATED, FLT#131
HAHNS PEAK #34	HP34	INT. PEARL LAKE	SL	WILLOWS	06/07/95	U	1	1	2405	NEW NEST, BIRD DID NOT FLUSH, PAIR SEEN W/O CHICKS THROUGHOUT SUMMER, FLT#140
HAHNS PEAK #35	HP35	UPPER LESTER CREEK	SL	WILLOWS/BEAVER POND	06/07/95	U	0	1	2385	NEW NEST, EGG(S) TAKEN BY UNKNOWN AGENT, FLT#141
HAHNS PEAK #36	HP36	BEAVER CREEK	SL	GRASS/BEAVER POND	06/07/95	0	0	2	2350	NEW NEST, FOUND EMPTY NEST AND PAIR W/O CHICKS, FLT#142
HAHNS PEAK #37	HP37	BEAVER CREEK	SL	WILLOWS	06/07/95	1	1	1	2325	NO NEST FOUND, PROBABLY FROM EMPTY NEST HP#15, FLT#144
HAHNS PEAK #38	HP38	LARSEN CREEK	SL	GRASS/WILLOW/BVR POND	06/07/95'	2	1	1	2370	NEW NEST, PROBABLY PAIR THAT USUALLY NESTS UPSTREAM, ONE EGG ABANDONED ON NEST DUE TO DISTURBANCE FROM FISHERMEN, FLT#146
HAHNS PEAK #39	HP39	N. FLOYD CREEK	SL	GRASS.WILLOWS/CREEK	06/07/95	2	1	1	2380	NEW NEST, PROBABLY BIRDS THAT USUALLY NEST UPSTREAM, 1 CHICK KNOWN TO HATCH ~7/1, BIRDS LAST SEEN W/ CHICK 7/28, FLT#147
MEADEN PEAK #21	MP21	RED CREEK	SL	WILLOW/BEAVER POND	06/07/95	2	1	1	2410	NEW NEST, FLT#135
BEARS EARS #5	BE5	GRIZZLY CREEK	SP	HUMMOCK/BEAVER POND	06/06/95	2	1	1	2395	HISTORIC SITE, FLT#71
BEARS EARS #9	BE9	ADAMS CREEK	SP	GRASS/BEAVER POND	06/22/95	0	U	2	2535	HISTORIC SITE WITH EMPTY NEST, ADULTS BEHAVIOR INDICATED HIGH POSSIBILITY OF CHICKS, OBS#157
BEARS EARS #24	BE24	DOUGLAS CREEK	SP	STICK/BEAVER POND	06/06/95	2	1	1	2455	HISTORIC SITE USED '92, FLT#70
BEARS EARS #25	BE25	DOUGLAS CREEK	SP	STICK/BEAVER POND	06/06/95	2	1	1	2430	HISTORIC SITE USED '92, FLT#69
BEARS EARS #32	BE32	SLATER CREEK	SP	STICK/WILLOWS	06/06/95	1	2	2	2440	NEW NEST, BIRD STILL ON NEST 6/25, FLT#63
BEARS EARS #33	BE33	SLATER CREEK	SP	GRASS/WILLOWS	06/06/95	2	1	1	2435	NEW NEST, HATCHED BY 6/25, FLT#64
BEARS EARS #34	BE34	SLATER CREEK	SP	GRASS/WILLOWS	06/06/95	2	2	2	2395	NEW NEST, FLT#66
BOCK POINT #1	BP1	SLATER CRK-TRIB	SP	STICK/BEAVER POND	06/06/95	2	1	1	2325	HISTORIC SITE ON POND NEAR ROAD, FLT#72
MEADEN PEAK #14	MP14	SLATER CREEK	SP	BEAVER LODGE	06/06/95	1	2	2	2465	HISTORIC SITE USED '92, FLT#80
MEADEN PEAK #20	MP20	SLATER CREEK	SP	SAGE	06/06/95		1	1	2470	POSS. NEST, MAY BE BIRDS THAT USUALLY NEST HIGHER UP IN TREES, FLT#61
STEAMBOAT SPRINGS #3	SS3	YAMPA RIVER	SS	CATTAILS	06/07/95	1	2	2	2005	NEW NEST, FLT#85
BEARS EARS #6	BE6	TUNNEL CREEK	TC	STICK/BEAVER POND	06/06/95	1	1	1	2395	HISTORIC SITE, CHICK LESS THAN 1 WEEK OLD, FLT#75

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TABLE 1. SUMMARY OF ACTIVE AND POSSIBLE ACTIVE SANDHILL CRANE NESTS IN NORTHWEST COLORADO, 1995.

NEST NAME	NEST ID	DRAINAGE	COMC AREA	HABITAT TYPE	OBS DATE	EGGS	CHICKS	ADULTS	ELEV	COMMENTS
BEARS EARS #35	BE35	TUNNEL CREEK	TC	HUMMOCK/BEAVER POND	06/06/95	2		1	2420	NEW NEST 0.4 KM ABOVE HISTORIC SITE BE#6, FLT#74
COW CREEK #2	CC2	TROUT CREEK	TW	SAGE	06/07/95		1	2	1935	NEW NEST, FLT#97
MILNER #6	M6	FISH CREEK	TW	SAGE	06/07/95		1	2	1945	NEW NEST, FLT#92
COW CREEK #1	CC1	YAMPA RIVER	YRE	GRASS	06/07/95		1	2	1930	HISTORIC SITE, FLT#100
COW CREEK #3	CC3	ELK RIVER	YRE	NEST UNK.	06/07/95			2	1930	POSS. NEST, BEHAVIOR INDICATES LIKELY NESTING, FLT#105
COW CREEK #4	CC4	YAMPA RIVER	YRE	CATTAILS/SLOUGH	06/07/95	1		2	1930	NEW NEST, HATCHED 6/20, CHICK WAS SEEN AGAIN IN EARLY 8/95, OBS#156
MILNER #7	M7	TOW CREEK	YRE	CATTAILS	06/07/95		1	1	1905	NEW NEST, COULD BE SEEN FROM HWY 40, OBS#155
MAD CREEK #6	M6	ELK RIVER	YRE	MEADOW/NESTS UNK.	06/07/95		6	29	1935	AT LEAST 3 DIFFERENT NEST BROODS WITH LARGE GROUP OF BIRDS, FLT#104
MAD CREEK #7	MC7	LAKE WINDEMERE	YRE	CATTAIL HUMMOCK/LAKE	06/07/95	2		1	1970	NEW NEST, WAS ABANDONED AFTER EGGS FAILED TO HATCH, FLT#107
MAD CREEK #8	MC8	LAKE WINDEMERE	YRE	CATTAIL HUMMOCK/LAKE	06/07/95	2		1	1970	NEW NEST, 10 M FROM MC#9, PAIR SEEN W/O CHICKS 7/7, FLT#108
MAD CREEK #9	MC9	LAKE WINDEMERE	YRE	CATTAIL HUMMOCK/LAKE	06/07/95	1		1	1970	NEW NEST, CHICK HATCHED 6/25, WAS LAST SEEN 7/27, FLT#109
MAD CREEK #10	MC10	LAKE WINDEMERE	YRE	CATTAIL HUMMOCK/LAKE	06/07/95	2		1	1970	NEW NEST, BEHAVIOR INDICATED POSS. CHICK(S) 6/25, SEEN 7/27 W/O ANY CHICKS, FLT#110
MAD CREEK #11	MC11	LAKE WINDEMERE	YRE	CATTAIL HUMMOCK/LAKE	06/07/95	2		2	1970	NEW NEST, HATCHING STATUS UNKNOWN, PAIR WAS SEEN 7/27 W/O ANY CHICKS, FLT#111
MAD CREEK #12	MC12	DECORA GULCH	YRE	CATTAIL/MARSH	06/07/95	2		1	1980	NEW NEST, FLT#106
HAYDEN #1	H1	YAMPA RIVER	YRW	GRASS FIELD	06/06/95		1	2	1865	HISTORIC SITE USED '92, DID NOT SEE BIRDS ON FLIGHT, WERE OBSERVED BY M. BAUMAN PREVIOUSLY, FLT#13
HAYDEN #3	H3	YAMPA RIVER	YRW	CATTAIL/SLOUGH	06/06/95	1		0	1865	NEW NEST, PAIR WAS SEEN WITH FLEDGLING IN WHEAT FIELD N. OF NEST SITE ON 9/23 & 24, FLT#12
HOOKE MOUNTAIN #9	HM9	YAMPA RIVER	YRW	SLOUGH	06/06/95		2	2	1890	HISTORIC SITE USED '91, '92, FAMILY LOCATED 0.5 KM FROM PROBABLE NEST SITE, BOTH CHICKS WERE KNOWN TO HAVE FLEDGED, FLT#16
HOOKE MOUNTAIN #2	HM2	YAMPA RIVER	YRW	MARSH/MEADOW	06/06/95		0	1	1890	HISTORIC SITE, NESTING COULD NOT BE CONFIRMED, BUT PAIR WAS REPORTED TO HAVE PROBABLE CHICK IN 8/95, FLT#18
RALPH WHITE LAKE #3	RWL3	YAMPA RIVER	YRW	COTTONWOOD GROVE	06/06/95		1	2	1840	NEW NEST, CHICK LESS THAN THREE DAYS OLD, FLT#5

Table 2. Abbreviations of nest names and concentraion areas for the sandhill crane study in northwest Colorado, 1995

TOPOGRAPHIC MAP NAME	ABBR.	CONCENTRATION AREA	ABBR.
Bears Ears Peaks	BE	California Park	CP
Buck Point	BP	Elk River	ER
Clark	C	Elkhead Reservoir	EHR
Cow Creek	CC	Hole-in-the-Wall	HW
Elkhorn Mountain	EM	Independence Creek	IC
Hahns Peak	HP	Little Snake River	LSR
Hayden	H	North Park	NP
Hooker Mountain	HM	South Fork Park	SFP
Mad Creek	MC	Steamboat Lake	SL
Meaden Peak	MP	Steamboat Springs	SS
Milner	M	Tunnel Creek	TC
Pilot Knob	PK	Twenty-mile	TM
Quaker Mountain	QM	Yampa River East	YRE
Ralph White Lake	RWL	Yampa River West	YRW
Sheild Mountain	SM		
Slide Mountain	SLM		
Steamboat Springs	SS		
Teal Lake	TL		
Tumble Mountain	TM		
West Fork Lake	WFL		
Wolf Mountain	WM		

(QM38) where one chick was located during the helicopter flights. Only one adult bird could be identified, so it is possible that this was a pair with a chick that had stayed out of sight until the chick fledged. These birds could not be located again and so this possibility can not be confirmed.

At Steamboat Lake, there were no data confirming the disappearance of any of the hatched chicks, but only one chick and probably another were known to fledge. The status of the other two chicks was unknown.

Steamboat Lake has historically been more successful at producing fledged chicks than California Park (Renner et al. 1989-1992). Even then, the production has been declining since the studies began in 1989. This year's data further confirms this decline.

If the two concentration areas are combined to calculate the nest production (number of fledged chicks from number of nests for which success is known), then the rate is 0.14 (2 chicks from 14 nests). Since the sample size for this year is smaller than any used in previous years (26 nests in 1992, 21 in 1991, 20 in 1990, and 18 in 1989), the estimated production rate should be used with some caution in comparing with previous estimated rates. Even if the seven nests at Steamboat Lake, for which success was unknown, fledged a chick and the possible chick from California Park was included the rate would only be 0.45 (10 chicks for 22 nests). This is the maximum production rate that could have been obtained in 1995 and extremely optimistic. Even this maximum rate is lower than the calculated nest production in 1989 and 1990. The actual nest production for 1995 is much lower than those of previous years. In 1989 the nest production rate was 0.56, in 1990 it was 0.55, 1991 was 0.42, and in 1992 it was 0.37 (Renner et al. summary 1992). An obvious decreasing trend in production rate has been occurring each year of the study with this year's rate being significantly low at 0.14. Ivey (1990) found that a stable or slowly increasing population should result if three chicks from every ten nests fledge. If the 0.14 is representative of the whole Colorado population, then it is likely that a decline in the population numbers will result.

<u>Year</u>	<u>Active Nests</u>	<u>Hatching Success</u>	<u>Nest Production</u>
1989	73	73%	0.56
1990	94	65%	0.55
1991	115	61%	0.42
1992	107	71%	0.37
1995	82	60%	0.14

NESTS by CONCENTRATION AREA

Status of all the sandhill crane nests found in 1995 in which pertinent information was known are detailed below. The California Park, Steamboat Lake, and Lake Windemere areas are discussed thoroughly since enough time was spent in these areas to monitor all or most of the nests.

California Park

California Park has one of the largest sandhill crane nesting concentrations in Colorado. This area has been selected for more intensive monitoring because of this fact. Nine nests were confirmed as active and one more as very likely.

BE21, Elkhead Creek: Both eggs hatched around July 1. John Sundberg from the USFS reported seeing the pair moving the chicks away from the nest on July 4 across the road toward Knowles creek. This nest was considerably close to the road and birds may have been disturbed by traffic after the road closure was removed on July 1. The chicks were never seen again, though a pair of adults was seen in the Knowles Creek area through August.

BE30, Stukey Creek: A nest could not be located here by helicopter or ground search. A pair of cranes was commonly in the area but no chicks were ever seen.

BE31, Jokodowski Creek: A pair was occasionally seen upstream from the nest site without chicks. The nest did not appear to have hatched.

BE36, Circle Creek: This nest was discovered by ground search on June 24. It contained 2 eggs that hatched the first week of July. Chicks were not seen, but adults behavior indicated their presence on July 11. The pair was not seen again until August 8 when they were spotted about 1 km upstream without any chicks. Coyotes were seen and commonly heard in this drainage.

MP1, Torso Creek: The adults were seen feeding apart and displaying distraction behaviors indicating possible chick(s) on July 12 and 17. The pair was seen on July 26 without chicks. They remained in their territory until they left for the staging grounds.

PK4, Armstrong Creek: Both eggs hatched about June 25. Two chicks were last seen with the adults on July 4. In August, a pair was commonly seen without any chicks 1 km north of the nest site until sheep were moved through the area.

PK9, First Creek: The nest could not be located to determine hatching. A pair without chicks was seen in trees 1/2 km south of nest site on August 1.

QM13, Elkhead Creek: The nest did not appear to have hatched. Sometime after the pair began nesting here, a beaver dam broke, draining the surrounding oxbow. This left the nest site on dry, open ground and very vulnerable to predators. The pair remained in the area until cattle were moved in.

QM24, Second Creek: Two eggs were found broken open on the nest during the helicopter flight on June 6. The eggs appeared to have been destroyed by an unknown predator. There were no adults present nearby.

QM38, Elkhead Creek: One chick less than a week old was seen on the helicopter flight June 6. The chick could not be found by ground search. On August 25, three cranes flew from the trees 1 km northwest of the nest site and across Elkhead Creek. Only one adult could be identified, allowing the slight possibility that this is the pair with the chick, and that they stayed out of sight until the chick fledged. This could not be confirmed.

Steamboat lake

The Steamboat Lake/Hahns Peak basin is the second area selected for intensive monitoring due to its high sandhill crane nesting concentration. Steamboat Lake is different from California Park in that it is a heavily populated summer recreation area. Despite the encroachment by humans, more chicks are fledged here than in California Park (Renner et al. 1989, 1990, 1991, 1992). Fourteen active and two more possible nests were located by aerial survey in this area. All the nests that could be located and monitored are discussed.

HP12, Beaver Creek: The pair was still nesting on June 27. The landowner had not seen any chicks around in August, though this nest was believed to have hatched the first part of July.

HP17, Mill Creek: This nest was found empty on helicopter flight June 7. The State Parks reported removing two eggs from it the end of May after it had been abandoned due to disturbance from fishermen.

HP19, Deep Creek: This pair was first seen between the lake and CR129 on June 27 with one chick. The chick hatched around June 20. The chick fledged and was last seen still in the same area on September 4. There was heavy road construction in this area of CR129 throughout the summer. This pair has historically been very

successful at raising young even in such a busy and disturbed location. A red fox was also seen in the pair's territory twice this year.

HP21, Red Creek: No cranes were found in this area and the nest could not be located to determine whether it was successful or not.

HP32 and 33, Willow Creek: The nesting pairs could not be found in this area and the nests could not be located to determine success. This is commonly a heavily used area and livestock (sheep and cattle) were also grazed near the nest sites, so the cranes may have moved up the hill into the trees where they could not be located.

HP34, Pearl Lake: There was no egg count for this nest. The adults were seen throughout the summer without any chicks. There was no information on whether the nest hatched successfully.

HP35, Pearl Lake, Lester Creek: This nest showed no sign of hatching and pair of adults was seen nearby on August 9 without any chicks.

HP38, Larsen Creek: One egg looked abandoned in the nest on June 23. When the nest was approached to try to retrieve the egg the adults started calling from the willows 5 m from the nest. The Parks personnel helped to watch the nest until July 3 when the egg disappeared. There were no eggshell fragments and the nest was located in a deep beaver pond so predators seem unlikely. There were many people at the lake that weekend, so it is possible a human removed the egg. This nest was very visible from a path used by fisherman to get to the lake and it is believed that the cranes abandoned the egg due to human disturbance. Two eggs had been laid and what happened to the other one is unknown. It is possible that it hatched and the adults did not finish incubating the second one, but the pair was never found after the first of July.

HP39, Floyd Creek: This nest hatched at least one chick about July 1. The pair was frequently seen feeding in the meadow between CR62 and the lake with one chick. They were last seen July 28 when cattle were moved onto the pasture. It is very likely the birds moved upstream, but they could not be found again.

Yampa River East, Lake Windemere

This area was also selected for intensive monitoring in 1995 due to the unusual number of nests that were found in such close proximity to each other. Lake Windemere is a small lake, less than 1 km square. It is fairly shallow, with several submerged islands. Expanses of cattails and other grasses grow on these islands and along the periphery of the lake. The surrounding area consists of hay meadows and ridges of sagebrush. Five pairs of cranes were found nesting within the lake in early June. This is very uncommon since cranes in Colorado generally nest at least 1 km away from each other.

MC7: The adults were seen still nesting on June 25. On July 7 both eggs were found abandoned on the nest. The eggs were retrieved and blown out. They were fairly rotten and the embryos were undeveloped. This is a very undisturbed area and the nest was not very vulnerable to predators. The pair most likely abandoned the nest after the eggs did not hatch.

MC8: This nest was located only about 10 m from MC9. The water was too deep to get out to the nest in order to determine the hatching success. The pair did not have any chicks on July 7.

MC9: This nest was also located in deep water 10 m southwest of MC8. The chick hatched around June 25 and the family was last seen feeding southeast of the lake on July 27.

MC10: This nest could not be located to determine hatching success, but both adults were seen near the nest site on June 25 and their behavior indicated a possibility of chick(s). The pair was seen again south of the lake on July 27 without any chicks.

MC11: Hatching success of this nest is unknown. The pair was seen on July 27 without any chicks.

Other Concentration Areas

The following are a list of nests in which information regarding the hatching and/or fledging success was known.

Elkhead Reservoir

HM10, Morgan Creek: This pair was seen in Smith's hay field near nest site without any chicks on July 30.

HM11, Morgan Creek: This nest had hatched in May, before the helicopter flight. The pair was seen the middle of August by USFS personnel with one fledged chick.

QM32, Dry-Fork Elkhead Creek: Pair was seen in hay field east of nest site with two chicks. Chicks probably hatched about June 15.

QM33, Dry-Fork Elkhead Creek: This nest was located near high water 10 m from the road. The pair was seen in the area without chicks on July 26.

Elk River

C3, Elk River: This was a pair found with a chick by ground search in August. The chick was fledging age when they were last seen on August 24.

Hole-in-the-Wall

QM6, Elkhead Creek-trib.: This nest was discovered on a beaver pond by John Sundberg of the USFS. The pair had one young chick on June 16. It is unknown whether the chick survived to fledging.

QM35, Calf Creek: This nest contained four eggs (one was an odd color) on the helicopter flight. This is the largest clutch size found in all the years of intensive study. The hatching success is unknown.

QM39, Elkhead Creek-trib.: The nest was reported by USFS in late May. It was washed out by high water in early June before the helicopter flight.

SLM2, N. Fork-Elkhead Creek: This nest could not be located, but the adults' behavior indicated that they were likely nesters on the helicopter flight June 6. John Sundberg of the USFS confirmed their nesting status on June 15, when he saw a pair with two chicks. The fledging status of these chicks is unknown.

SLM3, Elkhead Creek: These birds were also considered likely nesters, although a nest could not be located on June 6 of the helicopter flight. John Sundberg saw a pair with one chick in this area on June 15, confirming this as an active nest. It is unknown whether the chick survived.

Independence Creek

SM4, Dudley Creek: The nest contained downy feathers but no eggshell fragments on July 29. It was probably a successful hatch. The adults were seen still in the area on July 28 without any chicks. The other pair seen during the helicopter flight June 7 was also still in the area on July 28.

Little Snake River

SM9, Little Snake River: A pair with one chick, that hatched around the middle of June, was seen in a meadow

on June 27. One adult had a Colorado leg band on from 1991 or 1992, but the number could not be read.

TM12, Little Snake River: A pair with two chicks, that hatched about June 1, were located in a meadow on July 5. Both chicks were old enough to have fledged when last seen.

South Fork Park

This is another area of high concentrated nesting cranes, but not enough funds were allocated to allow us to fly this area thoroughly. This property is also privately owned and so only limited access is permitted. A small amount of time was allowed in the area, and two successful hatches were located. At least seven other pairs of cranes, in which nesting could not be confirmed, were located in the park. This area may have as high of a nesting concentration as California Park and Steamboat Lake.

MP11, S. Fork-Little Snake: A pair with one chick was seen at the edge of the trees 1 km west of the nest site on August 17. The hatching date was around July 1.

SM15, S. Fork-Little Snake: A nest was found by ground on July 31. Two eggs had hatched. There was one chick only a couple days old found dead in the water at the edge of the nest. The pair was seen on August 17 with the other chick still using the area near the nest. This hatching date, in the last week of July, is the latest that has been found in any of the intensive studies years.

Yampa River East

CC4, Yampa River: This nest was found by ground very close to highway 40. One chick hatched on June 20. The family was not seen again until August by a USFS employee.

Yampa River West

H3, Yampa River: A pair was seen with a fledged chick feeding in the wheat fields north of the nest site and highway 40 on September 23 and 24. They probably used this field instead of staging at Hayden.

HM2, Yampa River: This pair's behavior indicated that they were likely nesters, although the nest could not be located on the helicopter flight June 6. The landowner felt that the pair had one chick in late July. The chick could not be seen because of height of the grass.

HM9, Yampa River: A pair with two chicks that hatched the first of June were seen on the helicopter flight June 6, 0.75 km southeast of the likely nest location. The landowner reported seeing both chicks flying with adults

in early August. (The historic nest number was used for the USGS plot, but the flight location of the birds on June 6 is on the Mount Harris quadrangle.)

TERRITORIES

Territory size was determined for nine separate pairs of sandhill cranes within the concentration areas. Seven of the pairs were nesting pairs and the other two were non-breeding pairs. The first nesting pair was MP1 from upper Torso Creek in California Park, the second was HP19 from Deep Creek at Steamboat Lake, and the remaining nesting pairs were the five pairs from Lake Windemere, MC7-11. The two non-breeding pairs were from Elkhead Creek across from the California Park Guard Station (they will be referred to as A and B).

The pair at Torso Creek (MP1) had a territory size of approximately 39 ha consisting of a clearing around the beaver ponds of upper Torso Creek (Fig.1). They nested on a pond at the southwest edge of this territory and fed at the edge of the trees at the northwest end until they lost their young in late July. After July they were usually found using the whole clearing freely.

The territory of the Deep Creek pair (HP19) was similar in size to that of the Torso Creek pair, comprising about 39 ha of land along Deep Creek from the lake almost up to the trees (Fig.2). The main road, CR129, ran through the middle of their territory. They nested above the road and then moved the chick below the road after it hatched. They primarily used the area between the road and the lake unless they were disturbed (i.e. when the backhoe was digging out part of lower Deep Creek) and then they would feed upstream in the northwest area of their territory.

The five pairs of nesting cranes at Lake Windemere (MC7, MC8, MC9, MC10, and MC11) all nested within the lake. The MC8 and MC9 nests were the closest to each other being only about 10 m apart. The territories then extended outward from the lake. The territory sizes were 11 ha, 9 ha, 13 ha, 39 ha, and 24 ha respectively (Fig.3). Some of the territory sizes were very small, but the pairs all seemed very tolerant of each other and were not extremely strict about the territory boundaries. For instance, the MC9 pair with the chick let one of the MC10 adults get within 20 m of them before they called and approached the bird in defense. Then in August, the MC10 and MC11 pairs, which no longer had chicks, were seen feeding together in a hay field where their territories apparently overlapped.

The first non-breeding pair (A) had a territory northwest of the guard station that extended from the top of the ridge west of Elkhead Creek to upper Torso Creek. The territory was a narrow strip of land comprising about 49 ha (Fig.4). The pair used the area near the guard station for feeding and roosting early in the summer. Then after the Torso Creek pair lost their young, pair A was observed flying to and from upper Torso Creek to feed with pair MP1 in late July and early August. Pair A was very active in territorial defense. On one occasion they were seen trying to defend their territory against a cow elk which ended up chasing them. Another time they called to pair B when they noticed them

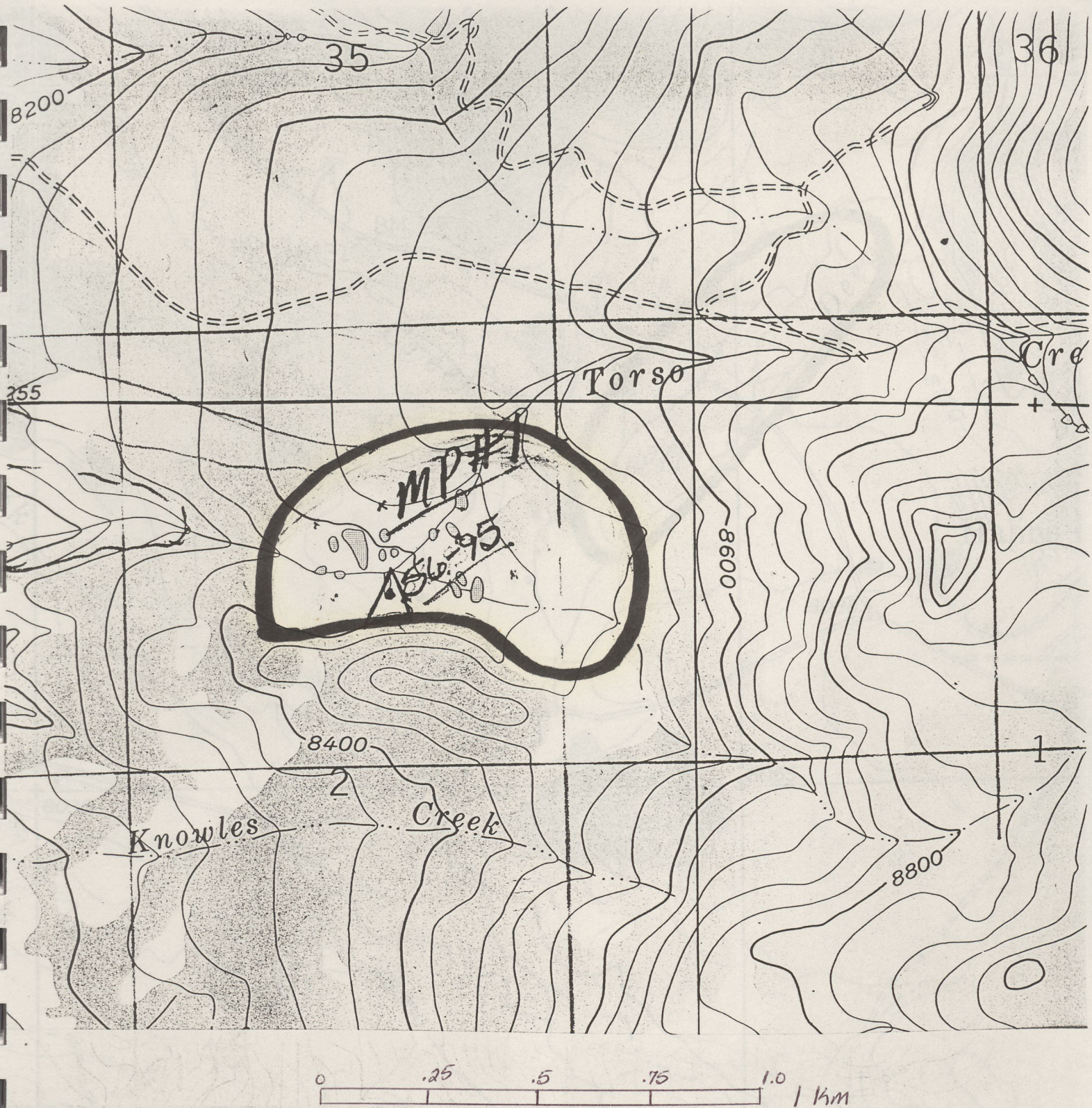


Figure 1. Territory of pair MP1 on Torso Creek.

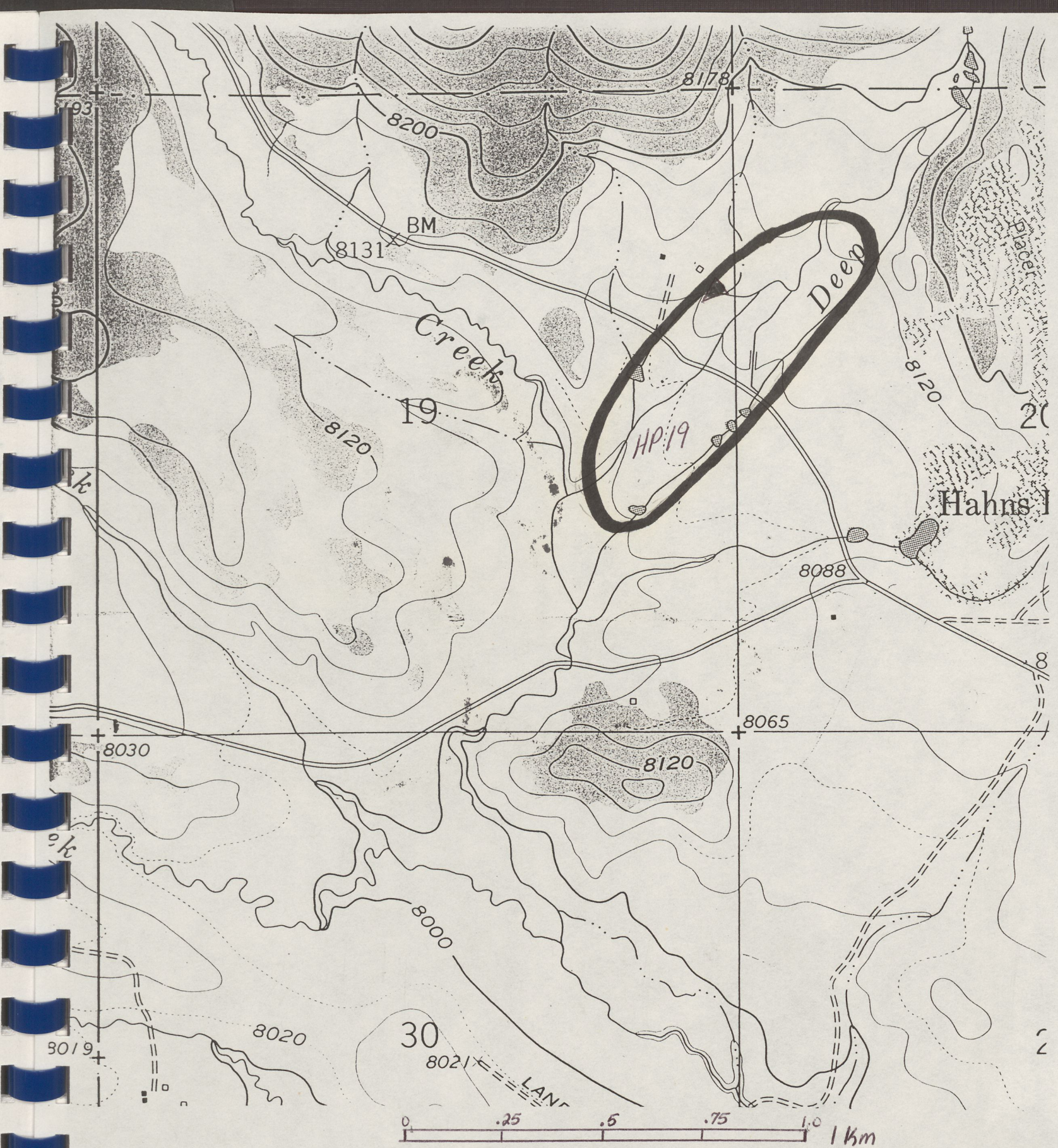


Figure 2. Territory of pair HP19 on Deep Creek.



Figure 3. Territories of pairs MC7, MC8, MC9, MC10, and MC11 at Lake Windemere.

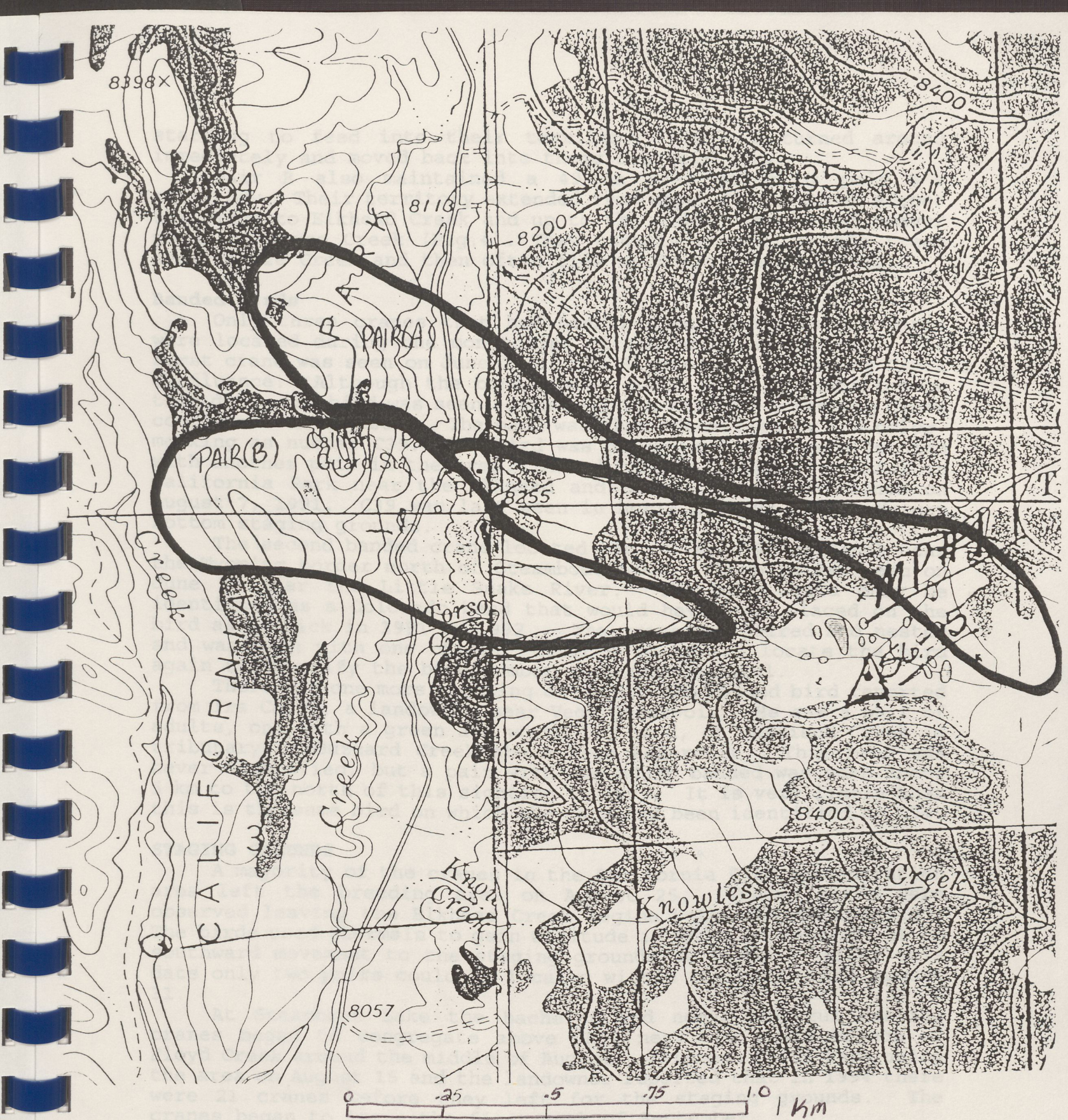


Figure 4. Territories of non-breeding pairs A and B in California Park.

starting to feed into their territory. Pair B turned around immediately and moved back into their own territory.

Pair B also maintained a 49 ha area south of pair A's territory. Their territory extended from upper Circle Creek across the ridge to Elkhead Creek and up to the middle section of beaver ponds on Torso Creek (Fig.4). They usually roosted in the trees near Circle Creek and then often flew up Torso Creek to feed.

Banded Birds

Only three cranes that had been banded from previous years were located during the monitoring of the breeding grounds. The first crane was seen on June 26 at the Elkhead and Armstrong Creek confluence. Although the band number could not be identified on this date, the bird was seen again near the Elkhead-Armstrong Creek confluence on August 9. The band was then identified by its color-marking as number C39. The bird was paired and they were feeding with another pair in the area. This bird was banded as a chick in California Park near the Elkhead and Stukey Creek confluence on August 7, 1991. C39 was last seen in April of 1992 at the Morgan Bottom staging grounds.

The second banded crane located was at Three Forks Ranch near the Wyoming border north of Steamboat Lake. The bird was seen on June 27 near the Little Snake River. The band could only be identified as a Colorado band that would have been placed on the bird as a chick in 1991 or 1992. The crane had paired and nested and was seen with one chick. Efforts to try to locate the bird again to identify the band number were unsuccessful.

There was one more sighting of a Colorado banded bird reported from Ira Caley, a landowner near Vega Reservoir. He saw a pair of adults, one with a green and white leg band, on Harrison Creek, a tributary of Buzzard Creek above Vega Reservoir. This band was never identified, but a pair with one adult banded was seen about 5 km to the north of this sighting in 1993. It is very likely that this is the same bird on which the band had been identified as C54.

STAGING GROUNDS

A majority of the cranes in the California Park concentration area left the breeding area on August 25. Twelve birds were observed leaving the Elkhead Creek region between 1000 and 1100. The birds used thermals to gain altitude in order to make the 35 km southward movement to the staging grounds at Hayden. After this date only two pairs could be located within the park until August 31.

At Steamboat Lake the bachelor and non-successful nesting cranes began to congregate above CR62 near the south branch of Floyd Creek around the middle of August. Thirteen birds were using the area on August 15 and the landowner reported that in 1994 there were 21 cranes before they left for the staging grounds. The cranes began to leave the first week of September.

Hayden

The Morgan Bottom and Hayden Power Plant areas are considered one staging ground and will be referred to together as the Hayden

Staging Area for this study. Each day the classification counts were conducted at both areas within reasonable time of each other in order to not recount any birds moving between the areas. The birds generally did not change fields during the feeding period unless they were disturbed. However, throughout the staging season birds would vary in which field they chose to feed at each day. In late August and early September the largest numbers of cranes were at the Morgan Bottom fields, but by late September most of the birds were using the Hayden Power Plant area. This may be due to the fact that they prefer Morgan Bottom, but as they eat most of the wheat stubble from those fields they begin to move over to the power plant where there is still ample food.

The first staging ground count was conducted at Morgan Bottom on August 16. From August 21 to September 24 the classification counts were conducted twice daily whenever possible. Total number counts were consistently higher during the evening counts, but juvenile classification and leg-band identification were better performed during the morning counts, so both were conducted whenever possible. A total bird count was always made and then juveniles were classified (Table 3 and 4). Unknown juvenile numbers in the counts at Morgan Bottom were usually caused by the birds being disturbed and flying away before the classifications could be completed. One unknown can be accounted for when the spotting scope would not work properly and the age of each crane could not be correctly identified. The juvenile numbers at the Hayden Power Plant were unknown because the field was too far away to identify chicks through the spotting scope in poor light.

The total bird count steadily increased from August 16 until it peaked at the highest count of 954 birds on September 14. It then slowly declined except for another climax on September 20 when 939 birds were present. The numbers dropped off sharply the following day, when about 700 birds left behind a large cold front that had passed through the area (Table 5). September 14 was the latest date for the recorded high count in the six years that intensive staging ground counts have been conducted (1989-93, 1995). From 1989-92 the date of the highest count ranged from September 5 to September 10. In 1993, the date was September 13.

The second large influx of birds on September 20, and the rapid decline of birds on the staging grounds after this date, is unlike data seen in previous years of the counts (Renner et al. summary 1992). By September 24 of this year the count was down to only 12 birds, when in other years, numbers remained in the hundreds until the end of September. These atypical counts may be due to the large cold front moving in from the north leaving snow above 2100 m in elevation. This may have caused a sudden migration of the remaining birds from the northern states and higher elevations.

The juvenile numbers were very low the first two weeks of the classification and then steadily began to increase throughout the remainder of the staging season. There was only one chick present at the first count on August 16 with the highest being 42 chicks at Morgan Bottom on September 14. The number of pair broods (families with two chicks) was also recorded when they could be identified.

Table 3. Number of sandhill cranes, chicks, and percent chicks at the Morgan Bottom Staging Area, August-September 1995.

DATE	TIME	LOCATION	TOTAL	CHICKS	%CHICKS
08/16/95	1800	MORGAN BOTTOM	99	1	1.01%
08/21/95	1900	MORGAN BOTTOM	47	1	2.13%
08/22/95	1900	MORGAN BOTTOM	81	UNK	0.00%
08/23/95	1800	MORGAN BOTTOM	247	2	0.81%
08/24/95	1745	MORGAN BOTTOM	169	2	1.18%
08/25/95	1830	MORGAN BOTTOM	292	UNK	0.00%
08/26/95	800	MORGAN BOTTOM	319	4	1.25%
08/27/95	1830	MORGAN BOTTOM	422	4	0.95%
08/28/95	1900	MORGAN BOTTOM	357	8	2.24%
08/29/95	1900	MORGAN BOTTOM	519	12	2.31%
08/30/95	800	MORGAN BOTTOM	472	11	2.33%
08/31/95	1830	MORGAN BOTTOM	566	10	1.77%
09/02/95	1800	MORGAN BOTTOM	569	25	4.39%
09/03/95	1815	MORGAN BOTTOM	783	31	3.96%
09/05/95	1830	MORGAN BOTTOM	668	*UNK AL 8	0.00%
09/06/95	830	MORGAN BOTTOM	691	19	2.75%
	1800	MORGAN BOTTOM	773	27	3.49%
09/07/95	1800	MORGAN BOTTOM	871	28	3.21%
09/08/95	930	MORGAN BOTTOM	646	24	3.72%
	1900	MORGAN BOTTOM	787	*UNK AL 8	0.00%
09/11/95	1800	MORGAN BOTTOM	593	22	3.71%
09/12/95	800	MORGAN BOTTOM	497	15	3.02%
	1900	MORGAN BOTTOM	556	26	4.68%
09/13/95	900	MORGAN BOTTOM	375	14	3.73%
	1800	MORGAN BOTTOM	748	34	4.55%
09/14/95	830	MORGAN BOTTOM	445	21	4.72%
	1900	MORGAN BOTTOM	926	42	4.54%
09/15/95	900	MORGAN BOTTOM	411	14	3.41%
	1800	MORGAN BOTTOM	694	29	4.18%
09/16/95	900	MORGAN BOTTOM	283	14	4.95%
09/20/95	900	MORGAN BOTTOM	467	16	3.43%
	1800	MORGAN BOTTOM	466	13	2.79%
09/21/95	900	MORGAN BOTTOM	299	12	4.01%
	1800	MORGAN BOTTOM	143	9	6.29%
09/22/95	800	MORGAN BOTTOM	69	6	8.70%
	1730	MORGAN BOTTOM	71	5	7.04%
09/23/95	845	MORGAN BOTTOM	10	0	0.00%
	1800	MORGAN BOTTOM	0	0	ERR
09/24/95	800	MORGAN BOTTOM	0	0	ERR
	1730	MORGAN BOTTOM	0	0	ERR

Table 4. Number of sandhill cranes, chicks, and percent chicks at the Hayden Power Plant Staging Area, August-September 1995.

DATE	TIME	LOCATION	TOTAL	CHICKS	%CHICKS
08/16/95	1900	HAYDEN POWER PLANT	5	1	20.00%
08/21/95	1830	HAYDEN POWER PLANT	46	1	2.17%
08/22/95	1830	HAYDEN POWER PLANT	4	0	0.00%
08/23/95	1900	HAYDEN POWER PLANT	12	0	0.00%
08/24/95	1715	HAYDEN POWER PLANT	10	2	20.00%
08/25/95	1800	HAYDEN POWER PLANT	2	0	0.00%
08/26/95	930	HAYDEN POWER PLANT	20	1	5.00%
08/27/95	1800	HAYDEN POWER PLANT	7	0	0.00%
08/28/95	1800	HAYDEN POWER PLANT	0	0	ERR
08/29/95	1800	HAYDEN POWER PLANT	0	0	ERR
08/31/95	1810	HAYDEN POWER PLANT	0	0	ERR
09/02/95	1730	HAYDEN POWER PLANT	0	0	ERR
09/03/95	1800	HAYDEN POWER PLANT	4	0	0.00%
09/05/95	1730	HAYDEN POWER PLANT	30	3	10.00%
09/06/95	730	HAYDEN POWER PLANT	53	4	7.55%
	1700	HAYDEN POWER PLANT	3	1	33.33%
09/07/95	1700	HAYDEN POWER PLANT	23	2	8.70%
09/08/95	730	HAYDEN POWER PLANT	41	3	7.32%
09/11/95	1700	HAYDEN POWER PLANT	11	UNK	0.00%
09/12/95	1830	HAYDEN POWER PLANT	203	10	4.93%
09/13/95	800	HAYDEN POWER PLANT	178	8	4.49%
	1730	HAYDEN POWER PLANT	61	5	8.20%
09/14/95	730	HAYDEN POWER PLANT	227	11	4.85%
	1800	HAYDEN POWER PLANT	28	UNK	0.00%
09/15/95	800	HAYDEN POWER PLANT	297	UNK	0.00%
	1900	HAYDEN POWER PLANT	128	6	4.69%
09/16/95	800	HAYDEN POWER PLANT	353	16	4.53%
09/20/95	800	HAYDEN POWER PLANT	173	11	6.36%
	1700	HAYDEN POWER PLANT	473	21	4.44%
09/21/95	800	HAYDEN POWER PLANT	360	16	4.44%
	1700	HAYDEN POWER PLANT	91	8	8.79%
09/22/95	700	HAYDEN POWER PLANT	129	7	5.43%
	1800	HAYDEN POWER PLANT	47	7	14.89%
09/23/95	900	HAYDEN POWER PLANT	229	15	6.55%
	1700	HAYDEN POWER PLANT	56	5	8.93%
09/24/95	830	HAYDEN POWER PLANT	43	6	13.95%
	1700	HAYDEN POWER PLANT	12	4	33.33%

AVG RECRUITMENT RATE FROM 08/21 TO 09/22 3.73%

Table 5. Number of sandhill cranes, chicks, and percent chicks at the Hayden Staging area, August-September 1995.

DATE	TIME	LOCATION	TOTAL	CHICKS	%CHICKS
08/16/95	1830	MORG BTM & POWER PLT	104	2	1.92%
08/21/95	1845	MORG BTM & POWER PLT	93	2	2.15%
08/22/95	1845	MORG BTM & POWER PLT	85	UNK	0.00%
08/23/95	1830	MORG BTM & POWER PLT	259	2	0.77%
08/24/95	1730	MORG BTM & POWER PLT	179	4	2.23%
08/25/95	1815	MORG BTM & POWER PLT	294	UNK	0.00%
08/26/95	845	MORG BTM & POWER PLT	339	5	1.47%
08/27/95	1815	MORG BTM & POWER PLT	429	4	0.93%
08/28/95	1830	MORG BTM & POWER PLT	357	8	2.24%
08/29/95	1830	MORG BTM & POWER PLT	519	12	2.31%
08/30/95	800	MORGAN BOTTOM	472	11	2.33%
08/31/95	1815	MORG BTM & POWER PLT	566	10	1.77%
09/02/95	1745	MORG BTM & POWER PLT	569	25	4.39%
09/03/95	1815	MORG BTM & POWER PLT	787	31	3.94%
09/05/95	1800	MORG BTM & POWER PLT	698	*11	0.00%
09/06/95	800	MORG BTM & POWER PLT	744	23	3.09%
	1730	MORG BTM & POWER PLT	776	28	3.61%
09/07/95	1730	MORG BTM & POWER PLT	894	30	3.36%
09/08/95	830	MORG BTM & POWER PLT	687	27	3.93%
	1900	MORGAN BOTTOM	787	*8	0.00%
09/11/95	1700	HAYDEN POWER PLANT	11	UNK	0.00%
	1800	MORGAN BOTTOM	593	22	3.71%
09/12/95	800	MORGAN BOTTOM	497	15	3.02%
	1845	MORG BTM & POWER PLT	759	36	4.74%
09/13/95	830	MORG BTM & POWER PLT	553	22	3.98%
	1745	MORG BTM & POWER PLT	809	39	4.82%
09/14/95	800	MORG BTM & POWER PLT	672	32	4.76%
	1800	HAYDEN POWER PLANT	28	UNK	0.00%
	1900	MORGAN BOTTOM	926	42	4.54%
09/15/95	800	HAYDEN POWER PLANT	297	UNK	0.00%
	900	MORGAN BOTTOM	411	14	3.41%
	1830	MORG BTM & POWER PLT	822	35	4.26%
09/16/95	830	MORG BTM & POWER PLT	636	30	4.72%
09/20/95	830	MORG BTM & POWER PLT	640	27	4.22%
	1730	MORG BTM & POWER PLT	939	34	3.62%
09/21/95	830	MORG BTM & POWER PLT	659	28	4.25%
	1730	MORG BTM & POWER PLT	234	17	7.26%
09/22/95	730	MORG BTM & POWER PLT	198	13	6.57%
	1745	MORG BTM & POWER PLT	118	12	10.17%
09/23/95	900	MORG BTM & POWER PLT	239	15	6.28%
	1730	MORG BTM & POWER PLT	56	5	8.93%
09/24/95	815	MORG BTM & POWER PLT	43	6	13.95%
	1715	MORG BTM & POWER PLT	12	4	33.33%
AVG RECRUITMENT RATE FROM 08/21 TO 09/22					3.73%

Table 6. Number and percentage of chicks from pair broods at Morgan Bottom, fall 1995.

DATE	LOCATION	CHICKS	PAIR BROODS	% PAIRS
08/26/95	MORGAN BOTTOM	4	1	25.00%
08/28/95	MORGAN BOTTOM	8	2	25.00%
09/08/95	MORGAN BOTTOM	24	4	16.67%
09/13/95	MORGAN BOTTOM	14	3	21.43%
09/14/95	MORGAN BOTTOM	21	4	19.05%
09/15/95	MORGAN BOTTOM	14	4	28.57%
09/16/95	MORGAN BOTTOM	14	3	21.43%
09/20/95	MORGAN BOTTOM	16	4	25.00%
09/21/95	MORGAN BOTTOM	12	4	33.33%
average percent of chicks from pair broods:				22.83%

Elk River

Only three counts were conducted at this staging ground due to the inaccessibility to the fields used by the cranes. The birds could not be seen feeding on the fields and so had to be counted as they flew to or from the field from roost sites. The data from the counts is shown below:

Date	Time	Total
09/06/95	1000	-100
09/14/95	1700	37
09/15/95	1700	0

On five different dates throughout September there was as many as four families that had been able to raise two chicks (Table 6). The mean brood size of fledged chicks on the staging grounds was 1.32 juveniles per pair.

The period of August 21 through September 22 was selected for determining the recruitment rate in 1995. This is different than the standard period from August 28-September 25 used in previous years (1989-1993). That time period was not feasible in 1995 with the abnormally early departure of the cranes. A uniform period that began with about 100 birds present and ended when there was again only about 100 birds was chosen for this year. The estimated recruitment rate (number of juveniles/total number of birds) for 1995 was determined to be 3.73%. This rate is significantly lower than the recruitment rates from 1989-93. Classifications from the San Luis Valley in 1994 turned up similar results in juvenile numbers with a recruitment rate of 3.9% (Drewien unpubl. data). Littlefield and Ryder (1968) concluded that a recruitment rate of 8-10% would produce a stable population in Oregon, while Drewien (1973) found a rate of 13-14% and an increasing population at Grays Lake National Wildlife Refuge, Idaho. The low juvenile counts at the Hayden Staging Area could be affected by other populations of cranes, since they are not exclusively Colorado birds, but the nest production for 1995 was also significantly lower than in previous years.

Year	Nest Production	Recruitment Rate(%)
1989	0.56	10.20
1990	0.55	9.35
1991	0.42	8.03
1992	0.37	10.10
1993	unk	8.54
1995	0.14	3.73

Elk River

Only three counts were conducted at this staging ground due to the inaccessibility to the fields used by the cranes. The birds could not be seen feeding on the fields and so had to be counted as they flew to or from the field from roost sites. The data from the counts is shown below:

Date	Time	Total
09/06/95	1000	~100
09/14/95	1700	37
09/15/95	1700	0

Banded Birds

There were at least seven different birds with Colorado leg-bands present at the Hayden staging grounds. Three of the bands were positively identified by the number. They were C32, C62, and C56. There were three more bands that by deductive figuring using the information that could be read from the bands, like one of the numbers or some of the color-marking, were concluded to be the only band that matched the given information. These bands were C72 or C46, C74, and C44. The band determined to be C46 or C72 could only be identified by the color-marking, which was a white "C", a white number, and then a red number. Both of these bands are marked this way and none of the numbers could be identified.

Table 7. Colorado banded sandhill cranes observed in 1995.

Band Number	Location Sighted	Date	Year Banded	Location Banded
C39	Calif. Park, Elkhead-Armstrong conf.	6/26 8/9, 15	1991	Calif. Park, Elkhead Creek
unk (C34)?	3-Forks Ranch & Morgan Bottom	6/27 & 9/2, 6, 7	1991	3-Forks Ranch, Little Snake Rvr
C54	Harrison Creek near Vega Resvr.	5/6	1992	Studer Ranch, Elk River
C32	Hayden Pwr Plt & Morgan Bottom	8/26 & 9/12	1991	3-Forks Ranch, Little Snake Rvr
C62	Morgan Bottom	9/12, 16 9/20, 21	1992	Steamboat Lake, Ways Gulch
C56	Morgan Bottom	9/14, 15 9/20	1992	Calif. Park, First Creek
C46 or C72	Morgan Bottom	9/15	1992 1993	Mkr., Milk Creek Stmbt Lk, Deep Ck
C74	Morgan Bottom	9/20	1993	Morgan Bottom, Wolf Mtn Ranch
(C44)?	Morgan Bottom	9/15	1991	Steamboat Lake, Dutch Creek

There was also one more banded adult seen at Morgan Bottom that had a chick. The band could never be identified, but it is very likely that this is the bird seen on June 27 at Three Forks Ranch discussed earlier in the report. Even though this band could never be read it is possible that it is C34. The chick banded with number C34 returned to Three Forks Ranch in the spring of 1992, after it had been banded there in 1991. It can be determined that the adults that raised this chick are no longer using this site, since a banded adult was observed nesting in the territory this year. It would be logical that this adult may be the chick from 1991 (C34), and it is now using its parent's territory. This analysis is not conclusive, but only a possibility.

The banded bird seen in California Park earlier in the summer (C39) was not located at the Hayden staging grounds. There were several birds that had bands that could not be distinguished. These may have been bands that were determined at another date or they may have been bands like the Three Forks bird that were never identified. Overall, there were at least nine different Colorado banded birds identified in 1995. It is very likely that there may have been more at the Elk River staging ground, since this staging ground is used primarily by Colorado birds, but it was not possible to check any of those birds for bands.

Roosting

Though no formal work has been done in northwest Colorado, it is thought that while at the staging grounds, the cranes roost in the river at night. Studies of the lesser sandhill cranes in Nebraska show that they roost on submerged sandbars in at least 1000 m widths of the Platte River (Grooms). The Yampa and Elk Rivers used by the greater sandhills in northwest Colorado do not have these similarities to the Platte River of Nebraska. The Yampa River is only a couple hundred meters wide in a few places and does not have large expanses of sandbars like the Platte River. It was of interest to try to determine if the cranes at the Hayden Staging Area were also roosting within the river.

The cranes were observed as they flew from the wheat fields after feeding periods. Though the evening roost sites were of the most interest, the cranes were observed during the day also. When the cranes leave the wheat fields they disperse in about a 5 km stretch along the river (Fig.5). They usually gather in small bachelor or family groups around the sloughs that connect with the river. They were seen in groups from two birds to groups as big as 30 birds in these areas. They continue feeding in the sloughs and the adjacent hay meadows.

As the day got hotter, the cranes would move into the shade of the trees or heavier cover. In this heavier cover they could not be observed to see whether they continued feeding or just used this area for roosting. The cranes did not move to the river to roost during the day. This may be due to the heavy day use of the river by boaters and fisherman.

At night, if the cranes left the wheat fields before dark, they would fly to the hay fields and sloughs and continue feeding. (Northern leopard frogs were one species observed in a field that

the cranes were feeding in.) Close to dark, the cranes would move towards the river. A pair of cranes was observed standing on a sandbar in the river near nightfall. Other cranes flying over seemed as if they also wanted to land on the sandbar, but may have sensed my presence. Not enough time could be spent to determine if these were the actual roost locations of the cranes, but the observations tend to agree that the cranes are using the river at night. Further work would need to be done to determine whether they are able to find enough roosting areas within the river or whether they also use gravel and sandy beaches along the edges.

Additional Crane Data

Additional information about a spring stopover area used by sandhill and whooping cranes in western Colorado has been added as an appendix to this report (Appendix A).

Figure 5. Roosting locations at the Hayden Steeple Area.

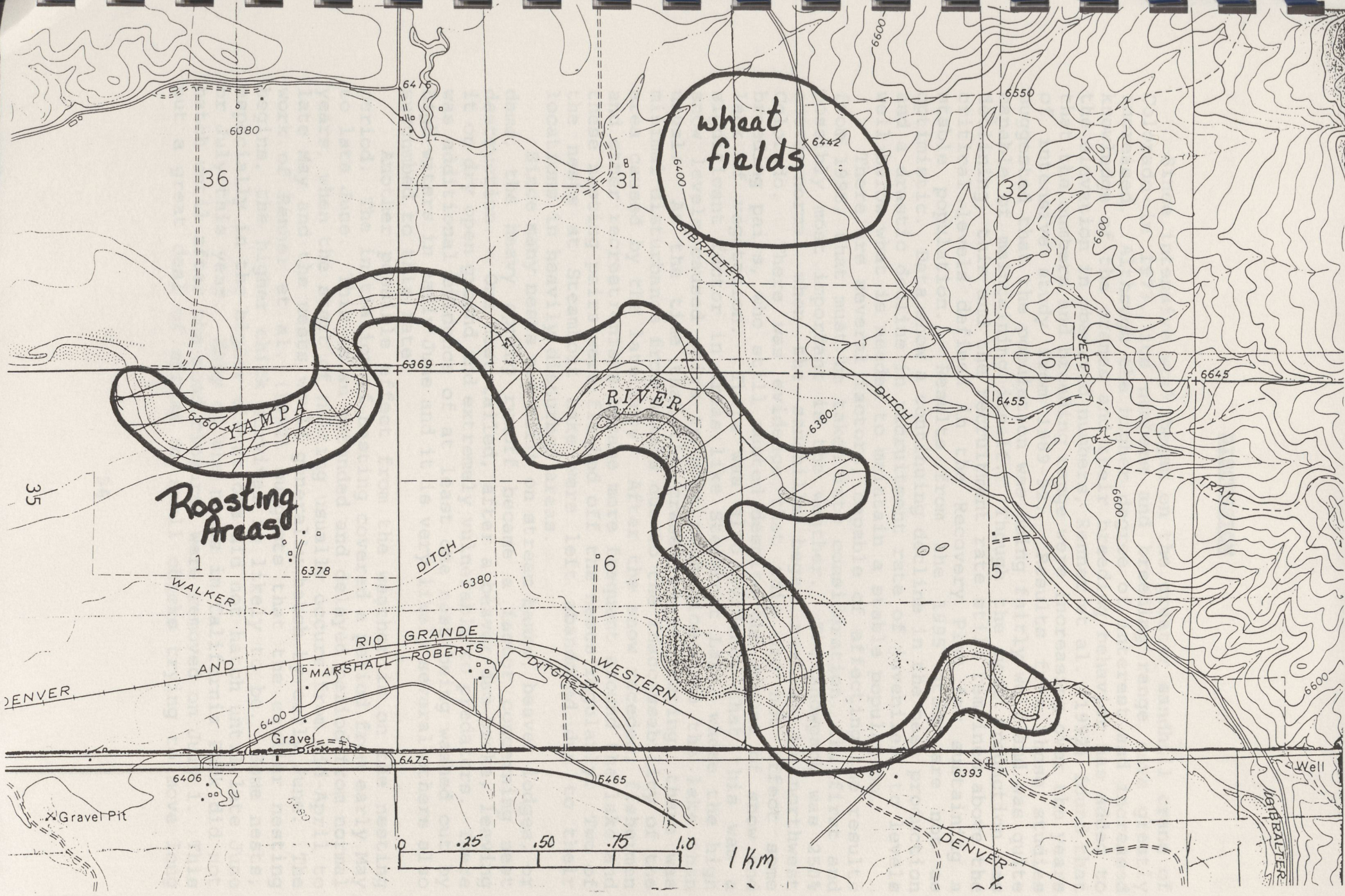


Figure 5. Roosting locations at the Hayden Staging Area.

DISCUSSION

Since intensive work began on the greater sandhill crane of Colorado in 1973, its numbers and breeding range have greatly increased. Although the higher degree of interest and increased knowledge of the cranes and their breeding behavior has added to the elevation in observed numbers, Renner et al. (1992) found that the numbers and breeding range were increasing over the years of intensive study from 1989-92. Results from those studies suggested that the population was doing fairly well and was quite capable of maintaining itself. Though the nest production was declining, this and the recruitment rate still remained above the critical levels defined in the Recovery Plan for sustaining a stable population. Results from the 1995 study are not as optimistic. Data show a continuing decline in the nest production and a drastic decline in recruitment rate of juveniles, to levels well below what is needed to maintain a stable population.

There are several factors, capable of affecting the results from 1995, that must be taken into consideration. The first and possibly most important is the weather. The snowpack was 250% above normal when the sandhills began nesting in northwest Colorado. There was evidence that this did not affect some breeding pairs, who still nested despite the amount of snow and lack of vegetation. There was also evidence that this was a significant factor in areas like Steamboat Lake, where the high snow levels caused pairs to nest much closer to the lake than usual. At the time that the cranes began nesting, there was minimal disturbance from humans due to the inaccessibility of the area caused by the late snow. After the snow receded, fishermen and other recreationists became more frequent around the lake and these nesting pairs were flushed off the nests regularly. Two of the nests at Steamboat Lake were left abandoned due to their locations in heavily disturbed areas.

Since many nests are built on stream banks, beaver lodges, or dams, the heavy spring runoff became a factor concerning nest destruction. One nest failed, after a beaver dam broke, leaving it on dry open ground and extremely vulnerable to predators. There was additional evidence of at least one nest being washed out by high waters in early June and it is very likely several others also succumbed to this fate.

Another possible effect from the weather is on the nesting period. The initiation of nesting covered a period from early May to late June. This is an extended and delayed period from normal years, when the start of nesting usually occurs from mid-April to late May and the nests would generally hatch by early June. The work of Renner et al. (1992) suggests that the earlier nesting begins, the higher chick survival is likely to be. Some nests, especially in the higher elevations did not hatch until late June or July this year. Many of the nests in California Park did not hatch until after the road closures were removed on July 1. This put a great deal of stress on small chicks trying to move long

distances, to safer habitat, to avoid recreationists and sheep herds moving into the park after July 1.

The above normal snowfall also contributed some certain advantages for the cranes. It provided deeper water for nesting, which may have deterred predators, and supplied ample food, especially insects and amphibians, throughout the rearing season. The large water supply also created a flourish of vegetation, providing exceptional cover for the chicks. A high percentage of the pairs who were able to raise chicks this year, were able to raise them both. There was evidence of this on the staging grounds, where an average of 22.8% of the chicks were from pair broods. Drewien (1973) found that the average number of pairs able to raise two chicks was 12.5-13.5%. In years of scarce food, one chick of a multiple brood will be obviously dominant during feeding to ensure that at least one chick will survive if there is not adequate food. If the food is abundant, the submissive chick will still be able to obtain enough to survive. The high percentage of chicks from multiple broods this year suggests that there was plenty of food to support both of the chicks.

Another factor affecting the results of the study this year, is that only one temporary, instead of two, was hired to do the ground monitoring. This makes a considerable difference in the overall amount of time available to locate new nests and monitor breeding pairs. It is much more difficult for one person to monitor as many pairs and on as regular of a basis as they were monitored from 1989-92. This resulted in a smaller sample size of known data for determining nest hatchings and production. This factor should be considered when comparing data from year-to-year.

Even though several important factors may have affected the results in the 1995 study, the declining nesting and rearing success of the cranes still warrants some concern.

The decrease of active nests in 1995 does not first appear to be a major concern. Although it is higher than when the studies began in 1989, several factors may suggest that nesting is not actually as good as it was in 1989. First of all, 25% more time was spent conducting the aerial survey than in any other year. The second is that the number of active nests increased by almost 20 nests every year of the study from 1989-92, partly due to improved observation proficiency and increased knowledge of the nesting habitat. (The 1992 number may have been undercounted by 30% making the nest number more likely around 130, due to a late flight time.) In 1995, even with an increase in flight hours and better knowledge of traditional nesting areas, the active nest number has dropped to 82. One consideration is that, South Fork Park, an area possibly equivalent to California Park and Steamboat Lake in concentrations of nests, was not completely covered on the aerial surveys this year. Although this may have contributed to a small undercount of active nests for 1995, it still would not completely explain such a large decrease from previous years. The number of active nests in 1995 is still above the critical number outlined in the recovery plan (Graham 1992), but there should be some concern whether the numbers are on the decline again, or if the abnormal year of weather had that great of an effect on the nesting.

The hatching success of the active nests was 60% in 1995, which is almost identical to percentages seen in 1990 and 1991 and very similar to percentages seen in 1989 and 1992. This would suggest that nest incubation was not radically effected by the abnormally late and ponderous snowpack. The number of nests lost to high waters and other destruction due to the snowpack was not significant enough to affect the normal hatching success of the active nests.

The nest production and recruitment rate for 1995 are where the most concern should be directed. As stated previously, the nest production rate of 0.14 was obtained using a relatively small sample size. Even though the production rate may not be completely reliable, other data does help to support it. The nest production has been steadily declining throughout the years of intensive monitoring at an average rate of 0.06. If the production continued declining at this rate it would be close to what was actually obtained for this year. There also was a very low percentage of juveniles (3.73%) identified in the population at the Hayden Staging Area this year. These data are analogous to data reported at the Pacific Flyway Study meetings in the spring and summer of 1995. The reports stated that the recruitment rates in the RMP crane population continue to be very low. The recruitment survey conducted in the fall of 1994, in the San Luis Valley indicated the population was composed of 3.9% juveniles (Drewien unpubl. data), 27.8% below the 1989-93 mean (5.4%), and 51.3% below the 1972-93 mean (8.0%). The 1994 recruitment rate is the 2nd lowest on record. These low recruitment rates are an indication of poor nest production.

The results of the 1995 study tend to indicate that successful recruitment of juveniles into the population is very low and not at a level that will maintain stable numbers. The normal hatching success and above average pair broods fledged suggests that the nesting cranes were not adversely affected by the unusual amount of snow this year, and may have in fact benefitted from it. The problem seemed to occur during the rearing period. The most common loss of young is generally due to predators and starvation. Another method that may be a considerable factor for this year, is the abandonment of the young due to a sizable or constant harassment from people and livestock.

In California Park, coyotes and golden eagles are the only major predators of the crane chicks. In the Steamboat Lake area there is only a very small population of coyotes, and they are generally not a significant factor in chick mortality. In California Park this year, only one coyote was seen near a nesting pair's territory and none were ever seen attempting attacks on any chicks. Two juvenile golden eagles were commonly seen around the park, but being juveniles would not be as experienced in catching such big prey as a crane chick. It seems unlikely that predation was any more of a significant factor to the juvenile recruitment than in previous years. The food supply should have been ample for most species in the area this year and so would not have caused any unusual stress on the crane chick population. The only factor of consideration would be if the thick vegetation this year helped in

concealing crane chicks, it may have also worked to conceal predators.

Sibling strife and starvation should not have been a factor in the high chick mortality this season. The number of pairs that were able to raise two young suggests that starvation was even less of a factor than in normal years.

Abandonment or death of the young due to harassment may have been a considerable factor during the rearing period. Generally the cranes are prepared for the movement of livestock and the increase of human activity in their nesting areas. The young usually hatch in time for them to grow large enough to make long journeys in avoidance of these disturbances. This year many nests hatched several weeks later than usual, while events like the California Park road opening on July 1 remained the same. Many of the cranes may have been forced to try to move very young chicks long distances to avoid sheep and human disturbances, making them more susceptible to predation, accidents, and illness. If the young chicks could not move quick enough or tired too easily, they may have been abandoned.

The California Park and Steamboat Lake concentration areas are currently very vital nesting habitat for the greater sandhill crane. They attract high concentrations of cranes and can be more easily monitored than other nesting areas. The preservation and management of these areas should be of great concern. Even though California Park does not contribute many juveniles to the population, it is one of the few areas in which the management can be controlled with help from the USFS.

Steamboat Lake traditionally has had a high percentage of fledged juveniles. This was contributed to the lack of predators and the ability of the cranes to adapt to humans. However, the nest production in this area is currently declining. It is unknown whether an increase in predators is significantly affecting the cranes or whether they are unable to handle the increase of human intrusions. As more and more of the large ranches are converted into smaller plots for residential homes, the nesting habitat will continue to diminish and the amount of people present will continue to increase. It is uncertain whether the cranes will be able to continue to adapt to this increase of stress. The best management that can be done in this area is to continue work with the Colorado State Parks and private landowners to help preserve the nesting habitat for the cranes.

The high concentration of nests at lake Windemere this year is very unusual and provides some feedback about the requirements of good crane habitat. It provided extremely good nesting habitat for not only sandhill cranes, but many other waterfowl and riparian species. The lake is shallow enough to allow cranes to build nests within it, but deep enough to protect the nests from predators. The surrounding hay fields and sagebrush provide food and cover for the young chicks. The fledging success was not exceptional, with only one chick thought to have survived out of five nests, but the tolerance between the nesting pairs is information that may be very useful in future crane management practices. Nesting pairs will tolerate close proximity to each other as long as there is

exceptionally good habitat. This knowledge may be very useful in the development of superior crane habitat.

The recovery plan for the Colorado greater sandhill crane (Graham 1992) calls for at least 70 active nests, a nest production of 0.30, and a recruitment rate of 8.0% for the crane to remain at downlisted status. Only one of these criteria was met by the population this year. The nest production and recruitment rate were significantly lower than those required and so should warrant some concern about where the population is headed.

The data from the five years of intensive studies suggest that there is a critical decline in the nest production in the selected concentration areas. The recruitment rate obtained from the staging ground classifications in Hayden suggests that the low nest production may be representative of the whole population. Further reports of recruitment rates from the San Luis Valley in 1994, suggest that these numbers may be representative of the whole Rocky Mountain Population.

Although the greater sandhill crane is programmed to sustain a rather high level of reproductive failure, the low level of recruitment this year should be of considerable concern. If the recruitment of juveniles continues at this rate, the population will certainly be in trouble again. It is recommended that intensive studies be continued to determine whether the actual status of the cranes is as bad as these results indicate, or whether it was just an unfortunate year for them. The staging ground counts at Hayden should at least be conducted to get a general estimate of the recruitment of young into the population. Although the Hayden Staging Area is not used exclusively by Colorado birds, most of the cranes are from Colorado and southern Wyoming (Renner et al. 1992). This information does give a general assessment of the population status for the region. If negotiations could be worked out with the landowner at the Elk River Staging Area, these classifications may give a more accurate census of the recruitment rate, since this area is used almost solely by Colorado birds.

The declines in juvenile numbers may not be immediately evident in the total population, due to the adult cranes' long life-span and ability to perservere. It should be emphasized, however, that it would be much easier to ascertain the actual status of the Colorado sandhills and address management techniques now, then to let their population decline to critical levels again.

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APPENDIX A

HARTS BASIN, COLORADO, A SPRING MIGRATION STOPOVER AREA FOR
ROCKY MOUNTAIN SANDHILL AND WHOOPING CRANES

RH: Colorado Spring Stopover • Peterson and Drewien

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Abstract: Greater sandhill cranes (Grus canadensis tabida) from the Rocky Mountain Population (RMP) and whooping cranes (G. americana) reared by RMP foster-parents were monitored during 1980-95 at a traditional spring migration stopover at Harts Basin in western Colorado. Counts during March and April 1986-93 showed that a mean of 10,656 RMP sandhill cranes stopped annually for 1 or more nights enroute from their spring staging area in the San Luis Valley, Colorado to summer grounds. Over 96% stopped between 11 March and 10 April. We estimated that approximately 50% of the RMP stopped annually at Harts Basin during spring migration. Ninety-three whooping crane sightings were recorded during 16 years (\bar{x} =5.8, annual range 2-12) with peak migrations (77.4%) during 1-10 April. Most whooping cranes (88.2%) migrated in April through Harts Basin during the latter half of the sandhill crane migration period. Managing human disturbance near roost sites at Fruit Growers Reservoir between 10 March-20 April would help ensure continued long-term use by migrants.

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Key words: Colorado, greater sandhill crane, Grus americana, Grus

canadensis tabida, Harts Basin, Rocky Mountain population, spring migration stopover, whooping crane.

Greater sandhill cranes from the RMP, and whooping cranes raised by cross-fostering to selected RMP breeding pairs (Drewien and Bizeau 1978), migrate annually to their traditional spring and fall staging area in the San Luis Valley, in southcentral Colorado, where they spend 2-6 weeks each season (Drewien and Bizeau 1974, 1978, Drewien et al. 1987, 1995). The primary RMP spring and fall migration route passes through the Gunnison River Valley in western Colorado (Drewien and Bizeau 1974, 1981); no cranes from other populations are known to migrate through this region. Crane migrations through western Colorado have been documented for nearly 100 years (Cooke 1897:62, Keyser 1902:315, Bailey and Niedrach 1965:301, Drewien and Bizeau 1974, 1981), although no traditional stopover areas were identified.

Recent studies by H. E. Heusser (Grand Junction, Colo., pers. commun.) during 1985-87 and 1990-91 revealed that sandhill cranes and occasionally whooping cranes stopped during migration, mainly during spring, in the Grand Valley in western Colorado. In addition, W. A. Davis (in Drewien and Bizeau 1974:730) reported over 400 sandhill cranes near Eckert, Colorado (Harts Basin) in October 1970. J. D. Vela (Eckert, Colo., pers. commun.) noted that sandhill cranes have stopped annually at Harts Basin since 1948. Since the 1960's, M. K. Peterson observed cranes stopping at Fruit Growers Reservoir in Harts Basin, especially during spring, and initiated spring monitoring surveys in 1980. In this

Paper we report 1) numbers and migration chronology of whooping cranes observed at Harts Basin, Colorado, during spring 1980-95, 2) numbers and migration chronology of RMP sandhill cranes visiting Harts Basin during spring 1986-93, and 3) sightings of whooping cranes during fall migration.

We thank K. D. Peterson for assisting with surveys and S. R. Hemphill, E. J. Horn, and J. Vanko for reporting observations of cranes. J. D. Vela kindly allowed access to his property near Fruit Growers Reservoir to observe cranes. We thank the U. S. Forest Service, Grand Mesa, Uncompahgre, and Gunnison National Forest for allowing time for M. Peterson to conduct some surveys while an employee. We thank W. M. Brown, J. C. Lewis, and R. E. Shea for reviewing the manuscript.

STUDY AREA AND METHODS

Harts Basin and Fruit Growers Reservoir (reservoir) are located 2 km east/southeast of Eckert in west-central Colorado (Fig. 1) in Delta County. Grand Mesa, about 15 km north of Harts Basin, is one of the largest flatop mountains in the world, and with elevations exceeding 3,300 m, dominates the landscape. The reservoir, at an elevation of 1,672 m, was built in 1898 for irrigation but washed out in 1937 and was reconstructed in 1939 by the Bureau of Reclamation. Water diversions from Surface and Current Creeks, tributaries of the Gunnison River, and natural runoff are the primary water sources for the reservoir. When full, the reservoir covers 188 ha and is 3.2 km long with a maximum width of 1.2 km.

Migrating cranes primarily used shallow water areas along the north and northwest reservoir shoreline for night roosts. They frequented meadows near these shores and foraged in harvested cornfields, hayfields, and cattle pastures within 1 km of the reservoir.

Cranes stopping at Harts Basin during spring migrations were monitored annually for 4-7 days weekly over 6-7 weeks during March and April, 1980-95. Occurrences of whooping cranes were recorded during 1980-95 and numbers of sandhill cranes were recorded during 1986-93. Annual estimates of total sandhill crane numbers using Harts Basin were obtained by counting small flocks ($\leq 100-150$), estimating numbers in large flocks, and summarizing daily totals by 10-day periods (1-11 day period, 21-31 Mar). Most cranes stopped only 1 night, therefore counts were excluded for days with inclement weather when cranes failed to migrate. This minimized duplicating counts of the same birds. Presence of marked cranes was also noted to identify individuals and to help interpret count data and turnover rates. To assess the proportion of the RMP using Harts Basin, we compared our count data with spring population counts obtained by the U. S. Fish and Wildlife Service in the San Luis Valley during 1987-93 (D. S. Benning, U. S. Fish and Wildl. Serv., Golden, Colo., pers. commun.). Although few cranes stopped during fall migrations, surveys were conducted when birds were reported at Harts Basin.

RESULTS

Sandhill Crane Migrations

Counts during 8 spring migrations (1986-93) revealed a mean of 10,656 RMP sandhill cranes (sd=650, annual range, 9,469 - 11,532) stopped at Harts Basin annually (Table 1). The earliest and latest sightings were on 10 February 1990 (6 cranes) and 17 April 1987, respectively. However, in 1982, 7 cranes were present on 2 May and reports indicated small numbers stopped after mid April in some years, indicating that dates of last observations (Table 1) were probably minimal for some years. The mean peak migration period was 21-31 March and included 45.3% of all cranes reported; 96.2% were tallied between 11 March and 10 April (Table 1). During March, an average of 60.3% (annual range, 21.5-83.8%) of the migration arrived or passed through Harts Basin. All annual peak count periods occurred during 21-31 March or 1-10 April (Table 1).

Observations of marked and unmarked RMP cranes indicated that approximately 90% remained only 1 night. Most migrants arrived in late afternoon or evening, roosted overnight at the reservoir, foraged in nearby fields and pastures the following morning, and departed during mid to late morning. During periods of inclement weather, cranes remained at Harts Basin for 2 or more days and resumed migration when weather improved. Marked RMP cranes ($n=51$) observed at Harts Basin were from breeding areas in southeastern Idaho (Grays Lake and the upper Blackfoot River Valley in Bonneville and Caribou Counties) and from western Wyoming (Yellowstone National Park, Bear and Green River Valleys)

(Drewien and Bizeau 1974, Drewien et al. 1987).

The mean spring (early-mid March) population count for the RMP in the San Luis Valley, Colorado during 1987-93 was 17,590, but included some counts obtained under poor survey conditions resulting in minimal population estimates (D. S. Benning, pers. commun.). We believe that 2 high counts of 20,014 (1992) and 21,292 (1990) probably better approximated RMP numbers during our count period (1986-93) at Harts Basin. We recorded a mean of 10,656 cranes which suggested that approximately 50% of the RMP stopped at Harts Basin annually.

Observations of Whooping Cranes

Ninety-three whooping crane sightings were recorded in Harts Basin during spring migrations over 16 years (Table 2), with an annual mean of 5.8 (sd=2.9, annual range 2-12). Of these sightings, 73 cranes were observed on the ground and 20 were migrating over the area. Of 73 cranes stopping, 66 (90.4%) remained for 1 night, 6 for 2 nights, and 1 for 3 nights. The earliest and latest observations were on 10 March 1983 and 2 May 1982, respectively. Over 77% of all observations occurred between 1-10 April and 88.2% were during 1-20 April (Table 2).

Twenty-nine different whooping cranes, identified by colored legbands, stopped at Harts Basin, representing 65.9% of the 44 known to be alive during 1 or more spring migrations between 1980-95 (R. Drewien, unpub. data). Twenty individuals were observed for multiple springs, including 1 that was observed during 8 of 14 years and another during 6 of 10 years. Eight individuals stopped for 2 years, 7 for 3 years, 2 for 4 years,

and 1 for 5 years. sandhill and whooping cranes were predictable
We obtained 6 observations of whooping cranes (3 ads, 3 juv)
stopping during fall migration; 5 stopped during periods of
inclement weather (15-16 Oct. 1984). All sightings were in April
October, including 5 in 1984 and 1 in 1987. None remained longer
than 1 night and all were traveling with sandhill cranes. All 3
adults had stopped during prior spring migrations at Harts Basin.

DISCUSSION

Observations during 16 spring migrations showed that Harts
Basin was used annually by migrating RMP sandhill and whooping
cranes. However, observations during fall revealed sporadic use
although cranes were observed and heard migrating through the
area, primarily during late September and October. We are
uncertain why migrants infrequently stopped during fall yet made
extensive use of the area during spring.

Harts Basin is 225 km northwest of the staging area at Monte
Vista National Wildlife Refuge and vicinity in the San Luis
Valley (Fig. 1). Radio tracking studies of migrating RMP cranes
during 1979-82 (Drewien and Bizeau 1981, R. Drewien, unpub. data)
showed that they were flying at 3,415 - 3,750 m when crossing the
Continental Divide between the Gunnison River drainage and the
San Luis Valley. Flying at such high altitudes must be strenuous
and tiring. A 225 km, high altitude flight during spring may
tire many migrants and encourage them to stop at Harts Basin.
Few other water areas with shallow roost sites and attractive
adjacent habitat exist in the area.

Migration chronology data from Harts Basin showed that peak

movements of RMP sandhill and whooping cranes were predictable among years and that most whooping cranes migrated during the latter half of the sandhill crane migration period. Most sandhill crane (81.6%) movements were during 21 March - 10 April; most whooping cranes (77.4%) migrated through Harts Basin between 1-10 April. During March, only 10.8% of whooping crane sightings were recorded, whereas, an average of 60.3% of all sandhill cranes had passed through or arrived in Harts Basin.

Repeated annual spring use by approximately 50% of the RMP revealed that Harts Basin is a traditional stopover, even though most cranes used the area for only 1 night. This use pattern does not conform to the definition of a "traditional stopover" (Melvin and Temple 1982:75-76) because cranes did not remain for extended periods nor were abundant food sources available. We prefer the term "staging area" for fall premigration and migratory locations used annually over extended periods by a population or major population segment; "traditional stopover" better defines those sites such as Harts Basin or the Grand Valley (H. E. Heusser, pers. commun.), Colorado and the Green River Valley in northeastern Utah (Drewien and Bizeau 1974, 1981) that receive repeated annual migration use for short time periods by individual cranes.

Cranes using Harts Basin are a 1 day flight from the RMP spring staging area in the San Luis Valley where they have spent 2-6 weeks foraging and resting prior to resuming migration to summer areas. The primary attractions at Harts Basin as an overnight stopover are adequate roosting sites, adjacent feeding

areas, and minimal human disturbance. By managing human disturbance near roost sites at Fruit Growers Reservoir during early morning and late evening hours between 10 March-20 April, long-term use of the area by RMP migrants could be ensured.

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Table 1. Numbers and migration chronology of greater sandhill cranes from the Rocky Mountain population recorded at Harts Basin, Delta County, Colorado, during spring migrations, 1986-93. Annual peak counts are underlined.

Year	March			April		Total cranes	1st obs.	last obs.
	<10	11-20	21-31	1-10	11-20			
1986		367	<u>9295</u>	1520	350	11532	3/13	4/13
1987		911	1341	<u>6718</u>	1481	10451	3/15	4/17
1988		952	<u>6275</u>	3525	38	10790	3/14	4/15
1989	65	1975	<u>6625</u>	1710	275	10650	3/07	4/13
1990	136 ^a /	1825	<u>4130</u>	4023	278	10392	2/10	4/15
1991	26	2462	<u>5350</u>	3495	115	11448	3/09	4/15
1992		751	2678	<u>6000</u>	40	9469	3/13	4/12
1993	70	3230	2960	<u>3916</u>	339	10515	3/06	4/13
X	37	1559	4832	3863	365	10656	3/07	4/14
%	0.3	14.6	45.3	36.3	3.4	99.9		

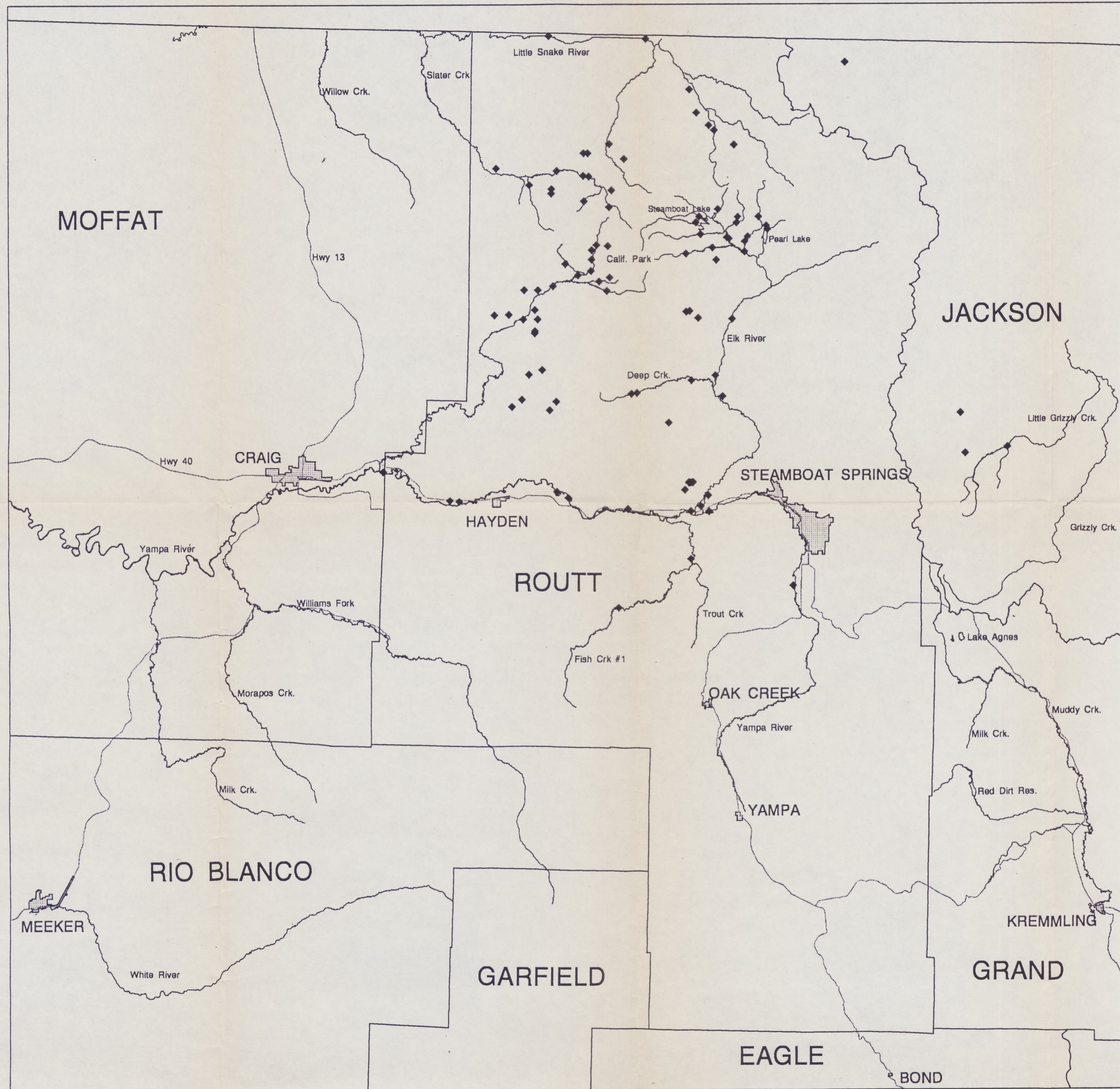
^a/ the earliest observation of sandhill cranes; 11 were recorded in February, including 6 on 10 Feb and 5 on 23 Feb.

Table 2. Numbers and migration chronology of whooping cranes from the Rocky Mountain population recorded at Harts Basin, Delta County, Colorado, during spring migrations, 1980-95.

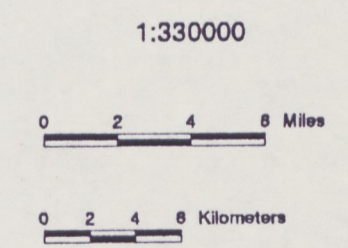
Year	March			April			May	Total
	1-10	11-20	21-31	1-10	11-20	21-30		
1980					2			2
1981				2				2
1982			1	2	1		1	5
1983	1			3	2			6
1984				8				8
1985				9				9
1986			5	5				10
1987		1		9	2			12
1988				5	1			6
1989			1	3				4
1990				6				6
1991			1	4				5
1992				8				8
1993				3				3
1994				2	2			4
1995				3				3
Total	1	1	8	72	10	0	1	93
%	1.1	1.1	8.6	77.4	10.8	0	1.1	100.1

Figure 6.
Greater Sandhill Crane
Nest Sites, 1995.

Greater Sandhill Crane Nest Sites Northwest Colorado 1995



- ◆ Sandhill Crane Nest Sites, 1995
- County Boundaries
- ▬ State Highways
- ~ Rivers, Streams and Lakes
- ▨ Municipal Boundaries



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