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THE WHOOPING CRANE CROSS-FOSTERING EXPERIMENT: THE ROLE OF ANIMAL DAMAGE CONTROL

by Roderick C. Drewien 1, Stephen H. Bouffard 2, Desmond D. Call 2, and Richard A. Wonacott 3.

Abstract: Predator losses of endangered species in reintroduction programs are unacceptable because of the scarcity of the species and the major commitment of staff time and funds. When the whooping crane *(Grus americana)* cross-fostering experiment (experiment) at Grays Lake National Wildlife Refuge (Grays Lake), Idaho was proposed in 1972, animal damage control (ADC) was considered unnecessary. Sandhill crane *(G. canadensis tabida)* nest success was high and coyotes *(Canis latrans)* and red foxes *(Vulpes vulpes)* were uncommon. Canids increased by the mid-1970's destroying whooping crane eggs and chicks. An ADC program initiated in 1976 has evolved into a major part of the experiment. The ADC program is costly and complex, requiring several permits and coordination among 5 state and federal agencies and 20+ private landowners. Current ADC effort uses several control methods and annually entails 40± hrs of helicopter time, 900± hrs of staff time and over 9600 km of vehicle use. Between 1975-84, 14 eggs and 23 to 58 flightless young whoopers were lost to predators, primarily coyotes. From 1976-84, 633 predators were removed from the control area; 72% were canids. The ADC program appears to have reduced predation on whooping crane eggs and chicks. Our experience at Grays Lake indicates that endangered species introduction programs should include ADC evaluations in preliminary planning processes.

The whooping crane recovery program is a international effort involving the U.S. Fish and Wildlife Service (FWS), the Canadian Wildlife Service, State and Provincial conservation agencies, and private conservation groups and individuals in the United States and Canada. The recovery effort has been successful to date. The wild population, nesting in Wood Buffalo National Park, Canada, and wintering on the Gulf Coast at the Aransas National Wildlife Refuge, Texas, has increased from a low of 16 in winter 1941 to a high of 86 in winter 1984. A captive flock, maintained at Patuxent Wildlife Research Center, Maryland (Patuxent), produces progeny annually and numbered 37 during August 1985. Efforts to establish a second wild population in the Rocky Mountains at Grays Lake, Idaho, have been underway since 1975. This flock contained 32 cranes in winter 1984, but breeding has not yet occurred.

The Whooping Crane Recovery Plan calls for downlisting the species to threatened status when the Wood Buffalo-Aransas Population (WBA) reaches 40 breeding pairs, and when 2 additional populations, each with 25 or more breeding pairs, have been established (U.S. Dept. Int. 1985). The successful establishment of a second wild breeding flock in the Rocky Mountains would significantly enhance the status of the species and contribute to the recovery objective.

The objectives of this paper are (1) to summarize losses of whooping crane eggs and flightless young to predators, and (2) to describe the ADC program and the effectiveness of various control techniques employed to minimize predation upon whooping crane eggs and young at Grays Lake, Idaho, 1975-1984. Our findings may be applicable to other potential locations currently being evaluated for the establishment of a third whooping crane population in eastern North America.

Study Area

Grays Lake is a high altitude (1,946 m) marsh in southeastern Idaho. The 8,900 ha marsh is dominated by hardstem

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bulrush *(Scirpus acutus)*. The refuge was established in 1965 and land acquisition is still incomplete. The FWS controls 7,418 ha of 13,284 ha within the approved boundary. The remaining 5,866 ha are currently controlled by the Bureau of Indian Affairs (BIA), Bureau of Land Management, State of Idaho, and private owners. The control area covers some 42,000 ha and includes Grays Lake and all lands within 5 km of the refuge boundary. Other private owners and the U.S. Forest Service own land within the control area. Water in Grays Lake is owned and controlled by the BIA, Fort Hall Irrigation District. The marsh is used as a temporary spring storage reservoir for irrigation water.

Whooping Crane Cross-Fostering Experiment

Grays Lake was selected for the first introduction site in 1975 because of high density of nesting greater sandhill cranes, high nest success, secure nesting and wintering habitat, and a shorter migration route that is geographically isolated from the WBA population (Drewien 1973, Drewien and Bizeau 1974, 1978). Selected sandhill crane pairs are used as foster parents to hatch whooping crane eggs, raise the young and guide them on the migration route to the wintering grounds (Drewien and Bizeau 1978, Drewien and Kuyt 1979).

Sandhill crane pairs selected as foster parents must have a good reproductive history, nest on secure territories, and winter on or near Bosque del Apache National Wildlife Refuge, New Mexico. Whooping crane eggs for the experiment come from wild nests in Wood Buffalo National Park, Canada, and from the captive flock at Patuxent. Removal of 1 egg from normal 2 egg clutches in the wild does not adversely affect productivity (Erickson 1976, Kuyt 1976, Erickson and Derrickson 1981). Fertile eggs from Patuxent are obtained by artificial insemination because whooping cranes in captivity do not normally copulate (Derrickson and Carpenter 1981). Eggs are flown to Grays Lake shortly before hatching and single eggs are placed in sandhill crane nests. Sandhill crane eggs are removed from nests and sent to Patuxent for other research projects (Drewien and Bizeau 1978).

From 1975-84, 226 whooping crane eggs were transplanted into sandhill crane nests. Sixty-nine eggs failed to hatch; 52 of these were infertile or contained dead embryos, while 14 (20%) were lost to predators, primarily coyotes. The fate of 3 eggs was undetermined (Table 1).

Eighty-nine (57%) of 157 young that hatched died before fledging (Table 2). Carcass remains or sign on crane breeding territories indicated that a minimum of 23 young (26%) were lost to predators; 21 were attributed to coyotes and 2 to red foxes. An additional 35 disappeared from unknown causes (Table 2). Tall and dense marsh and meadow vegetation on all breeding territories precluded finding sufficient evidence to identify mortality causes. We suspect that predators were responsible for many unknown mortalities. Thus, losses of young whoopers to predators ranged from a known minimum of 26% to a potential maximum of 65% if all unknown mortalities are included. Most losses assigned to the non-predator catagory were young that vanished soon after hatching during inclement weather (Table 2).

History of Predator Control at Grays Lake

ADC was considered unnecessary when the experiment was proposed in 1972. Because of 2 compound 1080 bait stations near Grays Lake, coyotes and red foxes were uncommon. Sandhill crane nest success was 78%; 95% of the pairs with successful nests raised at least 1 young (Drewien 1973). For these reasons, no ADC was planned in 1975, the first year eggs were transplanted. Predators ate 2 eggs and 1 chick; 2 other chicks were probably lost to predators.

The experiment continued in 1976 with no planned ADC effort. When a coyote was observed eating sandhill crane eggs during the egg transplant, ADC personnel were notified. They believed that control would be difficult due to terrain and ownership patterns. Much of the area was inaccessible except by all-terrain vehicle or airboat. Adequate trap

Table 1. Causes of whooping crane egg failure at Grays Lake NWR, Idaho, 1975-84. Figures in parentheses are percentages of total eggs lost.

Egg source	No. transplanted	Cause of failure			Total eggs failed
		Predator	Unknown	Non-predator	
Canada	153	11(27)	2(5)	27(68)	40(100)
Patuxent	73	3(10)	1(4)	25(86)	29(100)
Total	226	14(20)	3(4)	52(76)	69(100)

Table 2. Prefledging mortality of young whooping cranes at Grays Lake NWR, Idaho, 1975-84. Figures in parentheses are percentages of total young lost.

Egg source	No. hatched	Cause of mortality			Total young lost
		Predator	Unknown	Non-predator	
Canada	113	18(29)	26(42)	18(29)	62(100)
Patuxent	44	5(19)	9(33)	13(48)	27(100)
Total	157	23(26)	35(39)	31(35)	89(100)

coverage would require permission from several federal agencies and private landowners. Traps were set on land adjacent to the refuge where permission had been obtained. Later, a predated whooping crane egg was found with coyote sign at the nest. ADC personnel made a helicopter flight and shot 2 coyotes. However, the pair of coyotes had already destroyed 26 crane nests, including 3 with whooping crane eggs, and all known Canada goose *(Branta canadensis)* nests along 4 km of marsh edge. Another whooping crane egg was eaten, probably by ravens *(Corvus corax)*. Two other whooping crane eggs were destroyed, but it was not determined if the eggs were deserted or if they were predated by ravens.

By 1977 it was apparent that coyotes had increased since 1972 when use of compound 1080 was terminated. Planned control measures became necessary. During 3 spring helicopter flights 12 coyotes were removed. ADC personnel indicated that some coyotes probably escaped detection due to lack of snow cover. A coyote was observed in the marsh during the egg transplant. ADC personnel searched the area by helicopter, but failed to locate the coyote. Low water levels due to severe drought allowed predators easy access to the marsh; predation on whooping crane eggs and chicks was high. One egg from Patuxent was lost to an unknown predator. A red fox and a coyote were seen on 2 territories containing whooping crane chicks which did not survive, although predation was not confirmed as the causes of death. Fourteen other whooper chicks disappeared from unknown causes in 1977. A coyote den was located within 1.5 km of the territories of 8 missing chicks, but attempts to trap the coyotes were unsuccessful. Coyote tracks were also seen near territories of some other missing chicks. Predation was the suspected cause of loss of most, if not all, missing young.

The need to protect whooping crane eggs and flightless young from predation became more evident as the 1977 season progressed. ADC personnel set traps from June through September catching only 5 coyote pups. The FWS requested an exemption from the Environmental Protection Agency to use M-44's. Permission was granted in August and 1 coyote was taken in September. The M-44's were requested as an additional tool because they could be used in crane habitat with minimal human disturbance and without endangering cranes.

Planned ADC effort increased again in 1978. A letter from Secretary of the Interior Andrus directed FWS to "take whatever steps are necessary to see that our damage control personnel 'sterlize' the Grays Lake area of predators until such time that our flock has been substantially increased." Before the 1978 transplant, ADC personnel removed 66 coyotes and local residents took at least 13 more. An active den was located on the northwest portion of the refuge, but the coyotes evaded capture. Because the den was located before the egg transplant, whooping crane eggs were not placed in the area. Nine sandhill crane nests were destroyed near the den. Predator sign was seen on 2 territories where whooping crane chicks disappeared. ADC personnel removed 7 coyotes and 7 foxes with traps and M-44's near these territories. In 1978, permission was granted to the FWS by the Idaho Fish and Game Department to take foxes during the closed season.

In 1979, ADC efforts were increased and new agreements were obtained to use M-44's on BIA lands on, or near the refuge. Additional personnel were needed to operate the ADC program effectively.

In 1980, D. Call, an employee at Grays Lake, was assigned to ADC as his major responsibility. He was trained in aerial gunning, trapping, and M-44 use. ADC personnel continued to supervise and direct the program. Additional funds were allocated to increase helicopter hunting time to about 40± hrs annually. Over 900± hrs of labor were expended annually on the ADC program in addition to driving over 8,000 km in refuge vehicles and some 1,600 km on snow machines (Table 3). ADC efforts through 1984 have been similar with minor increases in aerial hunting time. Effectiveness appears to have improved with this increased effort and refinement of

Table 3. Summary of predators removed and ADC efforts at Grays Lake NWR, Idaho, 1967-84.

Dates	Predators removed			ADC efforts			
	Coyote	Red Fox	Skunk & badger	Air hours	Staff hours	M-44 nights	Trap nights
10/76-9/77[a]	16	0	38				
10/77-9/78	66	7	18	24.7	290	540	629
10/78-12/79	40	3	1	33.1	32[b]	2478[b]	632[b]
1980	47	1	32	40.1	906	2976[b]	2097[b]
1981	36	6	27	23.3	927	4912	1496
1982	47	5	16	24.1	923	4815	1410
1983	45	10	24	35.1	768[b]	4507	1615
1984	111	18	21	41.0	1132	3672	1724
Total	406	50	177	221.4	4978[b]	23900[b]	9603[b]

[a]Data for ADC effort not recorded until 10/77.
[b]Incomplete data.

techniques.

Evaluation of the ADC Program

The objective of the ADC program at Grays Lake changed from removal of problem predators to preventing predation by attempting to eliminate canid predators within the control area. The ADC program appears effective in reducing losses of whooping crane eggs and young to mammalian predators. Losses have generally been low to moderate except during 1977 when the ADC program was just beginning and the marsh water level was low.

Control efforts have primarily been directed at canids, although badgers *(Taxidea taxus)* and striped skunks *(Mephitis mephitis)* are controlled on an opportunistic basis. Coyotes are several times more abundant than foxes, but population estimates are unavailable. Raccoons *(Procyon lotor)*, a potential predator, are exceedingly rare at Grays Lake. Control techniques vary in their effectiveness and include helicopter hunting, trapping, and use of M-44's.

Helicopter hunting was the most effective method for controlling coyotes, as 294 (72%) were removed by this method. In contrast, only 4 (8%) of 50 foxes were removed by aerial hunting.

From 1980-84, 1 coyote and 1 fox were shot per 0.8 and 40.9 hrs of aerial hunting, respectively. Twenty helicopter flights (40 hrs) are made annually in late winter and early spring when snow cover is present. Snow provides maximum visibility of coyotes and slows their movements. Fresh powder offers optimal hunting conditions because coyotes can be tracked. After whooping crane eggs are placed in sandhill crane nests, overflights are avoided to minimize disturbance. Flights are resumed only when canids are seen near nests.

Trapping and M-44's are employed in situations were aerial hunting cannot be used. Trapping occurs mainly during snow-free months, but not on crane breeding territories. Daily trap checks are disruptive and cranes could step in traps. M-44's are used in areas closed to the public. During winter they are placed on boards which can be raised with the snow level and livestock carcasses are used to lure canids into the vicinity of M-44's. During summers, M-44's can be used safely on crane breeding territories. Disturbance is minimal because M-44's require less frequent checking.

Foxes are taken more frequently on M-44's, whereas, coyotes are more frequently caught in traps. Fifteen (4%) coyotes and 30 (60%) foxes were taken with M-44's. Sixty-seven (16%) coyotes and 5 (10%) foxes were taken in traps. From 1981-84, 1 coyote and 1 fox were taken per 1,279 and 779 M-44 nights, respectively, whereas, 1 coyote and 1 fox were taken per 130 and 3,123 trap nights, respectively.

Other control methods include shooting predators opportunistically when observed. Calling is also used to lure predators into gun range. Efficiency of opportunistic hunting or calling was not measured, but 30 coyotes (7%) and 11 (22%) foxes were taken with these methods.

All control work is done by FWS employees. Predator hunting and trapping on the refuge is closed to the public to protect cranes and other wildlife from disturbance and to protect the public from possible injury from M-44's. All traps and M-44's are removed during hunting seasons to prevent potential injury to hunters and dogs. During the rest of the year Grays Lake is closed to public access.

Avian predators are a potential threat to whooping crane eggs and young. To date, no control of avian predators has occurred. Several eggs have been destroyed by birds, probably ravens. In recent years, golden eagles *(Aquila chrysaetos)* have been observed killing sandhill cranes and waterfowl at Grays Lake. One juvenile whooping crane fledged in 1979 was killed by a golden eagle during migration in Colorado (Windingstad et al. 1981). We suspect that golden eagles occasionally take young whoopers but we do not have conclusive evidence. Great-horned owls *(Bubo virginianus)* have taken sandhill cranes at Malheur NWR, Oregon (Littlefield and Lindstedt 1983). We have no

evidence that owls have preyed on young whoopers at Grays Lake.

Conclusions

An ADC program, initially believed unnecessary, developed into a costly and complex, but effective program. Control efforts appear to have reduced predation on whooping cranes eggs and young and have probably increased survival of eggs and young of other avian species nesting at Grays Lake.

Lessons learned at Grays Lake apply to other endangered species recovery efforts. An evaluation of potential ADC needs should be included when selecting introduction sites, and when needed, become part of the recovery efforts. Personnel should be assigned to ADC as their major responsibility and be trained if control programs become necessary. Recovery programs need commitments of manpower, equipment, and funds to operate effective ADC programs.

Several control techniques should be considered because effectiveness and applicability among methods varies by species and under different conditions. Necessary permits, authorizations and agreements should be obtained before initial transplants. These agreements need to consider land ownership patterns and uses, jurisdiction over affected wildlife species, and public relations.

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