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Predator Management To Increase Duck Nest Success

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Abstract.--Operational programs of seasonal predator management to increase duck production may be economically feasible. Mammalian predators of nesting ducks and their eggs were reduced in numbers on selected areas of west central Minnesota during the nesting seasons 1982-86. Where predators were removed, nest success averaged 30% while nest success on nearby untreated habitat was 10%.

INTRODUCTION

Nesting failures by wild ducks in the mid-continental prairie wetland region are mainly the result of mammalian predation on eggs and nesting females. The separation of predators from duck nest habitats via natural barriers has resulted in higher reproduction by upland nesting ducks (Duebbert et al. 1983). The simulation of reduced predation conditions to increase waterfowl production on areas of treatment have been attempted over time in several locations through various mechanical procedures and techniques.

The Mid-Continent Waterfowl Management Project (MCWMP) of the U.S. Fish and Wildlife Service (FWS) initiated a pilot predator management operation in 1982 in three western Minnesota counties in an effort to increase duck nest success without cover management changes. In this project we tried to increase duck nest success on trial areas or zones through prescribed methods of predator removal during a series of nesting seasons.

Wildlife managers and administrators are often confronted with questions of cost-benefit ratios. We have addressed this aspect of a seasonal predator management program. The operational expenditures of this trial effort were documented and were linked to data from previously reported investigations along with our findings. This resulted in our estimated cost of new ducks (recruits) that we believe were produced. The projections are necessarily subject to change as additional data are compiled and examined. In the interim, they offer a point of reference.

INFORMATION REVIEW

The manipulation of upland vegetation has not provided consistent protection of duck nests from terrestrial predators. Cowardin and Johnson (1979) concluded that predator reductions (in waterfowl nesting habitats) combined with cover management are more effective for increasing recruitment than cover management alone. Idle seeded grasslands on most FWS Waterfowl Production Areas (WPAs) provide nest cover that is attractive to ducks. They also provide habitat conditions which favor relatively high populations of Franklin's ground squirrels (Spermophilus franklinii) locally. This species was identified as a nest predator by Sowls (1948) but has not often been recognized as an especially important threat to duck nests. More recently it was found that inside electric barrier fences designed primarily to exclude larger mammalian predators, the depredation of duck nests by Franklin's ground squirrels could rise to damaging levels (Lokemoen et al. 1982). During a study of Franklin's ground squirrels in North Dakota, Choromanski and Sargeant (1982) found that about 50 adults inhabited 286 acres of dense nest cover on a WPA. They concluded that substantial losses of duck production could be inflicted as the ground squirrels made extensive movements through the dense cover.

In eastern North Dakota and western Minnesota the list of mammalian predators of ducks and their eggs is long. In addition to Franklin's ground squirrels the list includes badgers (Taxidea taxus) (Duebbert 1969), mink (Mustela vison) (Eberhardt 1973 and Sargeant et al. 1973)

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raccoons (Procyon lotor) (Greenwood 1982), striped skunks (Mephitis mephitis) (Greenwood 1986), and red fox (Vulpes vulpes) (Johnson, D. H. and A. B. Sargeant 1977). The latter investigators determined that 18% of female mallards (Anas platyrhychos) are killed annually in North Dakota by red foxes, generally while the ducks are attending nests on upland sites. When Sargeant et al. (1984) conducted an extensive study of red fox predation on breeding ducks they found that the average fox family used 3.8 rearing dens during the denning season. Among 1,432 rearing dens they examined, the single den with the remains of the most individual ducks (n=67) was discovered in June, 1970 on the J. Clark Salyer National Wildlife Refuge (NWR), North Dakota. That refuge was formerly named the Lower Souris Refuge where E. R. Kalmbach identified red fox as a predator of ducks. In a very prophetic observation Kalmbach (1938) noted that red fox appeared in 1937 as a predator on the refuge and warned that it would become a factor of concern if its numbers increased.

Concern for the security of duck nests from depredation led to the initiation of a field study in 1934 (Kalmbach 1937) by the U.S. Biological Survey, predecessor of the FWS. He reported that egg destruction by crows (Corvus brachyrhynchos) occurred in 31% of duck nests found during 1934-35 in Saskatchewan and Alberta, respectively. In 1936 Kalmbach (1938) found that 30% of duck nests on Lower Souris Refuge were destroyed by skunks but less than 2% were damaged by crows, which were not numerous in that relatively treeless area. The overall rate of observed duck nest success was 54%. He also noted that in the winter of 1936-37, 423 skunks were trapped and removed to determine if that action would influence duck production. During the 1937 nesting season where the skunk removal had taken place only 7% of discovered duck nests (n=566) were destroyed by skunks and the observed nest success increased to 69%.

Another effort to influence duck nest success, more than 20 years after the Lower Souris Refuge study, was conducted during 1959-64 on the Agassiz NWR in northwest Minnesota (Balser et al. 1968). At Agassiz NWR duck nest success doubled and duckling production increased 60% on the predator reduction treatment areas. To reach the desired level of predator reduction, strychnine eggs, livetraps, steel traps, and Conibear traps were used.

The Minnesota Department of Natural Resources investigated the effect of predator removal on ring-necked pheasants (Phasianus colchicus) reproductive success on an area in southern Minnesota during 1960-62 (Chesness et al. 1968). Predators were removed from the area with livetraps, steel traps, shooting, and by den treatment with poison-gas cartridges. They found that intensified predator removal increased nest success on the trapped area during each successive year while nest success on the untrapped area remained low. That study demonstrated that predation was an important factor limiting pheasant nest success and production. They recommended that predator removal continue throughout the pheasant nesting season where predators were numerous.

In 1967-71 the South Dakota Department of Game, Fish and Parks conducted a program of predator reduction (Trautman et al. 1973). During that program, Duebbert and Kantrud (1974) observed duck nesting near Hosmer, South Dakota, and found that duckling production was over four times greater in the area where predators were removed than where they were not (22.0 vs. 4.8 ducklings/hectare). Eighty-five percent of the predator removal effectiveness was attributed to poisoning, 10% to trapping, and 5% to shooting. Mallard pairs on the area near Hosmer increased sixfold from 7 to 43 pairs/mi^2 during 1970-72 when predator reduction was most effective (Duebbert and Lokemoen 1980).

Sargeant et al. (1984) reported that an effective program to reduce predation on nesting waterfowl would have to include reduction of red fox populations. Regarding the relatively high numbers of red fox in the eastern prairie wetland region, they felt that the demise of coyote (Canis latrans) populations had permitted expansion of red fox populations. Current knowledge of the impact that coyotes have on nesting ducks is limited, but recent evidence indicates that coyotes have less impact on upland nesting ducks than red foxes (A. B. Sargeant and S. H. Allen, unpubl. data).

Red fox densities may be suppressed, eliminated, or excluded in much of the western United States where coyotes dominate. In some locations where coyotes are especially abundant they, too, can cause a substantial reduction in duck nest success. A predator reduction program was directed at coyotes (taken mainly by aerial gunning), raccoons, and ravens (Corvus corax) on a segment of the Malheur NWR, Oregon in 1986 (David G. Paullin, personal communication, 1-15-87). The purpose of that activity was to enhance the production of greater sandhill cranes (Grus canadensis) by reducing predation losses but it also increased duck nest success. Apparent nest success on the predator reduction area was 82% for dabbling ducks and 100% for diving ducks while the comparative rates from areas of the refuge without predator reduction were 25% and 67%, respectively.

Another program pertaining to predator removal took place in Alaska during the spring of 1986. A nesting colony of Pacific black brant (Branta nigricans) near the Tutakoke River suffered disasterous nest losses in 1984 and 1985 when nest success was about 3% and 6%,

respectively. With the removal of Arctic fox (Alopex lagopus) during the spring and summer of 1986, brant nest success rose to 83% (Anthony and Sedinger 1987).

Implications

The preceding review along with a host of unpublished data could provide waterfowl production managers with sufficient evidence to proceed with organized programs of predator management. Extremely large numbers of wild ducks can, under proper man-made or natural conditions, be supported on relatively small units of habitat with intensive management. In the absence of nest destruction by predators, small tracts of attractive nest cover can yield several thousand ducklings per acre (Duebbert et al. 1983). While it may be unrealistic to strive for that level of success on intensively managed habitats, it does illustrate that the upper limits of duck production are sufficiently high to justify relatively large expenditures.

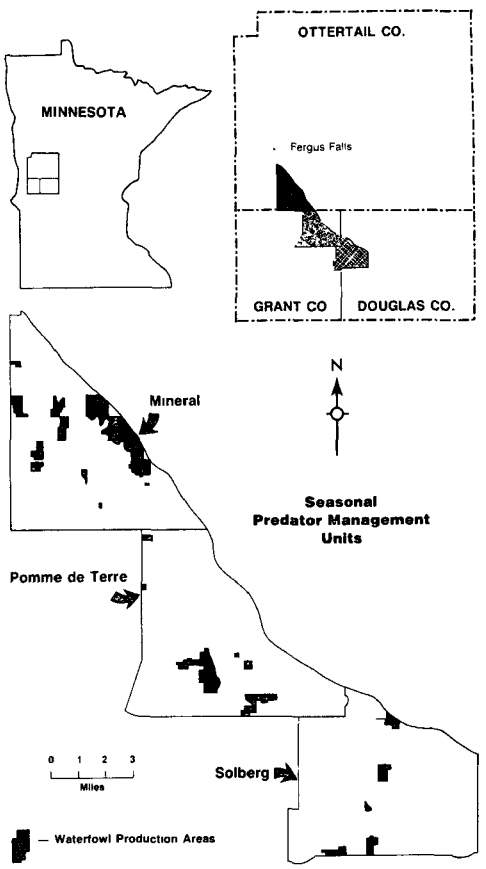

Figure 1.--Field activity areas.

THE AREA AND PROCEDURES USED

Seasonal predator management was conducted annually in April through June, 1982-86. Predator removal by trapping took place on three similar sized units of land, identified as Mineral, Pomme de Terre, and Solberg (fig. 1). These areas were in Otter Tail, Grant, and Douglas counties, Minnesota. They are on the eastern fringe of the prairie pothole region (Stewart and Kantrud 1973) and just east of the Agassiz Lake plain.

Trapping was done in close proximity to roads which bound nearly all sections of land. Major private land (about 90% of the area) usage was for cash crops, mainly corn, soybeans, oats, barley, wheat, and buckwheat. The presence of pasture and hayland was uncommon. WPAs constituted about 6% of the 142-square-mile area in the predator management units. Within the three units, there were about 121-square-miles of uplands which could be used by terrestrial predators and concurrently provide nest sites for dabbling ducks. About 3.6% of the uplands were situated on WPAs where the predominant condition was idle grassland.

In 1982 and 1983 livetraps were used exclusively to remove striped skunks and Franklin's ground squirrels. In the initial year, trapping took place only on the public and private lands in the Mineral unit. Predator reduction on privately-owned lands was conducted with the permission of landowners and was restricted to removals of striped skunks and Franklin's ground squirrels throughout the 1982-86 period. In 1983 the Pomme de Terre unit was added. In 1984 the Solberg unit was included along with procedures for the removal of additional species of predators. On all WPAs mechanical traps and wire snares were used to take red fox and raccoons; incidental captures of badgers and mink also occurred. On one WPA, strychnine-treated milo seed was used in ground squirrel burrows. Numbers of animals taken were recorded except for undiscovered Franklin's ground squirrels which consumed treated milo in their burrows. During 1985 and 1986 the program was continued as in 1984 except that treated milo and snares were not used. Shooting was rarely used to take predators and that action was confined to WPA lands. Dispatched animals were either shot or injected with a euthanasic drug and were disposed of daily in sanitary landfills. Road-killed predators were also noted and included in the records of known removals.

Table 1.--Areas of treatment and numbers of predators removed.

	Square miles			Individuals(n) removed			
Year	Area treated	Upland[1]	Other[2]	Striped skunk	Franklin ground squirrel	Red fox[3] adult	Raccoon
1982	47	36	11	79	27	0	0
1983	92	76	16	157	69	0	0
1984	142	121	21	270	53	22	61
1985	142	121	21	263	60	15	40
1986	142	121	21	266	118	27	53
Total	565	475	90	1035	327	64	154

[1] Estimated to be springtime habitat for skunks, fox, and raccoons.
[2] Includes areas of deep marsh, lake, river, roads, and residential.
[3] 37 pups were transported and released alive on public lands at a distance and additionally 28 pups were dispatched near dens.
Note - 5 mink and 15 badgers removed during the period.

Seasonal predator management was conducted in a manner that would approximate an operational program. Young persons with wildlife profession backgrounds were hired for 3-month periods annually and learned trapping techniques and routines through on-the-job training. Field operations required the equivalent of 3-person months in 1982, 6 in 1983, and 12 per season during 1984-86.

Annually (1979-82) during early May, surveys were conducted to record indicated pairs of breeding ducks in the tri-county area (fig. 1). Blue-winged teal (Anas discors), mallards, gadwalls (A. strepera), Northern pintails, (A. acuta), Northern shovelers (A. clypeata), and green-winged teal (A. crecca) were found to be the most common species of upland nesting dabbling ducks on the areas where predator management was conducted. Systematic nest searching with motor vehicles and chain drags (Klett et al. 1986) was done each year, 1979-86, mainly in the idle grassland fields on WPAs. Nest success was calculated via the Mayfield method (Miller and Johnson 1978).

Predator Population Reduction

About 80% of all striped skunk captures occurred by mid-May each year. The overall average annual take was slightly above 2 animals/mi^2 of habitable uplands (table 1). That density of striped skunks was very comparable to the population reported by Greenwood et al. (1985) on a study area in southeast North Dakota. The capture and removal of Franklin's ground squirrels, raccoons, and especially red fox was very likely much less effective or complete than appeared to be the case with striped skunks. A trap density of about 2 livetraps/mi^2 may have been insufficient to significantly reduce Franklin's ground squirrel numbers. The procedure of containing our trapping of raccoons and red fox on WPA uplands probably reduced our effectiveness in reducing their numbers throughout the treated units. Raccoons were taken as easily with livetraps as with steel traps. The number captured and released unharmed on private lands (n=255) during 1982-86 exceeded the number (n=154) taken on WPAs (table 1). Red fox adults were not known to enter livetraps and the tracks of surviving animals were present at all times on each of the three units.

The predator removal procedures used during this seasonal predator management trial were labor intensive and 78% of the $229/mi^2 annual expenditures were attributed to labor (table 2). Methods to reduce the cost of operation during the 1984-86 period would only have been possible by reducing labor costs or by holding those costs constant while increasing the area of treatment. The cost of striped skunk and Franklin's ground squirrel removal only during 1982-83 was only a few dollars less/mi^2 than the total cost of the expanded seasonal predator management routine used in the 1984-86 period.

Table 2.--Operational trial expenses, 1984-86.

Item	Average annual costs/mi^2
Labor and administration	$178
Vehicles, fuel, and upkeep	30
Durable equipment	5
Expendable supplies	16
Total	$229

Duck Nest Success

The composition by species of discovered nests was 74% blue-winged teal, 17% mallards, 4% gadwalls, 3% Northern shovelers, 2% Northern pintails, and a trace of green-winged teal. This was similar to the species composition as determined during the surveys of indicated breeding pairs. On non-treated WPA grassland our measure of nest success for 361 nests was 10% with minor variations during 1980-86 (table 3). For mallards this would represent about 22% hen success when estimates of renesting are considered (Cowardin and Johnson 1979). With the reduction of skunks and ground squirrels in 1982-83 our records of duck nests (n=57) indicated 21% nest success. When predator management procedures were intensified during 1984-86, nest success was 33% among 487 nests.

We took liberty with some parts of our data and borrowed from others in estimating duck production. We made some assumptions: (1) the dabbling duck population on treated and non-treated areas in the prairie habitat zone was 40 pairs/mi^2 as found during our breeding pair surveys, (2) our observation of 8.8 eggs hatched per successful nest was representative, (3) the 54% duck survival rate used by Lokemoen (1984) was applicable to this area, and (4) mallard hen success as described by Cowardin and Johnson (1979) was used in our treatment of mixed dabbler nest data (table 4). By this process we would predict an increase in new recruits (increase in fledged ducks) through seasonal predator management. Some increases in nest success (table 3) and estimated production (table 4) were noted during the 1982-83 period but substantial additional increases were recorded in the 1984-86 period. In this latter period red fox, raccoons, badgers, and mink were added to the list of predators to remove from WPAs and that change probably accounted for the increased nest success. Our highest estimated annual number of ducks fledged/mi^2 (n=95) (table 4) was 52 more than our estimate for the 1980-86 period (n=43) where no predator management was used. With an annual/mi^2 expenditure of $229 (table 2), the cost-benefit ratio for this specific form of predator management could be expressed as $4.40 for each new recruit. This does not, of course, include the costs of land acquisition and management.

Table 3.--Duck nest success with and without seasonal predator removal in WPA grassland nest cover, 1980-86.

Treatment	Nests (n)	Nest exposure days	Daily survival rate	Percent nest success mean	95% CL
No predator removal 1980-86	361	3810	0.9320	10	7-13
Action #1[1]	57	664	0.9533	21	12-36
Action #2[2]	487	6652	0.9669	33	28-38

[1]Striped skunk and Franklin's ground squirrel removal on public and private land in 1982-83.

[2]Same as previous action plus added removal on FWS lands of red fox, raccoons, and incidental badgers and mink.

Table 4.--Estimates of production from dabbling duck nesting data.

Treatment[1]	Rate of hen success	Production estimates per mi^2/year: Clutches of eggs hatched	Production estimates per mi^2/year: Fledged ducks
No predator removal 1980-86	.22	9	43
Action #1	.39	16	76
Action #2	.50	20	95

[1]Treatments were the same as described in table 3.

CONCLUSION

Our goal to increase the rate of duck nest success by reducing nest losses to predators was achieved in spite of some procedural shortcomings. It can be surmised that several other species of wildlife were concurrently benefitted during their reproductive periods. Added benefits to other game and nongame wildlife reproduction, and consequential sport hunting or nonconsumptive uses can often be equated to economic benefits for resource agencies and user groups. The effectiveness of future programs to reduce mammalian predators of upland nests and birds during springtime might become more efficient over time. Additional procedures and experience gained could also increase outputs while limiting program costs.

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