



## Duck Nest Success Higher in Areas Occupied by Coyotes Than in Areas Occupied by Red Foxes

Mammalian predation on duck eggs in nests has been identified as a principal cause of low recruitment rates among dabbling ducks in the Prairie Pothole Region (PPR). The red fox (*Vulpes vulpes*) is responsible for significant losses of nests. Coyotes (*Canis latrans*) also depredate duck nests, but are believed to be less harmful to duck production than are red foxes. Both coyotes and red foxes are territorial and, in sympatric populations, coyotes tend to exclude red foxes through interference competition. In the United States portion of the PPR, coyote populations are expanding to the detriment of fox populations. Changes in distribution and abundance of coyotes affect the potential magnitude of red fox predation on eggs in nests. If ducks benefit by coyotes suppressing the depredations by red foxes, there exists the possibility of using management of coyotes as a biological method for increasing success of duck nests.

### We Compared Nest Success on Areas Coyotes Occupied and Areas Red Foxes Occupied

During 1990–92 we tested the hypothesis that the presence of coyotes rather than foxes would result in higher duck nest success in uplands of waterfowl

production areas and national wildlife refuges in North Dakota and South Dakota. We worked in different localities each year so that findings would be representative of a large region. Study areas were selected randomly each year from a pool of  $\geq 30$  candidate study areas. The principal canid species of each study area was determined primarily from observations of tracks during two systematic surveys. To select study areas, a track survey of randomly ordered candidate areas was conducted in April–early May. We selected for study the first five to seven areas occupied exclusively or predominantly by coyotes and the first five to seven areas occupied exclusively or predominantly by red foxes. A second survey conducted in late May–June confirmed or changed canid status of areas. Information from incidental observation of canid tracks on study areas and sighting of canids on or near study areas also was used in final determination of the canid status of each study area.

Duck nests were located during three systematic searches of uplands on each study area at 3-week intervals from early May through June. We found nests by using a chain towed between two vehicles to flush hens from nests. Nests were visited at 7- to 10-day intervals until the fate of each nest was determined.

Daily survival rates (DSRs) of nests were calculated by the Mayfield method, and DSRs were

converted to nest success rates for ease in interpretation. A 2-way factorial treatment structure with randomized design was used in analyses of DSRs. Analysis of variance was used to test for differences in DSRs among coyote and fox areas and to test effects of year and canid-year interaction.

Of the 36 areas studied over the 3 years, red foxes occupied 13 areas, coyotes occupied 17 areas, and both canid species occupied 6 areas. The mixed-canid areas were excluded from analyses, other than reporting nest success, because they were not included in the hypothesis and because the sample size was small. We found 840 nests; 803 met criteria for inclusion in analyses (e.g., nests damaged by investigators were excluded). For analyses, nests of all species from each study area were combined.

We evaluated habitat composition on and surrounding each study area and occurrence of other predator species on study areas. These two factors could influence nest success, but we found no differences among or between treatments. Other predators that were present on our study areas were American crow (*Corvus brachyrhynchos*), black-billed magpie (*Pica pica*), raccoon (*Procyon lotor*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), and Franklin's ground squirrel (*Spermophilus franklinii*).

### Duck Nest Success Higher on Coyote Areas Than on Red Fox Areas

Nest success estimates for all years combined was 32% for the coyote areas, and 17% for the red fox areas ( $F_{1,24} = 9.63$ ,  $P = 0.01$ ). Nest success on the six mixed-canid areas was 25%. Overall, 93% of the nest failures was attributed to predation. Effects of year ( $F_{2,24} = 3.01$ ,  $P = 0.07$ ) and canid-year interaction ( $F_{2,24} = 0.54$ ,  $P = 0.59$ ) were not significant.

Nest success estimates varied greatly among both coyote and fox areas; estimates ranged from 18 to 62% for coyote areas and from 2 to 39% for fox areas. The considerable variability shows that the presence of coyotes does not guarantee high nest success or, conversely, that the presence of red foxes will result in low nest success. Many other factors such as the location of canid rearing dens, availability of prey, and abundance of other predators have major effects on nest success.

Our estimates of nest success rates on both the coyote areas and the red fox areas were higher than rates generally reported for the region. Two factors may explain the differences. First, our study was conducted when substantial amounts of cultivated land were enrolled in the Conservation Reserve Program and seeded to grassland habitat; many of our study areas had large enrolled fields of grassland nearby. The additional grassland may have resulted in greater dispersion of nesting ducks and may have reduced the risk of predation to their

nests. Second, drought persisted throughout the study and probably reduced duck abundance and nesting effort. Low nest density may have a positive influence on nest success by reducing predator efficiency in finding nests.

We calculated the percentages of depredated nests with fox-type predation patterns (all eggs missing from nest bowl and no shells or shell fragments present). The proportion of depredated nests with fox-type predation was 4% for coyote areas and 27% for fox areas ( $F_{1,23} = 14.1$ ,  $P = 0.001$ ).

Our findings support our hypothesis that duck nest success is higher in areas coyotes occupy versus areas red foxes occupy. The greater incidence of fox-type predation on fox areas compared with coyote areas supports our conclusion that differences in fox predation caused the differences in nest success. Our finding that average nest success on coyote areas was 15 percentage points greater than average nest success on fox areas is especially important because most coyote areas had nest success well above the 15–20% suggested thresholds for population stability of several dabbling duck species in the PPR.

### Cautions in Interpretation of Results

Although our results show that coyotes benefitted ducks by reducing nest depredation by red foxes, coyotes themselves can prey extensively on duck nests. Coyote populations were relatively low on our study areas. In areas with high coyote populations, coyotes can be major predators of duck nests. Evidence at depredated nests on some of our study areas suggested that coyotes were major causes of depredations.

The magnitude of difference in nest success we found between coyote and red fox areas probably does not apply to all parts of the PPR, to all habitat types, or to all years. For example, on our study areas there were almost no American crows—believed to be important predators elsewhere in the PPR. Depredation by these or other predator species uncommon or absent in our study areas could negate the benefits of coyote suppression of red fox predation. Also, higher populations of predator species that occurred on our study areas could negate the benefits of coyote suppression of fox predation. The benefits to nest success, however, could be greater than we documented if populations of other predator species were lower than on our study areas.

### Changes in Predator Community

Major change is now occurring in the distribution and abundance of canids in the PPR of North Dakota and South Dakota; coyote populations are expanding rapidly and may hold important ramifications related to waterfowl management. If the trend continues, nest success may be higher

than in the past 5 decades when red foxes were the principal canid in much of this area.

### **Canid Manipulation to Benefit Nesting Ducks**

In most areas, substantial coyote deaths are caused by humans. In the PPR, this source of death is believed to be the principal cause of low coyote populations. Thus, the distribution and abundance of coyotes, and hence foxes, in much of the PPR can probably be manipulated by regulating harvest of coyotes. Management of coyote harvest may be a cost-effective means for increasing duck nest success on both public and private lands.

Management to maintain or increase coyote populations is not without consequences; coyotes prey on big game species and livestock, and may also have deleterious effects on other species of

ground-nesting birds such as Canada geese, which may be able to defend themselves and their nests from foxes. The benefits of having coyotes must be weighed against the detriments. Based on findings from other research, we believe a density of about one coyote family (2-4 adults)/25-km<sup>2</sup> would be optimal for depressing fox populations and benefiting nesting ducks.

---

For more information contact:

Marsha A. Sovada or Alan B. Sargeant  
Northern Prairie Science Center  
8711 37th Street S.E.  
Jamestown, ND 58401  
(701) 252-5363

---