Wolf, *Canis lupus*, Predation on Dusky Canada Geese, *Branta canadensis occidentalis*

THOMAS R. STEPHENSON[1] and VICTOR VAN BALLENBERGHE[2]

[1]Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho 83844
[2]U. S. D. A. Forest Service, Pacific Northwest Station, 3301 C Street, Suite 200, Anchorage, Alaska 99503-3954

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On two occasions on the Copper River Delta, Alaska, radio-collared Wolves (*Canis lupus*) were observed locating and consuming Dusky Canada Goose (*Branta canadensis occidentalis*) eggs. On a third occasion, a pair of Wolves killed three geese. Non-mammalian Wolf prey on the Copper River Delta is abundant relative to other areas. Although geese may be less profitable than ungulate prey, there is less risk associated with their capture and the availability of such alternate prey may lead to decreased Wolf predation on Moose at this site. Wolf predation on geese may be additive to other mortality factors or compensatory due to displacement of coyotes.

Key Words: Wolf, *Canis lupus*, Dusky Canada Goose, *Branta canadensis occidentalis*, predation, alternate prey, Alaska.

Although scat analyses in several studies have identified Wolf (*Canis lupus*) predation on birds (Ballard et al. 1987; Fuller 1989; Peterson et al. 1984), no published observations of Wolf predation on geese are available. Utilization of non-mammalian prey by Wolves appears uncommon. However, most Wolf predation/food habits studies have emphasized winter foraging ecology, particularly as monitored through field observations. Direct observation avoids some limitations inherent in scat analysis by providing data on kill rates, killing versus scavenging behavior, and detection of highly digestible foods. Less is known about Wolf summer foraging behavior, when proportionately more non-ungulate prey may be available and utilized.

The incidents described here occurred on the Prince William Sound, Alaska, between 60° and 60°30′N latitude and 144°W longitude. MacCracken (1992) provided a detailed description of the study area. The first author observed the incidents while circling overhead in a Piper PA 18-150 "Supercub" fixed-wing aircraft.

Observations

At 21:10 on 21 May 1992, a radio-collared adult female Wolf flushed an adult Dusky Canada Goose (*Branta canadensis occidentalis*) from a nest and consumed the eggs. The Wolf then travelled 300 m, flushed a second goose from a nest at a distance of 50 m and, after failing to locate the nest during a quick search, departed the area. A ground search the following day revealed that the destroyed nest ini-

remains). The intact nest contained five eggs, with an additional eggshell 1 m from the nest; the eggshell was intact except for a 2 cm hole, characteristic of avian predation (Rearden 1951). Both nests were located in sedge (*Carex* spp.) meadows adjacent to willow (*Salix* spp.)/Sweetgale (*Myrica gale*) plant communities.

During 11:15–11:30 on 28 May 1992, a radio-collared adult female Wolf consumed the eggs of three goose nests. The nests were located by sequentially flushing the adults as the Wolf searched a broad sedge meadow. After consuming the third clutch, the Wolf behaved in an animated manner and chased its tail.

On 8 August 1993, two radio-collared adult Wolves, male and female, were located in an area with a high concentration of molting Dusky Canada Geese. Observations were made between 19:20 and 19:45. The Wolves were traveling about 50 m apart with the female leading and were headed in the direction of a large pond (1 ha) to the NW occupied by at least 50 geese.

When the Wolves were within 100 m of the pond, they separated; the female crouched and moved a short distance through a low willow/graminoid plant community. Some geese on the perimeter of the pond apparently detected her because there was a sudden large flush into the pond. The female Wolf then ran to the pond, jumped in, and began to chase geese. The male Wolf circled to the opposite side of the pond and entered the water when the geese were pushed there. By this time, about one-half of the geese had flown to an adjacent pond (75 m to NW) and the Wolves were chasing the remainder. Most of the geese were able to fly, but apparently not well enough to reach the other pond easily because they were still molting. The shallow water in the pond enabled the Wolves to leap (as opposed to swim) and thereby exhaust the geese. Precipitation was 46% below normal during June through mid-August 1993 (National Oceanic and Atmospheric Administration 1993) and likely resulted in lower than normal pond levels.

After 5 minutes of pursuit, the male captured a goose, carried it to the shore, and returned to the pond. During the next 6 minutes, working as a team, the female caught a goose and the male caught a second goose. By this time, most of the geese had flown to a larger adjacent pond 75 m to the NW and the female crossed the narrow strip of land between the ponds and began chasing geese in the shallow end of this pond. The geese moved to deeper water, however, and the female was forced to swim, and quickly fell behind. The female returned to the carcass of the first goose and began consuming it. The male was still consuming the second goose he caught as we departed at 19:45.

Discussion

Wolves in most locations consume primarily ungulate prey (Ballard et al. 1987). Huggard (1993) found that 9% of the biomass in the diet of Wolves in Banff National Park was non-ungulate in summer. In contrast, Fuller (1989) determined that Beaver (*Castor canadensis*) composed 20-47% of the items in scats in Minnesota during summer. Potential non-ungulate prey is abundant on the Copper River Delta (CRD). The CRD is the primary nesting ground for the Dusky Canada Goose (Cornely et al. 1985), 7% of the world's Trumpeter Swans (*Cygnus buccinator*) (Hansen et al. 1971), and numerous other waterfowl. The available biomass of non-mammalian prey, including waterfowl, during summer is substantial. Conant and Groves (unpublished report, U. S. Fish and Wildlife Service, Juneau, Alaska, 1994) estimated 26 584 ducks (one of the highest densities in Alaska), Jarvis (unpublished report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oregon, 1994) estimated 15 466 geese, and Groves and Conant (unpublished report, U. S. Fish and Wildlife Service, Juneau, Alaska, 1995) estimated 816 Trumpeter Swans on the CRD. Crouse (unpublished report, U. S. Forest Service, Cordova Ranger District, Alaska, 1994) reported that apparent nest predation on Dusky Canada Geese on the west CRD was 69% and that nests were destroyed primarily by avian predators, Brown Bears (*Ursus arctos middendorffi*), and Coyotes (*Canis latrans*). In addition to the predation incidents described in detail above, T.R.S. observed radio-collared Wolves on the CRD consuming Trumpeter Swan eggs on one occasion and located goose and eggshell remains at Wolf den sites. Furthermore, use of non-mammalian prey extended to consumption of salmon (*Oncorhynchus* spp.) during late summer through early winter (unpublished data).

The availability of geese to Wolves also is determined by access. During summers with low precipitation such as 1993, the lower water level in ponds that geese rely on for predator avoidance during molting reduces the ability of geese to escape mammalian predators capable of running in the shallower water.

Although less profitable than ungulate prey like Moose (*Alces alces*), prey such as geese involve less risk to capture. The dangerous prey hypothesis (Forbes 1989) predicts that the high handling time for dangerous prey should reduce returns, especially if less dangerous prey are available. Mech and Nelson (1990) and Weaver et al. (1992) documented Moose killing Wolves, and Mech (1970) and Haugen (1987) presented data on the high number of Wolf carcasses with injuries obtained from being kicked by ungulates.

Messier (1994) discussed two scenarios regarding the effect of alternate prey on Moose-Wolf interactions, both of which can be applied to the CRD. First, predation on geese may decrease predation on Moose by lowering the functional response (Holling 1959), whereby Wolves feeding on geese consume fewer Moose per unit of time. Secondly, the introduction of Moose to the CRD during 1949-1958 (MacCracken 1992) allowed Wolves, which were previously absent, to colonize the area and thus introduced Wolf predation on geese there. Berger and Wehausen (1991) discussed increased predation on sensitive prey populations following increases in alternate prey and described a predator/prey disequilibrium in the Great Basin Desert. Similarly, vegetation succession and alternate prey availability have altered predator/prey relationships on the CRD and have disrupted community dynamics. Ecosystem structure, which once favored geese, has shifted in favor of other species.

Further research is needed to assess predation on Dusky Canada Geese because, in addition to the above, increased Wolf populations may suppress more abundant and effective waterfowl predators such as Coyotes (Mech 1970). Potential effects of Wolf predation should not be exaggerated relative to the effects of declining nesting habitat and more abundant goose predators. Undoubtedly, the 1964 earthquake in the area around the Gulf of Alaska, which altered vegetation succession (Thilenius 1990) and resulted in a decline in goose nesting habitat, has had a detrimental effect on goose productivity. Overall, Wolf predation may be additive or compensatory depending upon the levels of other mortality factors such as non-Wolf predation, weather, human hunting, and habitat loss.

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