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Northern Harrier predation on Willow Ptarmigan.—There are few reports of Northern Harriers (*Circus cyaneus*) killing ptarmigan, although Braun and Rogers (1971) observed a harrier stooping on 2 White-tailed Ptarmigan (*Lagopus leucurus*). In North America, small mammals and birds comprise most of the diet of harriers (Watson 1977). In Scotland, however, Jenkins et al. (1964) found that harriers killed a substantial number of Red Grouse.

Here we document Northern Harrier predation on Willow Ptarmigan (*L. l. albus*) and detail the responses of the prey to presence of harriers during the breeding season in northern Canada. We suggest that harriers may be more important predators on ptarmigan, especially hens with nests, than has been reported previously.

Interactions between Northern Harriers and Willow Ptarmigan were observed in 3 populations in northern Canada between 1978 and 1985. A population of Willow Ptarmigan was investigated at La Perouse Bay near Churchill, Manitoba (58°24'N, 94°24'W), from 1981 to 1985 (Martin 1985). SJH studied populations of *L. l. albus* during 1978 at the

Anderson River Delta, Northwest Territories (69°42'N, 129°00'W), and *L. l. alexandrae* at the Chilkat Pass, Northwestern British Columbia (59°50'N, 136°30'W) from 1979 to 1985 (Hannon 1983). These areas are in subarctic, arctic, and subalpine tundra, respectively. Vegetation is open with shrub heights of about 50 cm in Manitoba and Northwest Territories and about 1 m in British Columbia.

Direct evidence of harrier predation on ptarmigan was observed 3 times. At La Perouse Bay, on 21 June 1985 at 09:35, DSH saw a female Northern Harrier flying slowly 5 m above 2 small islands 400 m distant. The harrier dove to the ground and was lost from view momentarily behind a small willow (*Salix* spp.) shrub. The harrier began to tear at something with its bill and when DSH was within 50 m, it flew away. The freshly killed carcass of a hen Willow Ptarmigan was found at the site. The breast and entrails were partially consumed and the head was still attached. The carcass was 40 cm from a ptarmigan nest containing 11 warm eggs. During this episode no cock ptarmigan was seen or heard. The next morning, the rest of the carcass had been removed and only the intact clutch and a number of ptarmigan feathers, mainly contours and rectrices, remained. On 22 July 1980, at the Anderson River site, a female harrier was observed dropping repeatedly on a brood of 10 recently fledged chicks and, despite being attacked by both ptarmigan parents, killing 4 chicks (T. W. Barry, pers. comm.). On 4 May 1979, at Chilkat Pass, SJH flushed a harrier off an intact carcass of a freshly killed yearling female Willow Ptarmigan.

We have also found rectrices or primaries of Northern Harriers at 6 kill sites on 3 areas (Table 1). Five kills were of females during egg laying and incubation, and the sighting at La Perouse Bay was of a hen at her nest. No bias was observed in ages of ptarmigan at these kill sites (Table 1). These observations are circumstantial evidence, as harriers may have been scavenging the carcasses (Watson 1977).

We observed ptarmigan responding to harriers 7 times during the breeding season. On 21 April 1985, at the Chilkat Pass, SJH observed a male harrier stoop at a territorial male ptarmigan, which jumped aside and called. The harrier flew on. On 17 May 1985 a female harrier flew over a resident pair of ptarmigan. The pair flew downslope; the cock gave a territorial call while the hen crouched under a bush after landing. At Anderson River (28 June 1978) an adult male ptarmigan was observed calling and then flying towards a harrier that had landed near it. The harrier flew away. On 30 June 1980, SJH watched an incubating female ptarmigan become alert and then "freeze" seconds before a female harrier flew over very low about 30 m from the nest. On 2 other occasions (12 June, 5 July 1982), KM observed harriers flying over nest sites at La Perouse Bay. In the latter case, the hen had been calling to her newly hatched chicks just prior to the overflight. In each case, both parents remained motionless and silent. On 5 July 1982, KM observed an adult female harrier repeatedly swoop over a single parent male Willow Ptarmigan with 10 2-day-old chicks. The cock lowered his wings and ran back and forth in front of the harrier. When the harrier landed on a 50-cm high willow, the male flew at it, wings dragging, neck feathers ruffled, tail fanned, and vocalizing intensely with "hisses" and "growls." The harrier swooped towards the brood about 6 more times before leaving, without capturing any chicks.

Ptarmigan are a relatively large prey item for harriers. In part, adult ptarmigan appeared to evade predation by aggressive responses to harriers. Berger et al. (1963) reported that when Greater Prairie Chickens (*Tympanuchus cupido pinnatus*) on leks held their ground and attacked harriers, the harriers invariably retreated. Of 886 encounters, only one prairie chicken was killed. The authors concluded that, although harassment was common, harriers were not normally a serious threat. Both male and female Ring-necked Pheasants (*Phasianus colchicus*) have been observed to deter attacks by harriers (Weigand 1967, Carroll 1985).

During nesting, hen ptarmigan may be more susceptible than males to predation by harriers. Hens weigh less than cocks, and during incubation hens are at their lowest annual

TABLE 1
CIRCUMSTANCES IN WHICH HARRIER RECTRICES OR PRIMARIES WERE FOUND AT
PTARMIGAN KILL SITES

Date	Site	Stage of ptarmigan breeding season	Sex and age of kill*	Observer
28 June 1978	Anderson River	Late incubation	AF	SJH
26 June 1979	Chilkat Pass	Late incubation or early brood season	YM	SJH
23 June 1984	La Perouse Bay	Early incubation	AF	KM
3 June 1985	Chilkat Pass	Egg laying	AF	SJH
19 June 1985	Chilkat Pass	Mid incubation	YF	SJH
26 June 1985	Chilkat Pass	Late incubation	YF	SJH

* AF = Adult Female, YF = Yearling Female, YM = Yearling Male.

weight (e.g., Chilkat Pass: females = 400 g, males = 470 g [Hannon and Roland 1984]; Anderson River: females = 525 g, males = 600 g [SJH, unpubl. data]; La Perouse Bay: females = 507 g, males = 617 g [KM, unpubl. data]). Female harriers weigh between 480 and 550 g (Scharf and Hamerstrom 1975). In addition, incubating female ptarmigan may not be able to scan for predators as well as males, and although concealed by vegetation, may be more vulnerable to detection by searching harriers.

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Predation on Black and Turkey vultures.—Reports of predation on communally roosting or perching Black Vultures (*Coragyps atratus*) and Turkey Vultures (*Cathartes aura*) are rare. Reported predation of vulture adults, eggs, and nestlings by mongoose (Scott 1892), fox (Howes 1926, Grube 1953), opossum (*Didelphis marsupialis*), and domestic dogs (*Canis familiaris*; Jackson 1983) took place at nests. We have also found canid scat and tracks in a freshly predated Turkey Vulture nest in Pennsylvania. Bald Eagles (*Haliaeetus leucocephalus*) sometimes pursue vultures, compel them to disgorge, and then consume the regurgitated material (Oberholser 1906). There is also a report of a Bald Eagle killing a vulture (Bent 1937). Although these reports indicate that vultures are susceptible to predation, we have been unable to find documentation of predation on vultures roosting or gathered in communal groups. Their large size, habit of roosting in tall trees, and congregation in large numbers seem to make Black and Turkey vultures unlikely candidates for predation. Here we report predation and what appeared to be attempted predation of communally perched and roosting vultures.

On 20 November 1984, at Gettysburg National Military Park, Pennsylvania, we observed what may have been attempted predation on Black Vultures by a Golden Eagle (*Aquila chrysaetos*). At 08:58 h, approximately 200 Turkey Vultures suddenly took off from a mixed flock of 300 Black and Turkey vultures perched in trees, on a fence, and in a pasture within 300 m of a permanent roost. The Black Vultures, which remained perched on the fence and ground, began shifting positions and looking up toward the sky. At 09:01 h an immature Golden Eagle stooped on the Black Vultures and chased one a short distance into the forest. The eagle then wheeled around and grabbed the back of a vulture still perched on the fence. Both birds fell to the ground. The vulture struggled free and flew off. The eagle perched on the ground as the remaining vultures took off and soared. After perching in a nearby tree for several minutes, the eagle landed on the ground and fed. The eagle departed at 09:33 h.

Upon investigation, we found that the eagle had been eating animal tissue containing several deer (*Odocoileus virginianus*) hairs. The material had the appearance and smell of meat recently regurgitated by vultures. Presumably the eagle attack caused one of the vultures to regurgitate its crop contents. Black Vultures regurgitate crop contents when disturbed, possibly as a defense mechanism (Jackson 1983). Whether the eagle was intent on catching a vulture or was pursuing the vultures to obtain regurgitated material is unclear. Our ob-