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Northern Harrier

Circus cyaneus

Order: ACCIPITRIFORMES

Family: ACCIPITRIDAE

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Diet and Foraging



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Figure 2. Owl-like facial discs of the Northern Harrier help it to locate prey acoustically.

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Drawing by Tony Henneberg.



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**Adult male Northern Harrier
prey exchange with female,
Kidder Co., ND, 14 June.**

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**Northern Harrier scavenging
fish, Farmington Bay, UT, 8
February.**

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While Northern Harriers mostly feed on rodents and small birds, they are also scavengers. This individual is taking advantage of a dead fish opened up by nearby Bald Eagles. Visit this photographer's website [here](http://www.briansullivanphotography.com/) (<http://www.briansullivanphotography.com/>).

Feeding

Main Foods Taken

Summer: small- and medium-sized mammals, primarily rodents, birds (chiefly passerines and small waterbirds), reptiles, and frogs. Winter: in northern parts of range, almost exclusively *Microtus* voles; in southern part, mammals and birds. In southeastern coastal marshes devoid of mammals, takes passerines and waterbirds ([Collopy and Bildstein 1987](#) (</Species-Account/bna/species/norhar/references#REF16036>)).

Microhabitat For Foraging

Forages over open habitats, e.g., prairies, shrub-steppe uplands, marshes. Frequency of use of certain habitats appears related to a combination of prey biomass and vegetative cover ([Preston 1990 \(/Species-Account/bna/species/norhar/references#REF16056\)](/Species-Account/bna/species/norhar/references#REF16056)). Areas of short vegetation, e.g., heavily grazed pasture and harvested fields, are underused, whereas idle and abandoned (often wet) fields with vegetative cover are used more than expected ([Linner 1980 \(/Species-Account/bna/species/norhar/references#REF34446\)](/Species-Account/bna/species/norhar/references#REF34446), [Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](/Species-Account/bna/species/norhar/references#REF34440), [Preston 1990 \(/Species-Account/bna/species/norhar/references#REF16056\)](/Species-Account/bna/species/norhar/references#REF16056)).

Males prefer more open habitats than females; differences are related to (1) use of different prey species (males take more birds than females do; [Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](/Species-Account/bna/species/norhar/references#REF34440)); (2) the smaller home ranges of females relative to those of males, which results in female "preference" for habitats surrounding nest sites ([Martin 1987a \(/Species-Account/bna/species/norhar/references#REF34447\)](/Species-Account/bna/species/norhar/references#REF34447)); and (3) female exclusion of males from preferred hunting habitats during winter ([Temeles 1986 \(/Species-Account/bna/species/norhar/references#REF16069\)](/Species-Account/bna/species/norhar/references#REF16069)). Females hunt more in taller and denser vegetation than males do ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](/Species-Account/bna/species/norhar/references#REF34440), [Temeles 1987 \(/Species-Account/bna/species/norhar/references#REF34451\)](/Species-Account/bna/species/norhar/references#REF34451)). Foraging behaviors unaffected by military operations near nesting sites (Schueck et al. 2001).

Food Capture And Consumption

Virtually always hunts on the wing, coursing low (<5 m) over ground with a buoyant, gliding flight; flaps intermittently. Most pursuits are short temporally and spatially, and close to ground. Sometimes uses the cover of vegetation and terrain to surprise prey. In British Columbia, used stealth (flying very low to the ground) to surprise roosting Dunlins at high tides (Dekker and Ydenberg 2004). Frequently follows distinct routes, e.g., ditches ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](/Species-Account/bna/species/norhar/references#REF34440)). Known to subdue large prey by drowning ([Bildstein 1988 \(/Species-Account/bna/species/norhar/references#REF46344\)](/Species-Account/bna/species/norhar/references#REF46344), Lapage 1997). Successfully caught a fish and brought it to land (Rozinski 2006). Can capture swimming rails (Evens and Paige

1986) Owl-like facial ruff and facial structures facilitate prey detection by sound, even in absence of visual cues ([Figure 2](#) (<https://download.ams.birds.cornell.edu/api/v1/asset/25015221>); [Rice 1982](#) ([/Species-Account/bna/species/norhar/references#REF34449](#))).

Uses 4 types of hunting flights: (1) gliding: prolonged, nonstationary, nonpowered flight; (2) transect flight: rather straight-line powered flight, with <5 sharp (>30°) turns/min; (3) quartering: powered flight to and fro over short distances, with >5 sharp turns/min; and (4) border-following: powered flight within 5 m of land- or vegetation-type edges, e.g., fencerows ([Bildstein 1987a](#) ([/Species-Account/bna/species/norhar/references#REF34440](#))). In Ohio in winter, about 58% of time spent in transect flight, 22% quartering, and 20% border-following ([Bildstein 1987a](#) ([/Species-Account/bna/species/norhar/references#REF34440](#))). In Kentucky, females used quartering flights ($n = 138$ of 187, or 73.8%) more often than transect flights ($n = 49$ of 187, or 26.2%), and males using quartering flights ($n = 43$ of 79, or 54.4%) and transect flights ($n = 36$ of 79, or 45.6%) to similar degrees ([Vukovich and Ritchison 2008](#)). Uses 4 types of pounces: (1) hook pounce: preceded by a sharp (>270°) turn with a radius of ≤ 1.5 m; (2) hover pounce: preceded by a 1- to 3-s hover; (3) straight pounce: without prior changing of flight direction or speed; and (4) slow pounce: low-velocity repeated strikes at vole nests. In Kentucky, flew a mean distance of 74.0 ± 7.8 m ($n = 342$ observations) between pounces or touchdowns ([Vukovich and Ritchison 2008](#)). Proportion of each type of hunting flight and pounce used varies among age and sex classes, habitats, vegetation height, and prey classes ([Bildstein 1987a](#) ([/Species-Account/bna/species/norhar/references#REF34440](#)), [Collopy and Bildstein 1987](#) ([/Species-Account/bna/species/norhar/references#REF16036](#)), [Temeles 1987](#) ([/Species-Account/bna/species/norhar/references#REF34451](#))). Such a flight-pause-pounce hunting strategy particularly effective in catching diurnal mammals in shrub lands of western US ([Schooley et al. 1996](#)).

In breeding season, hunting activity generally evenly distributed throughout daylight period, although there may be modest temporal "peaks" in midmorning, afternoon, and evening (e.g., [Smith and Murphy 1973a](#) ([/Species-](#)

[Account/bna/species/norhar/references#REF9613](#)), [Linner 1980 \(/Species-Account/bna/species/norhar/references#REF34446\)](#)). In Davis, CA (E. J. Temeles in litt.), concentrates hunting in early morning and evening to avoid midday heat (37°C). In Idaho ([Martin 1987a \(/Species-Account/bna/species/norhar/references#REF34447\)](#)), males observed hunting within 30 min of sunrise. Virtually all male prey deliveries between 0530 and 1900 h, with peaks between 0900 and 1200 h. Females observed hunting between 0600 and 2120 h. Diurnal pattern of foraging females similar to that of males. In se. Washington in winter ([Van Horn 1979 \(/Species-Account/bna/species/norhar/references#REF16075\)](#)), hunting flight highest mid- to late afternoon (sexes pooled). In areas with dense concentrations of larger *Buteo* hawks, avoids hunting during activity peaks of the latter ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)).

In New Brunswick ([Barnard 1983 \(/Species-Account/bna/species/norhar/references#REF16025\)](#)), breeding males reduce foraging activity on calm, warm to hot days; individuals drastically reduce hunting activity during periods of moderate and heavy rains, increase hunting activity above normal during period following rainfall. In winter, less active on windless days than during periods of light and moderate winds, although high winds may keep birds on the ground ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)). May cease hunting for about 40–50 min following prey consumption, apparently due to a food-processing constraint ([Temeles 1989a \(/Species-Account/bna/species/norhar/references#REF46369\)](#), b). See also Breeding: parental care, below.

Prey-capture success highly variable (5–35% of pounces successful; [Temeles 1986 \(/Species-Account/bna/species/norhar/references#REF16069\)](#), [Toland 1986b \(/Species-Account/bna/species/norhar/references#REF46372\)](#), [Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#), [Collopy and Bildstein 1987 \(/Species-Account/bna/species/norhar/references#REF16036\)](#), [Wolff et al. 1999](#), [Vukovich and Ritchison 2008](#), RBM), depending on habitat, prey type, and age or sex class of individual harrier. Success rates typically decline with agility of prey (e.g., amphibians and reptiles 74%, small mammals 34%, birds 14%; [Toland 1986b \(/Species-](#)

[Account/bna/species/norhar/references#REF46372](#)), but see [Collopy and Bildstein 1987 \(/Species-Account/bna/species/norhar/references#REF16036\)](#)). Adult males tend to be more successful than females, and juveniles less successful than adults ([Toland 1986b \(/Species-Account/bna/species/norhar/references#REF46372\)](#), [Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)), although confounding effects of habitat and prey types may obfuscate any differences among age and sex classes (e.g., [Collopy and Bildstein 1987 \(/Species-Account/bna/species/norhar/references#REF16036\)](#)). Among wintering Northern Harriers feeding on voles in British Columbia, prey-capture success higher with snow cover (49% \pm 11 SE) than without (2% \pm 2; [Temeles and Wellicome 1992 \(/Species-Account/bna/species/norhar/references#REF19206\)](#)). In s. U.S. in saltwater marshes, where Northern Harriers captured birds exclusively, individuals pounced 3 times as frequently, but had one-third the per-pounce hunting success, as did individuals hunting mainly cotton rats (*Sigmodon hispidus*) in freshwater marshes ([Collopy and Bildstein 1987 \(/Species-Account/bna/species/norhar/references#REF16036\)](#)). In British Columbia, only 5 of 300 attacks successful on wintering Dunlin ([Dekker and Ydenberg 2004](#)).

In breeding season, intraspecific food-robbery rare ([Simmons et al. 1986a \(/Species-Account/bna/species/norhar/references#REF16067\)](#), RBM). In winter, prey robbery an uncommon but regular hunting technique ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)). See Behavior: social and interspecific behavior, below.

Large items, especially birds, are plucked and eaten, usually on the ground but sometimes on elevated perches. Smaller items swallowed whole. Small birds usually beheaded, bewinged, and befooted; small mammals sometimes eviscerated. Small mammals consumed in 197 s ($n = 22$), passerines in 1,400 s ($n = 7$; [Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)). When disturbed by conspecifics during feeding, Northern Harrier usually defends prey; when disturbed by larger *Buteos*, quickly yields prey.

Diet

Broad, with pronounced annual, seasonal, and geographical variation, influenced by local prey abundance and availability (e.g., Jaksić and Braker 1983). See Sherrod (1978) for lists of prey items and species eaten).

Winter

Most data from pellets collected at communal roosts (pellets underestimate frequency of large prey in diet; [Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)). Birds wintering in northern part of range feed almost exclusively on *Microtus* voles (84–93% by frequency); also mice (deer mouse [*Peromyscus maniculatus*] and house mouse [*Mus musculus*]; 1–4%), shrews (Soricidae; 1–3%), rabbits (*Sylvilagus*; < 5%), and passerine birds (e.g., meadowlarks [*Sturnella* spp.], Northern Cardinal [*Cardinalis cardinalis*], and Song Sparrow [*Melospiza melodia*]; 1–9%) ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)). Few quantitative food studies from s. U.S., and none from Mexico in winter. In s. U.S., mostly mammals (58% in Arkansas [[Preston 1990 \(/Species-Account/bna/species/norhar/references#REF16056\)](#)] and 85% in Mississippi [[Jackson et al. 1972 \(/Species-Account/bna/species/norhar/references#REF46357\)](#)]), particularly cotton rat and house mouse; also harvest mice (*Reithrodontomys* spp.), rice rat (*Oryzomys palustris*), shrews, and passerine birds (e.g., meadowlarks and Northern Cardinal). Winter numbers correlated with previous spring abundance of voles and southern bog lemmings (*Synaptomys cooperi*) on Konza Prairie in Kansas (Reed et al. 2004). Proportion of passerine birds in diet higher in southern than in northern portion of winter range (>15% by frequency vs. <10%, respectively), but quite variable between studies; e.g., 16% in Mississippi ([Jackson et al. 1972 \(/Species-Account/bna/species/norhar/references#REF46357\)](#)), 42% in Arkansas ([Preston 1990 \(/Species-Account/bna/species/norhar/references#REF16056\)](#)). Presence of Loggerhead Shrikes in southern Texas negatively correlated with presence of harriers, shrikes seeking protective cover at approach of harriers (Kim et al. 2003).

Breeding Season

See [Appendix 1 \(/Species-Account/bna/appendix/norhar/APP1002495\)](/Species-Account/bna/appendix/norhar/APP1002495) . A variety of small mammals, reptiles, amphibians, and birds, the last including many recently fledged and ambulatory precocial young, and species not typically taken as adults ([Barnard et al. 1987 \(/Species-Account/bna/species/norhar/references#REF46342\)](#), Ivan and Murphy 2005, Stenzel et al. 2007, KLB). Took eggs from Red Phalarope nest in northern Manitoba (Gratto et al. 1983). Dead passerine chicks in harrier nest show harriers can be nest predators (Regosin et al. 1991); apparently they leave no sign at nest when removing contents (Pietz and Grandfors 2000). Throughout North America, some insects, including beetles (Coleoptera), grasshoppers, crickets, and locusts (Orthoptera), consumed in small amounts; frequently taken by recently fledged young (KLB). Vertebrate prey have masses ranging from about 7 to 1,000 g; average geometric mean prey mass 51.4 g (range 42.8–60.2, $n = 7$ studies); average food niche breadth index 3.96 (1.37–10.32, $n = 7$ studies; [Marti et al. 1993a \(/Species-Account/bna/species/norhar/references#REF46359\)](#)). When rodents are absent, will capture rabbits (Nus 2006).

Food Selection and Storage

Opportunistic predator, with prey choice apparently limited only by size, formidability, and availability of prey. Will congregate in large numbers if rodents abundant (Nelson 2006). Preys on Black Rails in California during extreme high tides in salt marshes (Evens and Paige 1986). Wounded or otherwise sickly prey sometimes taken ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)); will scavenge dead carcasses (Peterson et al. 2001, Soos and Wobeser 2006); caught in a mammal trap baited with dead duck (Godfrey and Fedynich 1988) . In the breeding season, females may capture heavier prey than males, including virtually all large, nonpasserine bird prey ([Barnard 1983 \(/Species-Account/bna/species/norhar/references#REF16025\)](#), [Toland 1985c \(/Species-Account/bna/species/norhar/references#REF16071\)](#), RBM). In New Brunswick, males deliver to nests significantly more passerine bird prey than females do ([Macwhirter 1985 \(/Species-Account/bna/species/norhar/references#REF46358\)](#)).

In breeding season, temporal shifts in prey selection are typical. In New Brunswick, shifts from meadow voles in spring to juvenile passerines and frogs in midseason ([Macwhirter 1985 \(/Species-Account/bna/species/norhar/references#REF46358\)](#)). Shift corresponds to increases in availability of passerine prey ([Barnard et al. 1987 \(/Species-Account/bna/species/norhar/references#REF46342\)](#)). On Middleton Island in Alaska, passerines were captured early in nestling stage by male, then rabbits fed to fledglings by female (Nus 2006).

In New Brunswick, food niche breadth index inversely correlated with abundance of voles in summer (RBM). Captures proportionately more adult and fledgling passerines in years of low vole abundance than in years of high vole abundance ([Macwhirter 1985 \(/Species-Account/bna/species/norhar/references#REF46358\)](#)).

Breeding males and females known to cache and retrieve supplemental food ([Simmons et al. 1987 \(/Species-Account/bna/species/norhar/references#REF16066\)](#), RBM). Caching not detected among wintering birds in Ohio ([Bildstein 1987a \(/Species-Account/bna/species/norhar/references#REF34440\)](#)).

Nutrition and Energetics

Few data. In fall-winter, a female in captivity consumed 100 g/d (beef); in spring-summer, a male in captivity consumed 42 g/d; these values were 19.0 and 12.1% of body mass, respectively ([Craighead and Craighead 1956 \(/Species-Account/bna/species/norhar/references#REF14301\)](#)). In pre-hatch period, males provide their mates with 3 items, or about 95 g/d ([Simmons et al. 1986b \(/Species-Account/bna/species/norhar/references#REF56901\)](#), RBM). Among free-ranging *C. c. cyaneus* wintering in the Netherlands, gross biomass intake 187 g/d ([Daan et al. 1982 \(/Species-Account/bna/species/norhar/references#REF30922\)](#)). See Behavior: locomotion, below.

In New Brunswick ([Macwhirter 1994 \(/Species-Account/bna/species/norhar/references#REF56898\)](#)), food consumption rates vary among broods, but female nestlings eat more (127.4 g/d, or 4.77 kg/nestling period) than males do (117.6 g/d, or 3.90 kg/nestling period). In the postfledging period, net food consumption rates (mean = 102.9 g/d) and the total amounts of food consumed (mean = 2.54 kg) by the sexes are similar. Over the entire period of parental care, females and males receive 7.18 kg (or 113.4 g/d) and 7.37 kg (or 124.6 g/d), respectively. Thus, prior to independence, each surviving offspring consumes about 245 prey (averaging 32 g each; RBM).

No data on energy assimilation efficiency. In order of decreasing caloric value per unit wet mass: birds, mammals, reptiles, and amphibians ([Golley 1960 \(/Species-Account/bna/species/norhar/references#REF56896\)](#), [Cummins and Wuycheck 1971 \(/Species-Account/bna/species/norhar/references#REF16037\)](#), [Bird et al. 1982 \(/Species-Account/bna/species/norhar/references#REF2717\)](#)).

Metabolism and Temperature Regulation

No data.

Drinking, Pellet-Casting and Defecation

Drinks in captivity (KLB). In captivity, single bird on ad libitum diet of small passerines and ground squirrels (*Spermophilus* spp.) produced 8 pellets in 149 h ([Errington 1930b \(/Species-Account/bna/species/norhar/references#REF16039\)](#)). In winter, average prey per pellet varies locally from 0.5 to 3.2 (median 1.3, $n = 5$ studies; [Craighead and Craighead 1956 \(/Species-Account/bna/species/norhar/references#REF14301\)](#), [Jackson et al. 1972 \(/Species-Account/bna/species/norhar/references#REF46357\)](#), [Holt et al. 1987b \(/Species-Account/bna/species/norhar/references#REF16045\)](#)). Mean pellet mass (\pm SD) from roosts in Michigan and Massachusetts 0.9 g ($n = 450$; [Craighead and Craighead 1956 \(/Species-Account/bna/species/norhar/references#REF14301\)](#)) and 2.9 ± 0.93 g ($n =$

180; [Holt et al. 1987b \(/Species-Account/bna/species/norhar/references#REF16045\)](/Species-Account/bna/species/norhar/references#REF16045)). In Massachusetts, mean (\pm SD) pellet length 36.9 ± 9.22 mm, mean bone mass per pellet 0.50 ± 0.335 g ($n = 180$). Percentage bone per pellet averages 17–18% ([Holt et al. 1987b \(/Species-Account/bna/species/norhar/references#REF16045\)](/Species-Account/bna/species/norhar/references#REF16045)). Young birds start producing pellets when they are fed whole animals (e.g. mice, Allen 1929).

Uric acid of Northern Harrier is chalky white; excreta green and pelletlike. No data on defecation rates.

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