

Species Composition and Visitation Frequency of Birds and Mammals at a Bait Station in Northern Minnesota

Abstract

An infrared camera was used at a bait station in an old growth forest near Bemidji, MN to photograph visiting species from 30 August to 27 October 2004. ANOVAs were used to compare four time periods (morning, midday, evening, and night) to determine when each species visited the station most frequently. Species visiting the station were American Crow, Common Raven, Turkey Vulture, Bald Eagle, Black Bear, Raccoon, and Porcupine, with crows and ravens comprising 87% of all individuals seen. Crows and ravens ($F = 2.325$, $P = 0.076$) and immature eagles ($F = 2.396$, $P = 0.069$) visited the station more frequently in the morning period. Surprisingly, few mammals visited the bait station throughout the fifty-nine day study, perhaps because bear scraps were used as bait. Studies show that most scavenging carnivores have an aversion to eating the meat of other carnivores.

Introduction

Many opportunistic animals that feed on carrion are found in northern Minnesota. Carrion eating birds such as American Crows (*Corvus brachyrhynchos*), Common Ravens (*Corvus corax*), Turkey Vultures (*Cathartes aura*), Red-tailed Hawks (*Buteo jamaicensis*), and Bald Eagles (*Haliaeetus leucocephalus*) are known to visit bait stations (Kilham 1989, Prior and Weatherhead 1991, Preston and Beane 1993, Bortolotti and Gerrard 1988). Often the larger birds such as eagles, vultures, and hawks find carrion by monitoring the foraging activities of crows and ravens (Bortolotti and Gerrard 1988, Prior

and Weatherhead 1991). To demonstrate this, carcasses rarely visited by corvids are, in turn, rarely visited by eagles (Bortolotti and Gerrard 1988). However, unless food is abundant, adult Bald Eagles usually drive away immature Bald Eagles and smaller birds (Erskine 1968). Although Turkey Vultures have more highly developed olfactory senses than most birds and, consequently, frequently find carcasses first, they are displaced by Bald Eagles and other large birds that are more dominant (Prior and Weatherhead 1991). In addition to their outstanding olfactory senses, vultures also have an advantage by covering a larger area scavenging through the air. As a result, most mammals discover carcasses only after vultures have discovered them (Prior and Weatherhead 1991).

Several studies have examined the feeding behavior of corvids at bait stations. According to Kilham (1989), crows and ravens are often timid at bait stations, unsure if they should take advantage of unexpected food sources. The feeding behavior of crows is also greatly affected by the presence of other species. For example, in areas dominated by larger buzzards and ravens, crows tend to use the method of storing, taking pieces of the carcasses and stashing them elsewhere (Hewson 1981). At other times they are undisturbed by larger birds and feed directly beside them (Kilham 1989). Often they are not able to pierce tougher hides of some dead animals and therefore rely on animals such as Coyotes (*Canis latrans*) before much feeding can be done (Kilham 1989).

Opportunistic mammals such as Black Bears (*Ursus americanus*), Striped Skunks (*Mephitis mephitis*), Red Foxes (*Vulpes vulpes*), Raccoons (*Procyon lotor*), and Coyotes are also known to visit bait stations in northern Minnesota (Hamilton 1936, Verts 1967, Banfield 1974, Weaver 1977, Kaufman 1982, Cypher 2003, Pelton 2003). Most of the vertebrates Black Bears consume are in the form of carrion, and their preference is for

food high in protein and fat (Pelton 2003). Their foraging behavior intensifies in the fall to increase their fat stores. In fact, carrion at this point can compose fifteen to eighteen percent of their diet, whereas typically it averages around ten percent (Eagle and Pelton 1983, Pelton 2003).

Striped Skunk's food is primarily located by odor, with carrion composing up to fourteen percent of their fall and winter diet while only comprising two percent of their spring and summer diet (Hamilton 1936, Banfield 1974). Red Foxes are found to rely on White-tailed Deer (*Odocoileus virginianus*) carrion and viscera as their primary food source (Schofield 1960, Cypher and Yahner 1996). Raccoons are extremely opportunistic feeders whose diet depends on the availability of food items (Anderson and Lotze 1979). Rennels and Yeager (1943) showed that 27.6 percent of Raccoon food in the months of October and November consisted of animal material. Besides mice and shrews, the bulk (87 percent) of the animal material in their study was carrion. The availability of carrion for Coyotes plays a large role in their foraging in northern regions, as they are opportunistic and eat a variety of food items in relation to their availability (Weaver 1979). In fall, the percentage of carrion scavenging in Coyote populations can increase three-fold (Weaver 1977).

Much is known about the interactions among birds at bait stations and the extent to which mammals rely on carrion in their diet. However, less is known about the time of day these species visit bait stations, especially nocturnal mammals. Thus, I investigated the species composition of birds and mammals at a bait station and the frequency each species visited the bait station throughout the day.

Methods

The bait station was located at the Bemidji State University Hobson School Forest (T 147, R 32, S 22), approximately 17 kilometers northeast of Bemidji, MN. The station, which was in an area with old-growth forest, was located within 100 meters of Lake Lyra, 1.1 kilometers southeast of the front entrance parking lot.

From 30 August to 27 October 2004, a Deer Cam was used to take pictures of animals visiting the bait station. An infrared beam from the camera sensed motion and took a picture when the beam was interrupted. The camera operated 24 hours a day and contained 400-speed film. According to the manufacturer's recommendations, the timing of the camera was adjusted so, following the taking of a picture, there was a ten minute time period where no pictures were taken. It was positioned 30 centimeters off the ground on a pine tree 120 centimeters in diameter. A bait station with fish, turkey, deer and bear scraps, and cat food was located 2 meters away from the tree on which the camera was secured. The film was checked and the bait replenished at least every three days.

After the film was developed, I recorded the species diversity and number of individuals of each species that visited the bait station. I also determined the time of day each individual visited the station. Each photograph was assigned to 1 of 4 time periods in a day; morning, midday, evening, night. Morning was defined as sunrise to 4 hours after sunrise, midday was 4 hours after sunrise to 4 hours before sunset, evening was 4 hours before sunset to sunset, and night was sunset to sunrise. I used ANOVA and Duncan's tests to determine the mean number of species visiting the station during each period of the day and if there was a significant difference between the time periods for each species.

Results

Seven different species visited the bait station during the fifty-nine day study: American Crow, Common Raven, Bald Eagle, Turkey Vulture, Black Bear, Raccoon, and Porcupine (Table 1). Crows and ravens were grouped into one category for the study as exact size could not always be distinguished between the two species. Eighty-seven percent of all visits were made by crows and ravens. Eagles comprised nine percent of the visits, Turkey Vultures two percent, bears one percent, and Raccoon and Porcupine both less than one percent (Table 1).

Using an alpha value of 0.1, crows/ravens visited the station more frequently in the morning period when compared to all other periods ($F = 2.325$, $P = 0.076$; Table 2). Immature Bald Eagles also visited the station more frequently in the morning period ($F = 2.396$, $P = 0.069$; Table 2). However, Turkey Vultures did not differ in their visitation rates among the time periods. For all other species, there was either insufficient data for analysis or no significant difference between the time periods (Table 2).

Discussion

The results of my study generally correlated with the expected feeding times of the species that visited the bait station. Crows/Ravens and Bald Eagles visited the bait station more frequently in the morning period. Other studies have also found this to occur (Knight and Knight 1983, Bortolotti and Gerard 1988, Kilham 1989). Turkey Vultures have been found to have a later arrival to food sources as they have a roosting behavior shortly after sunrise prior to searching for food (Knight and Knight 1983,

Kilham 1989, Kirk and Mossman 1998). Vultures also commonly discover carrion by monitoring the foraging activity of crows, resulting in their secondary arrival to food sources (Prior and Weatherhead 1991). The results of my study show no significant difference among day periods for Turkey Vultures. This could be from a lack of data and more could have been collected if the study was conducted in a different season. Turkey Vulture migration in Minnesota occurs in September and early October and this parallels the data as the last vulture to visit the station was 2 October (Hofslund 1966).

Black Bears increase their feeding activity in the fall, as they are active during the day and night during this time to obtain enough food for winter (Garshelis and Pelton 1980). This would explain the widely varying times bears visited the bait station in my study. However, too few bears visited the station to adequately determine their behavior. Further studies would be needed to gain more information on this.

I expected a greater variety of medium sized mammals to visit the bait station. The lack of visits by skunks, fox, and raccoon was surprising and the reason for it is unknown. Food preference may be one answer. Not only do most carnivores not eat their own species, they rarely eat other carnivores (Macdonald 1988). Additionally, much of the food source may have been depleted by birds feeding during the day. This finding invites a more conclusive investigation to possible causes of low visitation rates by these species.

Though fewer carnivorous mammals were recorded, it is interesting that a Porcupine visited the bait station. Porcupines have been known to visit carrion stations when a beaver carcass was used as bait (Tappan 1939). Additionally, Porcupines will

consume natural sodium sources such as carrion and aquatic vegetation in the absence of another supply (Rappole et al. 1985).

Overall, remote trip devices are fairly non-disruptive and can be used in almost any habitat; however, some problems are encountered with this method of study (Rappole et al. 1985, Cole et al. 1996). Lights emitted in the visible spectrum may cause a startle response from animals, and this, along with shutter noise, may frighten or attract a visiting animal (Buech 1985). Problems can also develop from curious species as the flash can stimulate interest and the animal may investigate long enough to use an entire roll of film or dislodge or damage equipment (Rappole et al. 1985). It is also difficult to get a high-quality size reference with photos (Cole et al. 1996), and it was for this reason that many ravens were not distinguishable from crows in my study.

The ability to keep a steady supply of food at the station could have also caused problems. Food was mostly brought to the bait station during the evening time period. If nocturnal mammals did not make use of the bait that night, often the food source was depleted by the large number of birds feeding the following day. This is evident when noting that, in one day of the study, pictures were taken containing over three hundred crows/ravens and twenty-one Immature Bald Eagles, with at least five of the eagles and twenty-five of the crows being distinct individuals.

Acknowledgements

I would like to thank Dr. Elizabeth Rave for all of her guidance in the research project, the Bemidji Locker Plant for helping supply meat scraps for the bait station, and the Hobson Memorial Forest Board for allowing me to use the forest for research.

Table 1. Species of birds and mammals visiting a bait station in northern Minnesota, 30 August to 27 October 2004.

Species	Total Number of Individuals Seen*	Mean # of Individuals/Day of Project
Crow/Raven	716 (87.11)	12.14
Immature Bald Eagle	72 (8.76)	1.22
Adult Bald Eagle	5 (0.61)	0.085
Turkey Vulture	18 (2.19)	0.305
Black Bear	8 (0.97)	0.136
Raccoon	2 (0.24)	0.034
Porcupine	1 (0.12)	0.017
Total	822 (100)	

* Numbers in parenthesis represent percent of total individuals of all species combined.

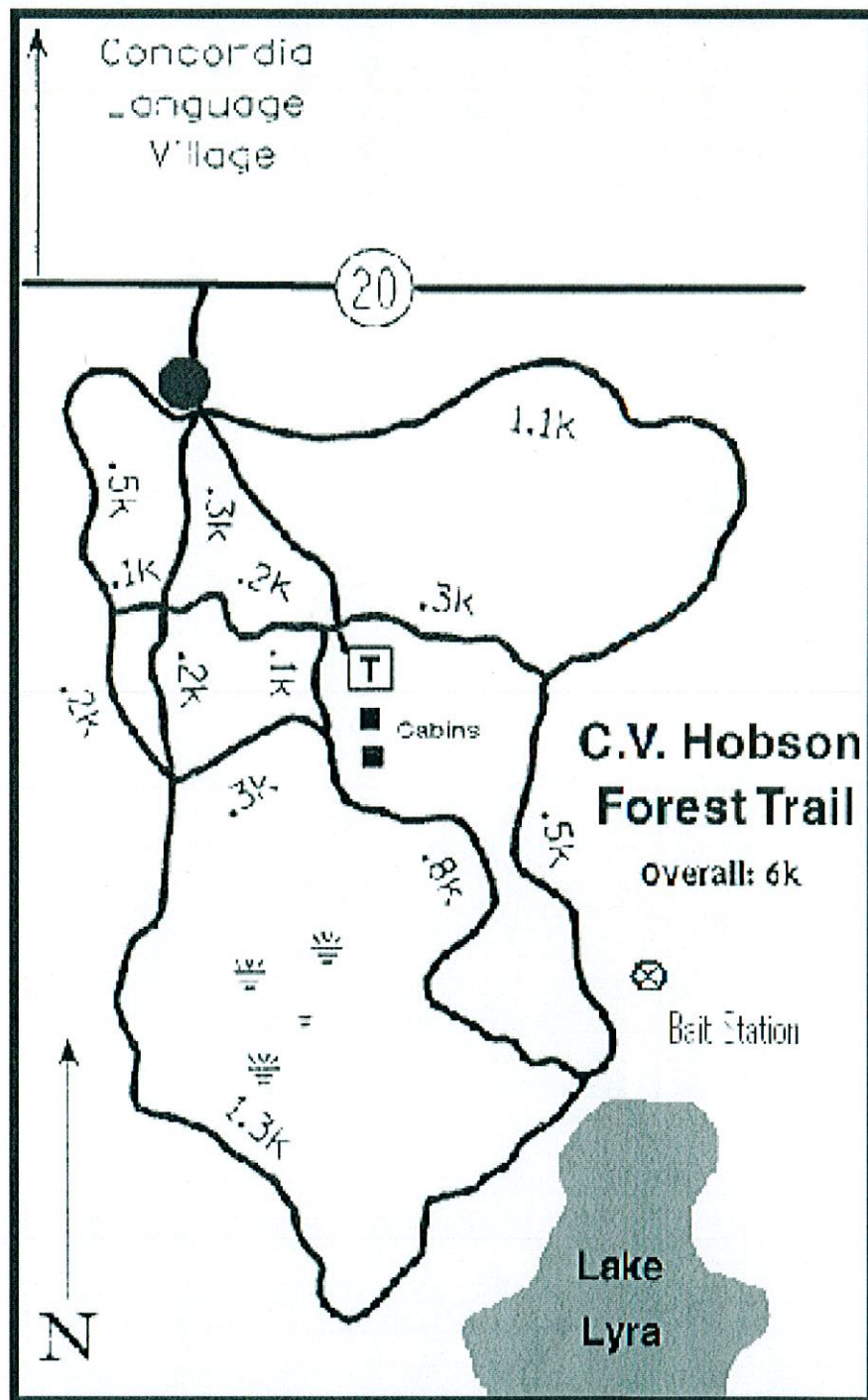
Also note, total number of individuals seen does not reflect distinct individuals as it is impossible to know for many photographs if they are identical to previously photographed individuals or new are individuals.

Table 2. Mean Number of Individuals/Day in each of 4 time periods for species visiting a bait station in northern Minnesota

	Crow/Raven	Imm. Bald Eagle	Ad. Bald Eagle	Turkey Vulture	Black Bear	Raccoon	Porcupine
Morning	(Sunrise to Sunrise + 4 hours) 7.661 ^a	0.847 ^a	0.017 ^a	0.100 ^a	0.080 ^a	0 ^a	0 ^a
Midday	(Sunrise + 4 hours to Sunset – 4 hours) 4.288 ^b	0.373 ^b	0.068 ^a	0.120 ^a	0.017 ^a	0 ^a	0 ^a
Evening	(Sunset – 4 hours to Sunset) 0.186 ^c	0 ^b	0 ^a	0.080 ^a	0 ^a	0 ^a	0 ^a
Night	(Sunset to Sunrise) 0 ^c	0 ^b	0 ^a	0 ^a	0.034 ^a	0.034 ^a	0.017 ^a

Means within a column sharing the same letter are not significantly different ($P < 0.1$).

Map 1. Location of Bait Station in Bemidji State University's Hobson School Forest (T 147, R 32, S 22).



References

- Anderson S., and J. Lotze. 1979. *Procyon lotor*. Mammalian Species 119:1-8.
- Banfield, A. W. 1974. The mammals of Canada. University of Toronto, Toronto.
- Bortolotti, G. R., and J. M. Gerrard. 1988. The bald eagle: haunts and habits of a wilderness monarch. Smithsonian Institution Press, Washington D. C.
- Buech, R. R. 1985. Methodologies for observing beavers (*Castor canadensis*) during the activity period. Pages 29-34 in R. P. Brooks, ed. Nocturnal mammals: techniques for study. School of Forest Resources, Research Paper No. 48. Pennsylvania State University, University Park.
- Cole, F. R., M. S. Foster, J. D. Nichols, R. Rudran, and D. E. Wilson. 1996. Measuring and monitoring biological diversity: standard methods for mammals. Smithsonian Institution Press, Washington D. C.
- Cypher, B. L. 2003. Foxes: *Vulpes* species, *Urocyon* species, and *Alopex lagopus*. Pages 511-546 in J. A. Chapman, G. A. Feldhamer, B. C. Thompson, eds. Wild mammals of North America: biology, management, and conservation. Second ed. Johns Hopkins University Press, Baltimore, MD.
- Cypher, B. L., and R. H. Yahner. 1996. Food habits of red foxes at Valley Forge National Historical Park. Northeast Wildlife 53:19-24.
- Eagle, T. C., and M. R. Pelton. 1983. Seasonal nutrition of black bears in the Great Smokey Mountains National Park. International Conference on Bear Research and Management 5:94-104.
- Ersine, A. J. 1968. Encounters between Bald Eagles and other birds in winter. Auk 85:681-683.
- Garshelis, D. L., and M. R. Pelton. 1980. Activity of black bears in the Great Smokey Mountains National Park. Journal of Mammalogy 61:8-19.

- Hamilton, W. J., Jr. 1936. Seasonal food of skunks in New York. *Journal of Mammalogy* 17:240-246.
- Hewson, R. 1981. Scavenging of mammal carcasses by birds in West Scotland. *Journal of Zoology*, London 194:525-537.
- Hofslund, P. B. 1966. Hawk migration over the western tip of Lake Superior. *Wilson Bulletin* 78:79-87.
- Kaufman, J. H. 1982. Raccoon and allies. Pages 567-585 in J. A. Chapman and G. A. Feldhamer, eds. *Wild mammals of North America: biology, management, and economics*. Johns Hopkins University Press, Baltimore, MD.
- Kilham, L. 1989. *The American crow and the common raven*. Texas A&M University Press, College Station, TX.
- Kirk, D. A. and M. J. Mossman. 1998. Turkey vulture: (*Cathartes aura*). In *The Birds of North America*, No. 339 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia.
- Knight, S. K., and R. L. Knight. 1983. Aspects of food finding by wintering Bald Eagles. *Auk* 100:477-484.
- Macdonald, D. W. 1988. *Running with the fox*. Facts on File Publications, New York.
- Pelton, M. R. 2003. Black Bear. Pages 547-555 in J. A. Chapman, G. A. Feldhamer, B. C. Thompson, eds. *Wild mammals of North America: biology, management, and conservation*. Second ed. Johns Hopkins University Press, Baltimore, MD.
- Preston, C. R., and R. D. Beane. 1993. Red-tailed hawk: *Buteo jamaicensis*. In *The Birds of North America*, No. 25 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia.
- Prior, K. A. and P. J. Weatherhead. 1991. Competition at the carcass: opportunities for social foraging by Turkey Vultures in southern Ontario. *Canada Journal of Zoology* 9:1550-1556.

- Rappole, J. H., L. D. Navarro, M. E. Tewes, and D. Everett. 1985. Remote trip cameras as a means for surveying for nocturnal felids. Pages 45-49 in R. P. Brooks, ed. Nocturnal mammals: techniques for study. School of Forest Resources, Research Paper No. 48. Pennsylvania State University, University Park.
- Rennels, L. E. and R. G. Yeager. 1943. Fur yield and autumn foods of the raccoon in Illinois river bottom lands. *Journal of Wildlife Management* 7:45-60.
- Schofield, R. D. 1960. A thousand miles of fox trails in Michigan's ruffed grouse range. *Journal of Wildlife Management* 24:432-434.
- Tappan, G. 1939. *Eyes in the Night*. Thomas Y. Crowell Company, NY.
- Verts, B. J. 1967. *The biology of the striped skunk*. University of Illinois Press, Urbana, IL.
- Weaver, J. L. 1977. Coyote-food base relationships in Jackson Hole, Wyoming. M.S. thesis, Utah State University, Logan, UT.
- Weaver, J. L. 1979. Influence of elk carrion upon coyote populations in Jackson Hole, Wyoming. Pages 152-157 in M. S. Boyce and L. D. Hayden-Wing, eds. *North American elk: ecology, behavior and management*. University of Wyoming, Laramie, WY.