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From the Field

Berry Important? Wolf Provisions Pups with Berries in Northern Minnesota

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ABSTRACT Wolves (*Canis lupus*) primarily provision pups by catching mammalian prey and bringing remains of the carcass to the pups at a den or rendezvous site via their mouths or stomach. In August 2017, we observed an adult wolf regurgitating wild blueberries (*Vaccinium* spp.) to pups at a rendezvous site in the Greater Voyageurs Ecosystem, Minnesota, USA, which is the only known observation of wolves provisioning pups with wild berries. This observation, in combination with other evidence from the Greater Voyageurs Ecosystem, suggests wild berries might be a more valuable food source for wolves in southern boreal ecosystems than previously appreciated. © 2020 The Wildlife Society.

KEY WORDS blueberry, *Canis lupus*, gray wolf, Minnesota, parental care, *Vaccinium.*

Wolves (*Canis lupus*) are cursorial predators that primarily hunt and kill mammalian prey. However, wolves are also opportunistic generalists that can capitalize on abundant nonmammal foods such as garbage, bear bait piles, and fruits (Mech et al. 2015, Gable et al. 2018*a*). In southern boreal ecosystems, such as northern Minnesota, USA, wild berries (mainly *Vaccinium* spp. and *Rubus* spp.) are plentiful in midsummer (Jul–Aug) and can account for up to 68% of the diet of adult wolves and >30% of the diet of pups during this time (Fuller 1989; Gable et al. 2017*a*, 2018*a*).

For much of the pup-rearing season (late Apr to late Sep), adult wolves provision pups by killing prey and carrying carcass remains to the homesite (i.e., a den or rendezvous site) via their mouths or stomachs (Mech et al. 1999). Yet, details of wolf provisioning habits in densely forested systems during summer are not well-understood because wolf pup diets have not been well-studied and visual observation of wolves is difficult in these systems (Bryan et al. 2006, Palacios and Mech 2010). Herein, we describe a unique observation of an adult wolf provisioning wolf pups by regurgitating blueberries. This observation, in combination with other recent evidence from the Greater Voyageurs Ecosystem (GVE), Minnesota, suggests wild fruits and berries might be a more valuable seasonal food source for wolves in southern boreal ecosystems than previously documented.

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STUDY AREA

The GVE was a 1,812-km^2 area located in northern Minnesota along the border of Ontario, Canada. The GVE's western boundary was 20 km east of International Falls, Minnesota, and Fort Frances, Ontario, and extended 50 km eastward to the western edge of the Boundary Waters Canoe Area Wilderness (Gogan et al. 2004). The GVE included the entirety of Voyageurs National Park (882 km^2) as well as a large area south of the park. The GVE's landscape was dominated by southern boreal forests, aquatic habitat, and numerous lakes. Wolves in the GVE primarily preyed upon adult and neonatal white-tailed deer (*Odocoileus virginianus*; density = 2–4 deer/km^2; Gable et al. 2018*a*) and beavers (*Castor canadensis*; density = ~1 colony/km^2; Gable et al. 2018*a*). Wolf densities during summer were 4–6 wolves/100 km^2 (Gable et al. 2016). See Gable et al. (2016) for additional details about the study area.

METHODS AND RESULTS

On 1 August 2017, author A. T. Homkes approached a cluster of Global Positioning System (GPS) locations from a collared Moose River Pack wolf in a drained beaver meadow approximately 1 km south (48°39′N, 92°79′W) of Voyageurs National Park. We were searching clusters of GPS locations, which are considered potential kill sites, as part of an intensive wolf predation study (Gable et al. 2016). As A. T. Homkes approached the area, which was later

determined to be a wolf rendezvous site, he observed 5 pups gathering around an adult wolf in the center of the beaver meadow approximately 100 m away. The pups licked up at the adult wolf's mouth for approximately 30 seconds, after which the adult wolf began to regurgitate food for the pups. Some of the pups ate the regurgitated food directly from the adult wolf's mouth as the adult slowly walked around, while other pups followed behind the adult wolf consuming the regurgitated food that fell to the ground. The adult wolf regurgitated 3 times over the course of approximately 1 minute before the pups and adult wolf moved out of sight into the forest surrounding the meadow. The adult wolf was an unmarked subordinate or nonbreeding member of a pack in which the breeding female was fitted with a functioning GPS-collar during summer 2017 and the breeding male wore bright green ear tags from capture events in 2014 and 2016. The only wolf in the pack with a functional GPS-collar was a yearling wolf whose collar took fixes every 20 minutes (this is the wolf that led us to the site).

Approximately 30 minutes after the wolves left, A. T. Homkes investigated the area where the wolves had been observed. At the site where the wolf regurgitated, there were several small piles of chewed and whole wild blueberries mixed with a foamy liquid on top of the matted grass (Fig. 1). The foamy liquid was presumably stomach fluids because the liquid was deposited right where the adult wolf was regurgitating food for the pups. The blueberries and foamy liquid were clearly fresh because there was no evidence of desiccation. Around the remaining regurgitated blueberries, there were several wet places on the ground (~10 × 10 cm) stained pink where the pups had consumed the piles of regurgitated blueberries. There were no prey remains (animal hair or bone fragments) present in any of the regurgitated material. The nearest area of berry forage was approximately 360 m away from the rendezvous site. The rendezvous site encompassed an entire drained beaver pond including the area below the pond's dam (~0.7 ha).

DISCUSSION

We conclude, based on our visual observation combined with the physical evidence at the site, that the adult wolf provisioned the pups by regurgitating blueberries. We are uncertain how common this behavior is in the GVE and other similar southern boreal ecosystems but suspect that our observation is not an isolated incident. Adult wolves in the GVE are mainly eating wild berries during late July and August (Gable et al. 2017*a*, 2018*a*), and it seems likely that adult wolves are provisioning pups with the same food they are subsisting on. Given that berries can constitute >30% of wolf pup diet biomass during the summer (Gable et al. 2017*a*), wolf pups are either being provisioned by adults, foraging for berries on their own, or some combination of these options. Van Ballenberghe et al. (1975) thought that the presence of berries in wolf pup diets in Minnesota was from pups eating berries that were abundant around rendezvous sites but our observation suggests that this might not strictly be the case; pups almost certainly consume berries around homesites, but whether the presence of berries in pup diets is from pups foraging berries or adults provisioning pups with berries is unknown.

We are uncertain whether provisioning pups with berries is the result of reduced prey availability in mid-to-late summer, an abundance of wild berries during this time, or an interaction of these conditions. During late spring and early summer (late May to mid-Jul) in the GVE, wolves are primarily hunting and killing white-tailed deer fawns and beavers (Gable et al. 2017*a*, 2018*a*). By mid-to-late summer (mid-Jul to Aug), deer fawns are quick enough to evade wolves, and beavers rely more on aquatic vegetation (Severud et al. 2013), which presumably reduces their vulnerability to wolves because beavers likely spend less time foraging on land (Gable et al. 2018*b*). This period of reduced prey vulnerability coincides with a period of abundant wild berries.

Though wild berries do not provide as much caloric value as mammalian meat (0.51 kcal/g vs. 1.87 kcal/g respectively; Gable et al. 2017*b*) and are likely less digestible for wolves than mammalian meat, their abundance and relatively low risk and energetic cost to obtain likely makes berries a valuable alternate food source for wolves. We think this unique observation, in combination with previous research in the GVE (Gable et al. 2017*a*, 2018*a*), provides another example

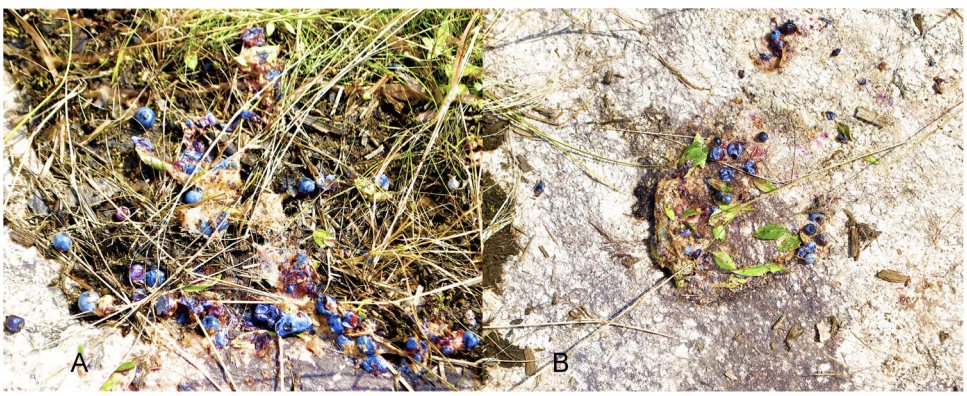

Figure 1. Two different piles (A & B) of blueberries (*Vaccinium* spp.) that were regurgitated in 2017 by an adult wolf to provision wolf pups at a rendezvous site in northern Minnesota, USA.

of the potential importance of berries as a food source for wolves. Given the dearth of information on the role of berries in wolf ecology, we think considerable research is needed to understand the importance of wild berries to wolves. Such research could, for example, illuminate how forestry practices that dramatically increase berry abundance (e.g., clear-cutting ridges and thereby creating ideal blueberry habitat; Brodeur et al. 2008) might affect wolf pup survival.

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