

COMMON RAVENS USING TREES FOR CACHING FOOD NEAR THE NEST

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ABSTRACT—We report details of 3 food caches created or retrieved by a pair of Common Ravens (*Corvus corax*) near their active tree nest in the Pattee Canyon Recreation Area, Missoula County, Montana, during spring of 2016. Caches were located in 3 different 30–35 m tall Ponderosa Pines (*Pinus ponderosa*). Caches were pieces of meat placed 1.0–1.5 m from the trunk on large lateral limbs at least 20 m above ground, and were 70–100 m from the nest tree. One cache was created by the non-incubating adult early in the incubation phase of nesting, and probably was fed to the incubating adult by its mate. The other 2 caches were retrieved early in the nestling phase, at least 1 of which was delivered directly to the brood at the nest. At least 2 of the caches were hidden under pieces of bark and lichen placed on the cached meat, probably to reduce likelihood of their detection and theft by other forest birds and mammals. The tree caches shared some characteristics of ground caches created elsewhere by nesting Ravens: (1) caches were within 100 m of nests; and (2) caches were often hidden or covered with vegetation. These appear to be the 1st published observations of tree caches created and retrieved by Common Ravens near their active nest. Our observations also suggest that caches may be used by the adults to feed themselves as well as their young.

Key words: breeding season, caching behavior, Common Raven, *Corvus corax*, food hoarding, food storage, Montana, nest site, tree caches

Common Ravens (*Corvus corax*) have been the focus of much observational and experimental study, which has revealed a great deal about raven intelligence and cognitive processes (Ratcliffe 1997; Boarman and Heinrich 1999; Heinrich 1999; Marzluff and Angell 2012). Caching (food storage and retrieval) is a prominent activity throughout the lives of Common Ravens, with important consequences for survival and reproduction (Vander Wall 1990). Formal studies of raven caching behavior have concentrated on its development and expression in different social contexts as individuals grow to adulthood, often conducted using captive birds and experimental manipulations during winter and spring (conditions where caching is particularly tractable) to

gain insights (Heinrich 1989, 1999; Heinrich and Pepper 1998; Bugnyar and others 2007).

Food hoarding by ravens during the breeding season is poorly documented (Heinrich 1989, 1999; Ratcliffe 1997; Boarman and Heinrich 1999), and direct observation of caching by wild adults near an active nest is rare. Kilham (1989) noted that a pair of ravens nesting in New Hampshire delivered food to their nestlings retrieved from a number of cache locations on a cliff, typically from patches of grass and small ledges, all within 80 to 90 m of the nest. Ratcliffe (1997) briefly noted that food was commonly cached in holes among rocks and under stones by a nesting pair of ravens in England, without noting how close to the nest the caches were located, but possibly nearby. Heinrich (1999) published observations from Montana shared with him by Terry McEneaney, where nestling Black-billed Magpies (*Pica hudsonia*) killed by a nesting pair of ravens were cached under sagebrush shrubs an undetermined distance from the raven nest. Recently, Howe and Coates (2015) reported finding whole eggs of Greater Sage-Grouse (*Centrocercus urophasianus*) cached in rock crevices within 50 m of an active raven nest in Nevada. Summarizing these few reports, food may be cached close to raven nests in a variety of sites and later retrieved and fed to nestlings. Here we present our observations of caching behavior in trees by a nesting pair of ravens in western Montana, which also suggest that food caching is not just for the benefit of nestlings. All observations were opportunistic and made with the aid of 10X binoculars.

On 5 March 2016 we discovered a pair of Common Ravens early in the process of constructing a nest in the Pattee Canyon Recreation Area, Missoula County, Montana (46.82269°N, 113.92438°W; 1268 m elevation). We followed the progress of this nesting intermittently through fledging, which occurred sometime during 22 to 28 May. The forest around the nest was dominated by second-growth Ponderosa Pine (*Pinus ponderosa*), Western Larch (*Larix occidenta-*

lis), and Douglas-fir (*Pseudotsuga menziesii*). On the date of discovery, each adult carried sticks to the nest platform, a flimsy collection of sticks 1.5 m below the apex of a live 30-m tall (77.2 cm dbh) Ponderosa Pine. By 10 March, the nest was a bulky collection of woven sticks, and on 12 March, both adults carried wads of finer, unidentified vegetation in their bills to the nest, adding this to the nest lining. Between 12 March and 22 May, we observed 1 case of caching food and 2 cases of retrieval of cached food by this pair in the vicinity of their nest.

At 11:55 MST on 20 March, an adult raven landed in silence about 20 m above ground in the lower canopy of a live but needleless 30-m-tall (70.6 cm dbh) Western Larch about 100 m upslope from the raven nest. The bird perched about 1 m from the trunk on a large lateral limb about 8 cm diameter, whereupon it regurgitated a bolus of red meat about 6 cm in length and placed it atop the limb. It gathered 5 to 6 pieces of bark and lichen within 1 step of the cache site during the next 2 min, 1 item at a time, and placed each piece of vegetation atop the cached meat. When done covering the cache, the raven moved to a higher limb, wiped its bill 2 to 3 times, gave a soft croak, and then sat in silence until flying from the tree and out of view at 12:02. At 12:06, it flew to the nest tree as its incubating mate departed, moved up to the nest and settled on the nest, all the while in silence. The caching adult may have been the male, because females perform most or all of the incubation (Ratcliffe 1997; Boarman and Heinrich 1999), but because of the nest exchange the sexual identity of the caching bird remains uncertain.

At 08:57 on 28 April, the nestling ravens were very vocal. After hearing a few quork calls an adult raven landed about 30 m above ground on a limb in the crown of a live 35-m-tall (91.7 cm dbh) Ponderosa Pine about 100-m upslope from the raven nest and about 20 m from the larch used as a cache site on 20 March. The raven remained silent after it landed. It hopped upwards twice to a 3rd limb about 8 cm diameter. When about 1 m from the trunk, the raven removed 2 pieces of loose bark from the top of the limb with the tip of its bill, picked up a 3-cm cube of cached meat and swallowed it (at least to its throat), then flew in silence upslope and away from the nest tree. The bird approached this cache fairly directly and with little

hesitation. Total time in this cache tree was about 30 s. This raven then appeared at the nest about 2 min later, approaching in silence, and fed the begging nestlings through regurgitation, possibly with the retrieved meat.

At 10:20, also on 28 April, an adult raven landed in silence about 30 m above ground in a live 35-m tall (66.5 cm dbh) Ponderosa Pine about 70 m upslope from the raven nest and about 60 m from the cache pine noted earlier that morning. After landing in the pine, the raven hopped up to a 2nd lateral limb about 8 cm diameter and, when about 1.5 m from the trunk, it bent over and immediately picked up and swallowed a 5-cm cube of meat before leaving the tree. We failed to see it remove any vegetation that might have been covering this cache. Once again, the bird approached this cache fairly directly and with little hesitation. The raven departed in silence from the cache tree after being there about 20 s, flew downslope to the nest tree, landed a little below the nest, hopped up to the nest and fed the begging and vocal nestlings with the regurgitated meat.

Although limited in scope, our observations nevertheless contribute to an understanding of the process and expression of caching activity by Common Ravens during the nesting cycle. They are noteworthy for 3 reasons: (1) the 3 caches we observed were located in separate trees within 100 m of the nest tree; (2) the tree caches were created or retrieved during both the incubation and nestling phases of nesting; and (3) at least 2 of the 3 tree caches were concealed with loose vegetation.

Specifically, use of tree caches by ravens during nesting seems not to have been reported in the literature before now. Heinrich (1999) mentions that ravens also cache in trees but provides no additional details, including whether in winter or by nesting pairs. We have seen ravens in the Missoula, Montana area cache meat in trees during midwinter, and previously reported a case where a raven cached a vole atop a wooden power pole in February (Hendricks 2008). The 3 cache trees we observed were within 100 m of the nest, which fits with other reports of caching very close to active nests (Kilham 1989; Howe and Coates 2015). Kilham (1989) concluded that an advantage of caching food near nests is providing adults more time to guard nestlings without having to leave the area to forage. We suspect that ravens routinely cache

food in trees near their nests, particularly if using tree nests in forests, but that the activity usually goes unreported because of the challenges of following ravens through forests to observe their activities when they are away from nests. The difficulty may be compounded by the secretive nature of ravens at their caches; the birds we observed rarely vocalized while near their tree caches. However, there are no studies on the spatial distribution of caches around active raven nests, so it remains uncertain if caching within 100 m of nests is typical or not, nor is there data on the relative proportions of ground and tree caches created by ravens nesting in forests.

Our observations suggest that caches may be used as sources of food for the adult ravens while incubating eggs, not just as a food supply for nestlings. The cache we observed in late March was created during the incubation stage of nesting, probably no later than day 3 of a 20- to 25-d incubation period, assuming egg-laying began 5 d after we saw adults add wads of vegetation to the nest lining on 12 March (Boarman and Heinrich 1999). Recovery of caches greatly diminishes by 14 d after their creation (Heinrich and Pepper 1998), so this cache was probably retrieved by the adult that made it, and perhaps delivered to its incubating mate (Ratcliffe 1997; Boarman and Heinrich 1999), prior to the appearance of nestlings. The 2 meat caches we saw retrieved during the nestling period probably were delivered to the nestlings, which is similar to events at the nest watched by Kilham (1989); but we observed this happen with certainty only once, when the adult flew directly to the nest after retrieving the cache.

Of the 3 caches we observed, at least 2 were covered with pieces of bark and lichen. Covering caches with vegetation or other objects is a common component of caching behavior by corvids, including ravens, when storing food on the ground (Simmons 1968, 1970; Heinrich 1999; Bugnyar and others 2007; Austin and Mitchell 2010). The raven creating the tree cache on 20 March gathered bark and lichen from the limb within 1 step's reach of the cache, similar to observations of ravens gathering nearby material to cover ground caches. Covering caches on the ground and scattering the cache locations probably helps reduce the likelihood of them being stolen by conspecific competitors (Hein-

rich and Pepper 1998; Heinrich 1999), as well as by mammalian and other avian scavengers, including other corvids (Lafferty and others 2016). The same logic applies to covered caches in trees, such as those we noted by the ravens. Covering caches in trees makes them less likely to be discovered and pilfered by Steller's Jays (*Cyanocitta stelleri*) and Gray Jays (*Perisoreus canadensis*), 2 corvid species inhabiting the forest around the Pattee Canyon raven nest and likely to steal caches made by other species (Burnell and Tomback 1985; Waite 1988; Kalinowski and others 2015).

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