

Note

Clark's Nutcrackers (*Nucifraga columbiana*) caching Whitebark Pine (*Pinus albicaulis*) seeds in trees

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Abstract

On 17 September 2017, I observed two Clark's Nutcrackers (*Nucifraga columbiana*) from 8–10 m distance as they cached seeds in a stand of dead Whitebark Pines (*Pinus albicaulis*) at 2500 m elevation on Saint Mary Peak in the Bitterroot Mountains of Ravalli County, Montana. Over 5 minutes, the nutcrackers created 14 caches in seven different multi-trunk tree clusters in an area of about 50 m². All caches appeared to be single Whitebark Pine seeds, positioned 2–5 m (mostly 3–4 m) above ground in dead trees. Of the 14 caches, three were placed under loose pieces of bark on a trunk (one) or large limb (two), and the remaining 11 were in encrustations of American Wolf Lichen (*Letharia columbiana*) growing on branches of the dead trees. Nutcrackers are known to sometimes cache seeds above ground in trees during the late summer and autumn harvest of pine seeds, but usually not to the exclusion of other microsites. The ground at the Montana site was covered by 7–9 cm of fresh snow that fell the previous day, which may have encouraged the nutcrackers to place all of their seed caches above ground in trees.

Key words: American Wolf Lichen; caching behaviour; Clark's Nutcracker; *Letharia columbiana*; Montana; *Nucifraga columbiana*; *Pinus albicaulis*; tree caches; Whitebark Pine

Clark's Nutcracker (*Nucifraga columbiana*) is a major disperser of the large wingless seeds of Whitebark Pine (*Pinus albicaulis* Engelmann), the only *Cembrae* pine of five globally that occurs in the mountains of western North America (Tomback and Linhart 1990). During late summer and fall, nutcrackers harvest Whitebark Pine seeds from the indehiscent cones and transport as many as 150 seeds in a single load up to 30 km from the source tree, where they are often cached in the ground for later retrieval and use as a high-energy food source during the following winter, spring, and summer (Tomback 1978, 1998, 2001; Lanner 1982, 1996; Dimmick 1993; Lorenz *et al.* 2011). Thousands of seeds are scatter-hoarded by individual nutcrackers each year, more than the nutcrackers need for survival and reproduction (Hutchins and Lanner 1982; Tomback 1982). Seeds are often cached in microsites where they have a good chance of germinating if they are not retrieved or predated (Tomback and Linhart 1990). Thus, through their caching activities the nutcrackers ensure the persistence of Whitebark Pine by planting the seeds across landscapes where the pines are most likely to persist or become established and eventually produce more seeds, which also results in the continued availability of a food resource generally relied on by nutcrackers throughout the year (Tomback 1978, 1982).

Clark's Nutcrackers typically cache Whitebark Pine seeds at bill-depth in the ground at the base of trees or rocks, in open terrain on slopes, under forest litter, in dense moss, and among tree roots, fallen logs, and annual plants (Tomback 1978, 1982; Hutchins and Lanner 1982; Dimmick 1993). Caching seeds above ground in trees is infrequently reported across the range of the nutcracker (Tomback 1978; Dimmick 1993), although

above-ground caching may be a regular behaviour of individual nutcrackers in some locations (Lorenz *et al.* 2011). Here I report opportunistic observations made of a pair of Clark's Nutcrackers caching Whitebark Pine seeds in dead Whitebark Pines. I provide details on the context of the caching activity and speculate about conditions that may encourage the choice of an arboreal microsite for caching seeds.

On 17 September 2017, while hiking to the summit of Saint Mary Peak in the Bitterroot Mountains, Ravalli County, Montana, I encountered two Clark's Nutcrackers at about 2500 m elevation caching seeds near the trail. The site (46.50569°N, 114.23336°W) was a stand of mature dead Whitebark Pine on the south-facing slopes of the peak. During 1055–1100 Mountain Daylight Time, I watched the nutcrackers from about 8–10 m with a 10× binocular as they performed their caching activities. I concentrated my attention on the closest bird, as both appeared to be behaving similarly. I saw the focal bird cache seeds 14 times, although the actual number of caches created was possibly double that amount during the 5 min of my observations, assuming both birds cached at the same rate.

All of the caches were located 2–5 m (mostly 3–4 m) above ground in seven different dead Whitebark Pines within an area of about 50 m², and all appeared to involve a single Whitebark Pine seed, based on the large size of the wingless seeds disgorged from the nutcracker's sublingual pouch to the tip of the bill and movement of the birds to new microsites after placing a single visible seed in a cache. Each bird paused and visually examined three or four microsites before caching a seed; at microsites where seeds were cached, the birds first probed two to five times with their bills. Three

of the 14 caches were placed under flakes of bark on a vertical trunk ($n = 1$) or large limb ($n = 2$) of a dead pine, and the other 11 were placed in encrustations of American Wolf Lichen (*Letharia columbiana* (Nutt.) J.W. Thomson) growing in patches on smaller branches of the dead trees (Figure 1). I did not see the nutcrackers cover any of the caches with extra bark or lichens. Although my sample of caches is small, the nutcrackers appeared at that time to prefer caching their seeds above ground (100% of 14 caches), rather than in the ground, and in lichens more so than other microsites on the trees (one-sample proportion test; Statistix® 8, Analytical Software, Tallahassee, Florida, USA; Z [corrected] = 1.87, $P = 0.061$). At no time during the encounter did I see either bird descend to the ground. My observations terminated when a third nutcracker flew downslope over the two caching birds and gave two or three “kraack” calls (“short-location calls”; see Tomback 1998), whereupon the two caching nutcrackers responded with “mew calls” and immediately flew away in the direction the third bird had travelled.

The amount of caching of Whitebark Pine seeds in trees by the Clark’s Nutcrackers I observed is high relative to most other reports of larger samples of caches made by nutcrackers, although still a small fraction of

the thousands of caches made each year. On the eastern slope of the Sierra Nevada Mountains in California, Tomback (1978, 1982) observed nutcrackers make 80 separate caches, only three (3.75%) of which were in trees (two-sample proportion test: Z [corrected] = 8.26, $P < 0.001$). Also in the Sierra Nevada, Dimmick (1993) observed the creation of 937 caches, of which only about 19 (2.0%) were placed above ground in erect Whitebark Pines or Lodgepole Pines (*Pinus contorta* Douglas ex Loudon; Z [corrected] = 19.15, $P < 0.001$). Of at least 157 nutcracker caches reported in northwestern Wyoming (Hutchins and Lanner 1982), none were placed in trees, which is the same pattern I observed for 95 nutcracker caches made elsewhere in Montana (Marks *et al.* 2016), all of which were buried in the ground at bill-depth.

Caching in the ground is also the typical pattern for the Eurasian Nutcracker (*Nucifraga caryocatactes*) in northern Japan when caching seeds of Japanese Stone Pine (*Pinus pumila* (Pall.) Regel; Saito 1983; Kajimoto *et al.* 1998; Hayashida 2003) and in northeastern China when caching seeds of Korean Stone Pine (*Pinus koraiensis* Siebold & Zucc.; Hutchins *et al.* 1996). Only ground caches were reported in the Japan studies, whereas tree caches accounted for 11 (8.4%) of 144



FIGURE 1. Typical American Wolf Lichen (*Letharia columbiana*) growth on a dead branch of Whitebark Pine (*Pinus albicaulis*) in which Clark’s Nutcrackers (*Nucifraga columbiana*) cached pine seeds in the Bitterroot Mountains, Ravalli County, Montana. The lichen patch is about 30 cm in length. Photo: P. Hendricks.

caches reported in the China study (Z [corrected] = 8.66, $P < 0.001$).

In sharp contrast with the earlier studies, Clark's Nutcrackers on the eastern slopes of the Cascade Range in Washington state regularly cached pine seeds in trees (Lorenz *et al.* 2011), and tree caches of Whitebark Pine seeds in particular made up 129 (64.8%) of 199 caches made by radio-telemetered birds. This is still less than the proportion of tree caches in my sample (Z [corrected] = 2.41, $P = 0.016$), but indicates that caching pine seeds in trees may be routine under some circumstances by some nutcracker populations. It is worth noting, however, that only 11 (5.5%) of the caches of Whitebark Pine seeds reported by Lorenz *et al.* (2011), both in trees and in the ground, were made in Whitebark Pine forest, unlike in Montana where all 14 caches I observed were in this forest type. Furthermore, most tree caches in the Cascades study, regardless of forest type, were in live trees among needle clusters, in lichen clumps within the foliage, and under pieces of bark. The microsites for the caches I noted in Montana fit in the last two categories, but all caches were in dead trees lacking any foliage other than arboreal lichens, unlike in Washington. Also, the lichens in which the Washington caches were placed were not identified or described, so it is unclear how similar or dissimilar the lichen cache microsites really are.

Lorenz *et al.* (2011) noted that nutcrackers caching seeds in live trees are less conspicuous than birds on the ground and may be overlooked unless they are telemetered, which could explain why they were observed more often caching Whitebark Pine and Ponderosa Pine (*Pinus ponderosa* Douglas ex Lawson & C. Lawson) seeds in trees than in studies lacking a telemetry component (Tomback 1978; Hutchins and Lanner 1982). Lorenz *et al.* (2011) also suggested that the amount and duration of winter snowpack could influence the magnitude of ground caching, because snow cover inhibits future access to ground caches (Tomback 1978) but not caches in trees. Earlier studies reporting caching behaviour were conducted at the lower latitudes of California (Tomback 1978, 1982) and Wyoming (Hutchins and Lanner 1982) in drier forest types with less winter snowpack than the Cascades, possibly favouring a greater amount of ground caching at those locations.

The Montana nutcrackers I encountered were quite visible in the dead pines, which lacked any foliage other than lichens, and it was easy to observe them caching seeds. Nevertheless, limited data from Montana (Marks *et al.* 2016) indicate that ground caching by nutcrackers may be routine in Whitebark Pine forest during the harvest of pine seeds, as it is in California (Tomback 1978, 1982; Dimmick 1993) and Wyoming (Hutchins and Lanner 1982). Here, factors in addition to future cache accessibility during winter and spring may affect choice of cache microsites. In particular, access to an array of potential microsites at the time of cache cre-

ation could influence the incidence of caching pine seeds in trees. When I made my observations, the ground at the Montana site was covered with 7–9 cm of soft snow, which had fallen the previous day. The two nutcrackers I encountered showed no inclination to cache pine seeds in the ground, which could have been purely a response to the presence of an ephemeral snow cover that interfered with location of potential cache microsites on the ground rather than any general preference by the birds to cache seeds in trees. Frequent use of lichens as a microsite for tree caches may have been a result of lichen abundance in the absence of other foliage.

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