Food caching by bears: A literature review and new observations for Asiatic and American black bears

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Abstract: Food caching is a common behavior for many mammals, but less is known about the prevalence and importance of food caching for some species. Here we report the first documented caching events by Asiatic black bears (*Ursus thibetanus*, $n = 5$) in Japan and 3 additional caching events by American black bears (*U. americanus*) in California, USA. We also performed a systematic literature review on caching by bears as a reference point for future investigations. Caching was most frequently reported for brown bears (*U. arctos*), and most caching by bears occurred with large prey. Caching is most likely used to protect large carcasses from spoiling or detection by scavengers, allowing bears to consume more of the carcass. The lack of published studies on caching by bears may be due to the behavior being infrequently used and difficult to record. We encourage an increase, but also consistency, in future reporting, including specific descriptions of caching behavior.

Key words: American black bear, Asiatic black bear, cannibalism, food caching, foraging strategies, scavenging, *Ursus americanus*, *Ursus thibetanus*

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Food caching, or storing food for later consumption, is a behavior that preserves surplus food (MacDonald 1976, Smith and Reichman 1984). Caching often occurs during times of resource abundance to extend the pulse of food, while also limiting detection of food by competitors. Caching has been observed in many taxonomic groups; in mammals, well-known examples include many species of rodents caching nuts or seeds (Smith and Reichman 1984) and Arctic foxes (*Vulpes lagopus*) caching excess eggs for later consumption during a limited waterfowl breeding season (Careau et al. 2007). Many large carnivores cache the remainder of ungulate or other large kills that are too large to consume in a single feeding bout, either in a tree (e.g., leopards [*Panthera pardus*]; Balme et al. 2017) or covered with soil or other debris for later consumption (e.g., pumas [*Puma concolor*]; Hornocker 1970). Although caching of food has been observed in many carnivores, there is variation among species in how and why caching is used.

Bears are carnivores that have evolved to consume large amounts of food quickly during periods of food abundance and most bear species hibernate during seasons of food scarcity. For example, bears are well-known to exploit pulses of food, such as neonatal ungulates (Bull et al. 2001, Bertram and Vivion 2002), patches of ripening berries or insects (Bull et al. 2001), and spawning fish (Barker and Derocher 2009). The general feeding strategy of bears is to consume as much food as possible in a patch; but there are times, such as with large prey, that food needs to be stored for consumption over multiple days. Although it is rare for most bear species—with the exception of polar bears (*Ursus maritimus*) and brown bears (*U. arctos*) in some areas—to regularly kill large prey, many bear species exploit the carcasses of adult ungulates or other large prey they find or usurp from other carnivores (e.g., Cristescu et al. 2014, Elbroch et al. 2015). The carcasses of large prey often need to be consumed over a period of multiple days, and caching these carcasses could help preserve them and limit losses to other scavengers.

Although caching is a common behavior for brown bears, less is known about caching by other bear species. The absence of systematic investigations into caching behavior in many bear species results in confusion about its prevalence and importance. For example, Craighead and Craighead (1972) have been cited by multiple authors as evidence of caching by American black bears

(*U. americanus*), despite there being no mention of caching behavior reported anywhere in the manuscript. Similarly, Svoboda et al. (2011) cite evidence of caching by American black bears, but both studies cited (Elgmork 1982, Bertram and Vivion 2002) detail caching by brown bears rather than American black bears. On the other hand, the absence of caching observed during mortality-site investigations of livestock has sometimes been used to assign cause of mortality to American black bears (Bertram and Vivion 2002). Here we report multiple instances of caching of ungulates by both American black bears and Asiatic black bears (*U. thibetanus*). We also performed a systematic literature review as a reference point for future investigations, on account of uncertainty regarding the prevalence of caching behavior by most bear species.

Materials and methods

Study areas and field methods

We studied Asiatic black bears with Global Positioning System (GPS) collars in the Ashio–Nikko Mountains of central Honshu Island, Japan. The study area has a wet and cool-temperate climate. From 2006 to 2017, annual precipitation averaged 2,236 mm and the annual mean temperature was 7.2°C (Japan Meteorological Agency 2018). Up to 1,600 m above sea level, the natural vegetation of this area is dominated by deciduous broad-leaved forest composed of *Quercus crispula, Q. serrata, Acer* spp., and *Fagus crenata* (Furusaka et al. 2019). We have captured and fitted bears with GPS collars in the area since 2003 and on average monitored 10 bears fitted with GPS collars each year. We randomly visited GPS location clusters of collared bears after they had left the area, to determine food items or record environmental conditions associated with resting sites (Furusaka et al. 2019).

We also studied Asiatic black bears and other scavengers in Nikko National Park, central Japan. Precipitation averaged 1,631 mm/year and the mean annual temperature was 7.7°C. Forest types included deciduous broadleaved forests, conifer plantation forests, and patches of mixed forests, with an understory of bamboo grasses in each forest type (Inagaki et al. 2020). In this study, we deployed video camera traps on 49 sika deer (*Cervus nippon*) carcasses to document scavenging activity. We obtained fresh deer carcasses from culled nuisance animals or animals killed through vehicle collisions from June to November in 2016, 2017, and 2019, and secured each carcass to a tree with a wire rope. We monitored the carcasses using Ltl Acorn 6210 camera traps (Green Bay, Wisconsin, USA; Inagaki et al. 2020). We programed cameras to record either 30-second videos at each trigger with a 30-second refractory period or 30-second videos at each trigger with a 1-second refractory period.

We studied American black bears and other scavengers in the Mendocino National Forest, California, USA. Climate in the Mendocino National Forest is considered Mediterranean, with hot and dry summers and generally mild and wet winters. The mean annual rainfall was 1,320 mm and average daily temperatures ranged from −1°C to 24°C (Allen et al. 2015a). The area is primarily forested with conifers mixed with some deciduous trees, but also contained chaparral and open grassland habitats. We deployed video camera traps on 100 Columbian black-tailed deer (*Odocoileus hemionus columbianus*) carcasses to document scavenger activity. We obtained fresh deer carcasses from animals killed through vehicle collisions from January 2010 to November 2012 (Allen et al. 2015b) and secured each carcass to a tree with a wire rope. We monitored the carcasses using Bushnell Scout-Cam camera traps (Overland Park, Kansas, USA), and programed the camera traps to record 60-second videos at each trigger with a 1-second refractory period.

Literature review

On 8 February 2020 we performed a systematic literature search on Web of Science to find peer-reviewed documentation of caching among bears. We searched Web of Science for the term "cach*" matched with the search term "ursus" and "bear" in English and Japanese. We then read each entry and removed duplicate and mismatched publications, as well as those not from peer-reviewed journals and studies involving captive animals. The systematic search using Web of Science resulted in few relevant studies ($n = 5$). We thus augmented our systematic review of the literature using snowball sampling by searching the references of papers that we reviewed for additional articles ($n = 11$).

Results

Asiatic black bear observations

We documented caching by Asiatic black bears on 5 occasions.

1. On 23 October 2006, a 10-year-old female Asiatic black bear initiated a cluster of GPS points (elevation 1,210 m). On 26 October the bear left the area after staying 3 days at the location (Table 1), and we investigated the location. We found a mostly consumed juvenile (3-yr-old) Asiatic black bear carcass cached with leaves under a Japanese oak (*Quercus mongolica;* Fig. 1a).

Table 1. Summary of the common variables across the 7 instances we documented food caching by American and Asiatic black bears (*Ursus americanus, U. thibetanus*), observed in California, USA, and Japan, respectively.

American black bear					
Date	**Sex and age**	**Habitat**	**Food cached**	**Duration of visit**	**Other scavengers**
14 Nov 2011	Adult	Hardwood–conifer forest	Scavenged black-tailed deer	1 day	Gray fox, American black bear
6 Apr 2012	Unknown	Douglas fir forest	Scavenged black-tailed deer	6 days	Gray fox, ringtail, common raven, woodrat sp.
24 Sep 2012	Adult female	Hardwood–conifer forest	Scavenged black-tailed deer	5 days	American black bear
Asiatic black bear					
Date	**Sex and age**	**Habitat**	**Food cached**	**Duration of visit**	**Other scavengers**
23 Oct 2006	10-yr-old female	Oak forest	3-yr-old black bear	3 days	Unknown
6 Aug 2013	9-yr-old-male	Oak forest	Sika deer	3 days	Unknown
21 Nov 2017	Adult	Conifer plantation	Scavenged sika deer	1 day	Asiatic black bear, Japanese marten, mountain hawk-eagle, raccoon dog, red fox, wild boar
14 Jul 2019	10-yr-old female	Riparian forest	Sika deer	1 day	Unknown
11 Aug 2019	Unknown	Conifer plantation	Scavenged sika deer	5 days	4 total bears

2. On 6 August 2013, a 9-year-old male Asiatic black bear initiated a cluster of GPS points (elevation 1,270 m) along Chuzenji–Lake shore line in Nikko area, and stayed at the same location for 3 days (Table 1). When investigating the location, we found a mostly consumed sika deer carcass cached with soil and rocks under the root of a fallen birch tree (*Betula platyphylla*).

3. On 7 November 2017, we set out an adult sika deer carcass at an elevation of 660 m in a conifer plantation forest under a Japanese cedar (*Cryptomeria japonica*). A raccoon dog (*Nyctereutes procyonoides*) discovered the carcass first on 20 November at 2308 hours. An Asian black bear discovered the carcass on 21 November at 0005 hours (Table 1), while it was snowing. The bear began to scavenge and cache the carcass with fallen leaves at 0021 hours, as recorded on 5 minutes of video (Video 1 thumbnail; see Supplemental material). The bear was present at the site for ≥2 hours and 7 minutes and fed for ≥55 total seconds (recorded on 16 videos) over the next day, but we did not document caching behavior after the initial visit. Another Asiatic black bear, red fox (*Vulpes vulpes*), Japanese marten (*Martes melampus*), wild boar (*Sus scrofa*), and mountain hawk-eagle (*Nisaetus nipalensis*) were also documented scavenging at the carcass (Table 1).

4. On 14 July 2019, a 10-year-old female Asiatic black bear initiated a cluster of GPS points where she stayed for 14 hours (Table 1). When we investigated the cluster, we found a cached sika deer carcass buried by grass in a riparian forest with vegetation dominated by *Clethra barbinervis*. The carcass remains included the broken skull and foot bones.

5. On 9 August 2019 we set out an adult sika deer carcass at an elevation 650 m, in a conifer plantation forest (*Cryptomeria japonica* and *Chamaecyparis obtusa*). On 11August we visited the site and found that the deer carcass was moved 20 m up a slope and was cached with undergrowth in an open area dotted with *Morus australis* between the conifer plantation forests (Fig. 1b). Based on camera footage, ≥4 bears (2 solitary bears, and a mother with a cub) visited the carcass until the carcass was completely consumed on 13 August, but other scavenger species were not recorded (Table 1).

American black bear observations

We documented caching by American black bears on 3 occasions.

1. On 11 November 2011, we set out a field-dressed black-tailed deer carcass at an elevation of 1,254 m, under a blue oak (*Quercus douglasii*) with a canopy cover of 76%. A gray fox (*Urocyon cinereoargenteus*) discovered the carcass initially on 13 November at 2139 hours, and made 4 short visits, before an American black bear discovered the carcass on 14 November at 2255 hours.

Fig. 1. Documentation of caching by Asiatic black bears (*Ursus thibetanus*) observed in the Ashio–Nikko Mountains of central Honshu Island, Japan, including (a) the cache pile of a cannibalized Asiatic black bear and (b) the caching a sika deer (*Cervus nippon*) with vegetation.

Video 1 Thumbnail. An Asiatic black bear (*Ursus thibetanus*) caching a Sika deer (*Cervus nippon*) carcass during a snowstorm.

Video 2 Thumbnail. An American black bear (*Ursus americanus*) caching a black-tailed deer (*Odocoileus hemionus columbianus*) carcass in Mendocino National Forest.

During the initial visit of 13 minutes, the bear sniffed around the carcass, but did not feed. It returned less than half an hour later at 2346 hours and fed for 2 minutes. The bear returned again on 15 November at 0014 hours, for a visit of 15 minutes where it investigated the bait and fed, before caching the carcass with leaves. The bear returned half an hour later and finished caching the carcass entirely with leaves. We assume that the same bear returned for multiple visits over the course of 6 days, and a female with cubs also fed on the carcass for a few minutes.

2. On 28 March 2012, we set out a field-dressed black-tailed deer carcass in a Douglas fir (*Pseudotsuga menziesii*) stand at an elevation of 974 m with a canopy cover of 99%. A gray fox discovered the carcass initially on 1 April at 2202 hours, and a ringtail (*Bassariscus astutus*) discovered the carcass on 4 April at 2206 hours. Both species made multiple short visits to the carcasses, before an American black bear discovered the carcass on 6 April at 1836 hours. During its twelfth visit on 8 April, the bear cached the carcass with needles and duff (Video 2 thumbnail; see Supplemental material for video), and subsequently made 3 more short visits to the carcass over the next 3 days. The carcass was subsequently visited by common ravens (*Corvus corvax*) and woodrats (*Neotoma* sp.; Table 1).

3. On 24 September 2012, we set out a field-dressed black-tailed deer carcass in at an elevation of 1,428 m, under a ponderosa pine (*Pinus ponderosa*) with a canopy cover of 89%. An American black bear discovered the carcass on 24 September and made multiple visits that night until a female bear and her cub appeared at 2238 hours.

The original bear initially won a contest over the carcass, but the female initiated another contest and usurped the carcass from the original bear. The usurping female then fed for 51 minutes, during which she cached the carcass with pine needles and litter. The female and her cub fed in an alternating pattern with what we assume was the original bear until the carcass was completely consumed on 29 September, but did not cache the carcass again.

Literature review

Most of the published studies of caching by bears had small sample sizes (Table 2). Most reports were for brown bears, with 2 studies each for polar bears and American black bears and our observations. Most studies reported caching based on observations during field investigations of clusters of bear activity or depredations. However, one study used direct observations of predation and subsequent caching (Dean et al. 1986) and one study used a mix of field investigations and direct observations over 45 years (Stirling et al. 2019), and we also used camera-trapping at experimental ungulate carcasses. The prey items that were reported cached were almost always large prey (e.g., ungulates, marine mammals, or other large-bodied mammals), with the exception of fish ($n = 1$). Most studies had small sample sizes, and caching material was most often reported as vegetation and leaf litter or soil, but polar bears always cached with snow (Table 2).

Discussion

We documented 8 instances of black bears (Asiatic, $n = 5$; American, $n = 3$) caching large animal carcasses. These are the first documented caching events by Asiatic black bears, and only the third study to unequivocally document caching by American black bears. The prior published literature on caching by bears was most frequently (75%) about brown bears, and caching may be less frequent for other bear species. For example, Stirling et al. (2019) were only able to document 19 instances of caching by polar bears across 45 years of extensive field research and observations. The lack of published studies on caching in most bear species may be because they are less often reported or of less interest to researchers, but is most likely due to the behavior being infrequently used and difficult to record (Stirling et al. 2019). Understanding the frequency of the behavior will help researchers and managers understand whether it plays an important part in their feeding ecology.

An important aspect of caching behavior for bears is that it is most often used, or at least reported, for large prey. For example, 6 of our cases were caching of ungulates, and the other case was caching of a bear. Similarly, in the prior literature, most cached prey were ungulates, marine mammals, or bears; the exception being the caching of multiple migrating broad whitefish (*Coregonus nasus*) by brown bears (Barker and Derocher 2009). Two other reviewed studies documented brown bears caching multiple individuals at the same site, including ungulates (Cristescu et al. 2014) and domestic sheep (*Ovis aries*; Elgmork 1982), but the caching of multiple individuals has not been reported for other bear species. Caching of smaller prey may just not be documented or reported as often as large prey, but it appears to occur less frequently than with large prey. This may be because caching is not needed as a result of smaller prey being consumed more quickly, or the difficulty of locating small prey compared with large prey during field investigations.

That caching by bears is primarily for large food items (ungulates, livestock, and other large prey) likely indicates that the proximate mechanism for caching is the preservation of food. Large prey take longer for bears to consume, whereas the energetic costs of returning to small prey that is cached can decrease the net energetic gain for bears. But large prey are also prone to competition from scavengers and decomposers (e.g., Allen et al. 2015b). Covering food may decrease the rot and consumption of large prey by decomposers, as well as detection by scavengers. In most of the observations we documented for black bears, they stayed in the vicinity of the large animal carcass for multiple days, often staying until the carcass was completely consumed. The effects of caching by bears for scavenger deterrence were more equivocal. In Japan, one cached carcass we monitored with a camera trap was visited by 5 other scavengers, whereas the other was visited by other Asiatic black bears. Similarly, in the United States, 2 cached carcasses were visited by other bears, whereas the other was visited by 4 other scavenger species. In one instance, a pair of American black bears had 2 direct encounters where they fought over the carcass.

Although there was a strong pattern of bears caching large food items, other patterns were less clear. There was little seasonal or geographic pattern, suggesting that caching occurs in most seasons and across the geographic range of the bear species for which caching has been reported. Most reports were based on field investigations of clusters of activity for collared bears, with 2 studies also using direct observations, but most of our observations (5 out 8) were made using video camera traps. The use of field investigations and camera-trapping are impor-

Table 2. The results of our review of peer-reviewed literature on caching by bears. We report the bear species, location, caching events, type of food cached, and cache material.

Bear species	Location	Caching events	Food cached	Cache material	Study
American black bear	Coahuila, Mexico	Not reported	Cattle (*Bos taurus*)	Not reported	Doan-Crider et al. 2017
American black bear	Michigan, USA	1	White-tailed deer (*Odocoileus virginianus*)	Vegetation and litter	Svoboda et al. 2011
American black bear	Mendocino National Forest, California, USA	3	Columbian black-tailed deer	Vegetation and litter	This study
Asiatic black bear	Ashio–Nikko Mountains, Japan	3	Sika deer, Asiatic black bear	Vegetation, soil and litter	This study
Asiatic black bear	Nikko National Park, Japan	2	Sika deer	Vegetation and litter	This study
Brown bear	Alberta, Canada	85	Ungulates	Not reported	Cristescu et al. 2014
Brown bear	Northwest Territories, Canada	Not reported	Broad whitefish	Vegetation and litter	Barker and Derocher 2009
Brown bear	Hokkaido, Japan	1	Female adult brown bear	Soil and debris	Kadosaki 1983
Brown bear	Hokkaido, Japan	2	Sika deer	Soil, litter, and snow	Kadosaki and Inukai 2000
Brown bear	Hokkaido, Japan	Not reported	Sika deer	Soil and vegetation	Okada and Yamanaka 2001
Brown bear	Hedmark, Norway	2	Moose (*Alces alces*)	Vegetation and litter	Mysterud 1973
Brown bear	Hedmark, Norway	5	None	Vegetation and litter	Mysterud 1980
Brown bear	Vassfaret, Norway	16	Sheep	Vegetation and litter	Elgmork 1982
Brown bear	Lapland Reserve, Russia	Not reported	Moose, reindeer (*Rangifer tarandus*), cattle	Snow, or vegetation and litter	Semenov-Tian-Shanskii 1972
Brown bear	Cantabrian Mountains, Spain	Not reported	Livestock	Not reported	Clevenger et al. 1994
Brown bear	Denali National Park, Alaska, USA	1	Brown bear	Sand and Gravel	Dean et al. 1986
Brown bear	Yukon Flats, Alaska, USA	Not reported	Moose	Soil	Bertram and Vivion 2002
Polar bear	Svalbard, Norway	2	White-beaked dolphin (*Lagenorhynchus albirostris*)	Snow	Aars et al. 2015
Polar bear	Norway, Greenland, and Canada	19	Bearded seal (*Erignathus barbatus*), ringed seal (*Pusa hispida*), harp seal (*Pagophilus groenlandicus*),beluga (*Delphinapterus leucas*), polar bear	Snow	Stirling et al. 2019

tant because otherwise caching events would most likely only be encountered by chance. Camera traps are useful for documenting behaviors that are difficult to document (e.g., Allen et al. 2019), and could be used for detailed studies of caching behavior in the future. It seems that most caching involved covering or burying carcasses in vegetation or soil without excavating a hole or depression, but it is difficult to be sure in some accounts from the prior literature.

Our Web of Science search performed poorly, missing approximately two-thirds of the records in the peer-reviewed literature that we were eventually able to find. Past studies may also have used other terms for caching, such as covering, which could lead to records being missed. For example, there were vague or potentially conflicting terms in the reports, including 'bury' versus 'cover' versus 'excavate' versus 'burial mound' (in Japanese). We encourage future studies to use the term 'cache' to describe when bears cover their food with vegetation, soil, or other material, and to include specific descriptions of caching behavior.

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Literature cited

AARS, J., M. ANDERSEN, A. BRENIÈRE, AND S. BLANC. 2015. White-beaked dolphins trapped in the ice and eaten by polar bears. Polar Research 34:26612.

ALLEN, M.L., L.M. ELBROCH, D.S. CASADY, AND H.U. WITTMER. 2015a. The feeding and spatial ecology of mountain lions (*Puma concolor*) in Mendocino National Forest, California. California Fish and Game Journal 101:51–65.

———, ———, C.C. WILMERS, AND H.U. WITTMER. 2015b. The comparative effects of large carnivores on the acquisition of carrion by scavengers. American Naturalist 185: 822–833.

———, M.P. WARD, D. JUŽNIČ, AND M. KROFEL. 2019. Scavenging by owls: A global review and new observations from Europe and North America. Journal of Raptor Research 53:410–418.

BALME, G.A., J.R.B. MILLER, R.T. PITMAN, AND L.T.B. HUNTER. 2017. Caching reduces kleptoparasitism in a solitary, large felid. Journal of Animal Ecology 86:634–644.

BARKER, O.E., AND A.E. DEROCHER, A. E. 2009. Brown bear (*Ursus arctos*) predation of broad whitefish (*Coregonus nasus*) in the Mackenzie Delta region, Northwest Territories. Arctic 62:312–316.

BERTRAM, M.R., AND M.T. VIVION. 2002. Moose mortality in eastern interior Alaska. Journal of Wildlife Management 66:747–756.

BULL, E.L., T.R. TORGERSEN, AND T.L. WERTZ. 2001. The importance of vegetation, insects, and neonate ungulates in black bear diet in northeastern Oregon. Northwest Science 75:244–253.

CAREAU, V., J.F. GIROUX, AND D. BERTEAUX. 2007. Cache and carry: Hoarding behavior of arctic fox. Behavioral Ecology and Sociobiology 62:87–96.

CLEVENGER, A.P., M.A. CAMPOS, AND A. HARTASANCHEZ. 1994. Brown bear *Ursus arctos* predation on livestock in the Cantabrian Mountains, Spain. Acta Theriologica 39: 267–278.

CRAIGHEAD, F.C., AND J.J. CRAIGHEAD. 1972. Data on grizzly bear denning activities and behavior obtained by using wildlife telemetry. Bears: Their Biology and Management 2:84–106.

CRISTESCU, B., G.B. STENHOUSE, AND M.S. BOYCE. 2014. Grizzly bear ungulate consumption and the relevance of prey size to caching and meat sharing. Animal Behaviour 92: 133–142.

DEAN, F.C., L.M. DARLING, AND A.G. LIERHAUS. 1986. Observations of intraspecific killing by brown bears, *Ursus arctos*. Canadian Field-Naturalist 100:208–211.

DOAN-CRIDER, D.L., A.N. TRI, AND D.G. HEWITT. 2017. Woody cover and proximity to water increase American black bear depredation on cattle in Coahuila, Mexico. Ursus 28:208–217.

ELBROCH, L.M., P. LENDRUM, M.L. ALLEN, AND H.U. WITTMER. 2015. Nowhere to hide: Pumas, black bears, and competition refuges. Behavioral Ecology 26:247–254.

ELGMORK, K. 1982. Caching behavior of brown bears (*Ursus arctos*). Journal of Mammalogy 63:607–612.

FURUSAKA, S., K. TOCHIGI, K. YAMAZAKI, T. NAGANUMA, A. INAGAKI, AND S. KOIKE. 2019. Estimating the seasonal energy balance in Asian black bears and associated factors. Ecosphere 10:e02891.

HORNOCKER, M.G. 1970. An analysis of mountain lion predation upon mule deer and elk in the Idaho Primitive Area. Wildlife Monographs 21.

INAGAKI, A., M.L. ALLEN, T. MARUYAMA, K. YAMAZAKI, K. TOCHIGI, T. NAGANUMA, AND K. SHINSUKE. 2020. Vertebrate scavenger guild composition and utilization of carrion in an East Asian temperate forest. Ecology and Evolution 10:1223–1232.

JAPAN METEOROLOGICAL AGENCY. 2018. Past weather data research. Japan Meteorological Agency, Tokyo, Japan. [In Japanese.] http://www.data.jma.go.jp/gmd/risk/obsdl/index.php. Accessed 29 Mar 2021.

KADOSAKI, M. 1983. Food habits of brown bear in Hokkaido. Journal of Mammalogical Society of Japan 9:116–127. [In Japanese with English abstract.]

———, AND T. INUKAI. 2000. Food habits. Pages 213–252 in M. Kadowaki and T. Inukai, editors. Brown bears. The Hokkaido Shinbun Press, Sapporo, Japan. [In Japanese.]

MACDONALD, D.W. 1976. Food caching by red foxes and some other carnivores. Zeitschrift für Tierpsychologie 42: 170–185.

MYSTERUD, L. 1973. Behaviour of the brown bear (*Ursus arctos*) at moose kills. Norwegian Journal of Zoology 21: 267–272.

———. 1983. Characteristics of summer beds of European brown bears in Norway. Bears: Their Biology and Management 5:208–222.

OKADA, H., AND M. YAMANAKA. 2001. Brown bears. Pages 10–137 in Shiretoko Museum, editor. Mammals in Shiretoko 2. The Hokkaido Shinbun Press, Sapporo, Japan. [In Japanese.]

SEMENOV-TIAN-SHANSKII, O. 1972. The brown bear in the Lapland Reserve, USSR. Aquilo, Series Zoologica 13:98–102.

SMITH, C.C., AND O.J. REICHMAN. 1984. The evolution of food caching by birds and mammals. Annual Review of Ecology and Systematics 15:329–351.

STIRLING, I., K.L. LAIDRE, A.E. DEROCHER, AND R. VAN MEURS. 2019. The ecological and behavioral significance of short-term food caching in polar bears (*Ursus maritimus*). Arctic Science 6:41–52. http://dx.doi.org/10.1139/as-2019-0008.

SVOBODA, N.J., J.L. BELANT, D.E. BEYER, J.F. DUQUETTE, H.K. STRICKER, AND C.A. ALBRIGHT. 2011. American black bear predation of an adult white-tailed deer. Ursus 22: 91–94.

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Supplemental material

Video S1. An Asiatic black bear (*Ursus thibetanus*) caching a Sika deer (*Cervus nippon*) carcass during a snowstorm.

Video S2. An American black bear (*Ursus americanus*) caching a black-tailed deer (*Odocoileus hemionus columbianus*) carcass in Mendocino National Forest.