

# BROWN BEAR USE OF ANT MOUNDS IN SCANDINAVIA

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**Abstract:** Brown bears (*Ursus arctos*) in Scandinavia forage in early spring on ants (Formicidae) they excavate from large ant mounds. We collected information on the selection and handling of ant mounds by bears by following their tracks in snow during 3 consecutive spring seasons in 1970–72 in the Vassfaret area of central southern Norway. The density of large ant mounds in the study area was about 9/km of bear track or about 3 mounds/ha. Approximately half of the 143 ant mounds recorded were excavated by bears. The excavations ranged from superficial to complete; 9 completely excavated ant mounds were used as day beds, the others for food. The excavated ant mounds were relatively large, spanning 60–190 cm in base diameter and 40–150 cm in height. Excavated mounds were smaller, had more ants present, and had greater vegetative cover than untouched mounds.

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Brown bears have been known for centuries to excavate ant mounds and feed on ants in Scandinavia. In 1599, the Norwegian clergyman Peder Claussøn Friis reported that brown bears excavate ant mounds and consume ants (Storm 1881). Pontoppidan (1753), Essendrop (1761), and Wille (1786) described “ant” bears as a smaller variety of brown bear in contrast to the larger “horse” bears. Wille (1786) stated explicitly that the name ant bear was derived from bears’ ant foraging behavior. Similar accounts are present in early Swedish literature. In 1748 Linné recognized in his lectures in zoology a small variety of brown bear called the ant bear, *Ursus formicarius* (Ordbok över svenska språket). This pattern of excavation of ant mounds continued into modern times and has been recorded from Scandinavia (Nilsson 1820, Ekman 1910, Collett 1912, Haglund 1968, Wikan 1983) and Russia (Semenov-Tian-Shanskii 1972, Shtarev 1972, Kaletskaya 1973). Ants are an important dietary component of brown bears in Norway in spring (Elgmork and Kaasa 1992).

Although it has long been known that brown bears excavate ant mounds for food in northern Europe, selection for type and size of ant mounds and degree and mode of excavation have not been published. We collected data on such characteristics from the Vassfaret area in central south Norway during the spring seasons of 1970–72.

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## STUDY AREA

This study was conducted in the Vassfaret area in central south Norway at 60°30’N and 9°30’E (Fig. 1). The

study area was primarily in the subalpine zone and mostly forested. Timberline was located at about 900 m. Much of the forest consisted of Norway spruce (*Picea abies*) dominated stands, although Scots pine (*Pinus sylvestris*) and a few deciduous trees, primarily birch (*Betula* spp.), were also present. Bears were primarily located in old spruce forests with some deciduous trees on the southern side of the Vassfaret valley. This area was the most undisturbed zone in the Vassfaret area with no human habitation, cabins, or forestry roads and practically no human traffic. The study area was described in more detail by Elgmork (1976, 1978), Aune (1978), Elgmork et al. (1978), and Elgmork and Kaasa (1992).

## METHODS

Use of ant mounds was recorded while tracking bears on snow during spring 1970–72 (Elgmork et al. 1978). When a bear track was located, we followed it as far as possible in both directions and recorded details of the activities of the bear based on inspection of tracks. The locations of ant mounds <15 m from the track on both sides were plotted on 1:18,000 aerial photographs. We collected data from both excavated and untouched ant mounds in these 30-m wide transects.

The volume of each ant mound was calculated as a cone, which somewhat underestimated the real volume. If a mound were missing its apex, the height was estimated after projecting the shape of the mound upwards. The excavation effort was estimated by determining the amount of mound material removed. The vegetation cover and density were estimated subjectively as low, medium, or high. The quantity of ants on the ant mounds was estimated after the bear left the area. The time between excavation and our estimate of ant density was  $\leq 2$  weeks.

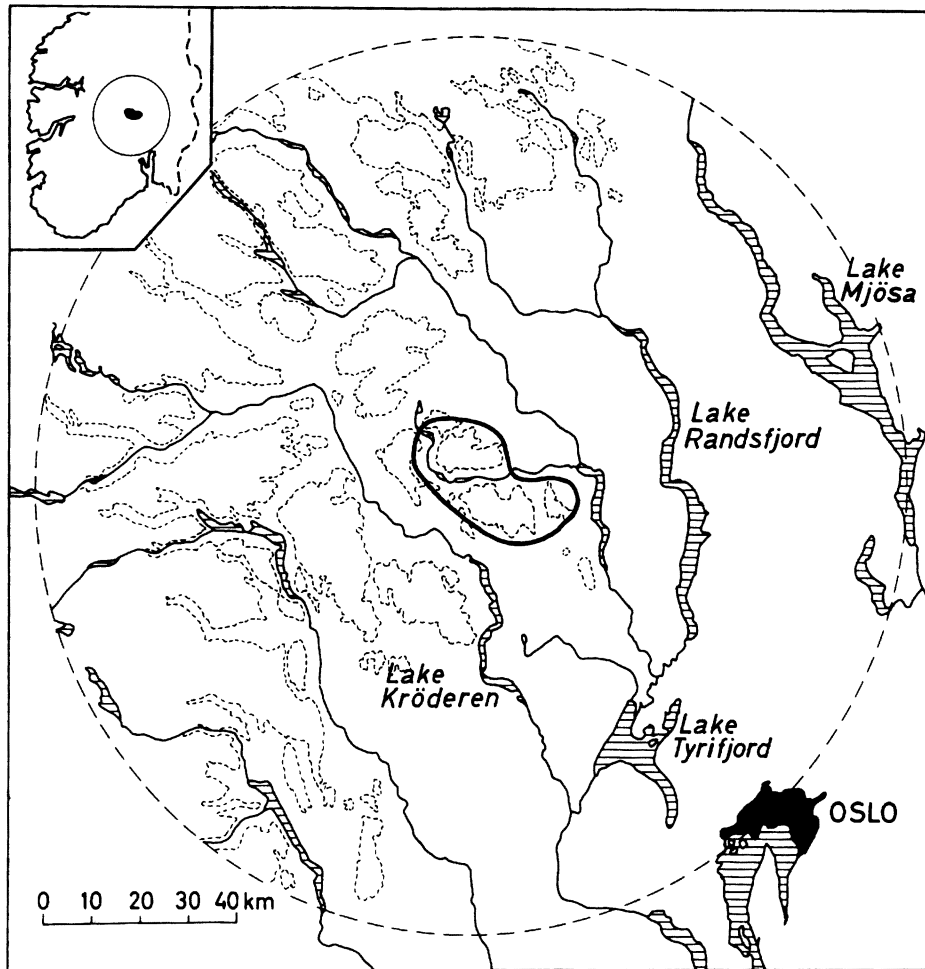


Fig. 1. Study area and surroundings in central south Norway, 1970–72. Stippled lines indicate the timberline.

Statistical tests used were *t*-test, ANOVA,  $\chi^2$ , and linear regression. The reported confidence interval (CI) is the 95% confidence interval of the mean.

## RESULTS

### Ant Mound Characteristics

All ant mounds recorded along the tracking routes were inhabited by only 1 ant species, *Formica aquilonia*. The main building materials in the ant mounds were Norway spruce needles and small twigs. Based on the more linear tracking routes in 1970 and 1971 (Fig. 2), 9 ant mounds were encountered/km of bear tracks, corresponding to a density of about 3 ant mounds/ha. The ant mounds were large with a mean base diameter of 126 cm (CI = 120–132 cm, range = 60–200 cm,  $n = 103$ ). Mean height was 94 cm (CI = 89–98 cm, range = 45–150 cm,  $n = 103$ ) and

mean volume was 443 dm<sup>3</sup> (CI = 387–499, range 47–1256,  $n = 103$ ). There was a slight tendency for the ant mounds to be smaller at higher elevations ( $r = -0.18$ ,  $P = 0.06$ ,  $n = 102$ ). Elevation ranged from 640–1000 m with a mean of 770 m (CI = 755–783,  $n = 113$ ). Temperature at the top of the ant mounds averaged 10.9° C in 1970 (CI = 10.2–11.6, range = 7.2–14.5,  $n = 30$ ). Most of the ant mounds were covered with vegetation varying from scanty to complete cover. The vegetation on the ant mounds reflected the plant species found on the forest floor. Blueberry (*Vaccinium myrtillus*) and *V. vitis-idaea* were common. Grasses, *Empetrum* spp., *Calluna vulgaris*, and mosses occurred less commonly.

The quantity of ants per mound was greatest in 1970, slightly less in 1971, and smallest in 1972 ( $P = 0.02$ ,  $n = 114$ ). There was no correlation between ant quantity and size of ant mounds. The lack of association between quantity of ants and elevation ( $r = -0.036$ ,  $P = 0.71$ ,  $n = 112$ )

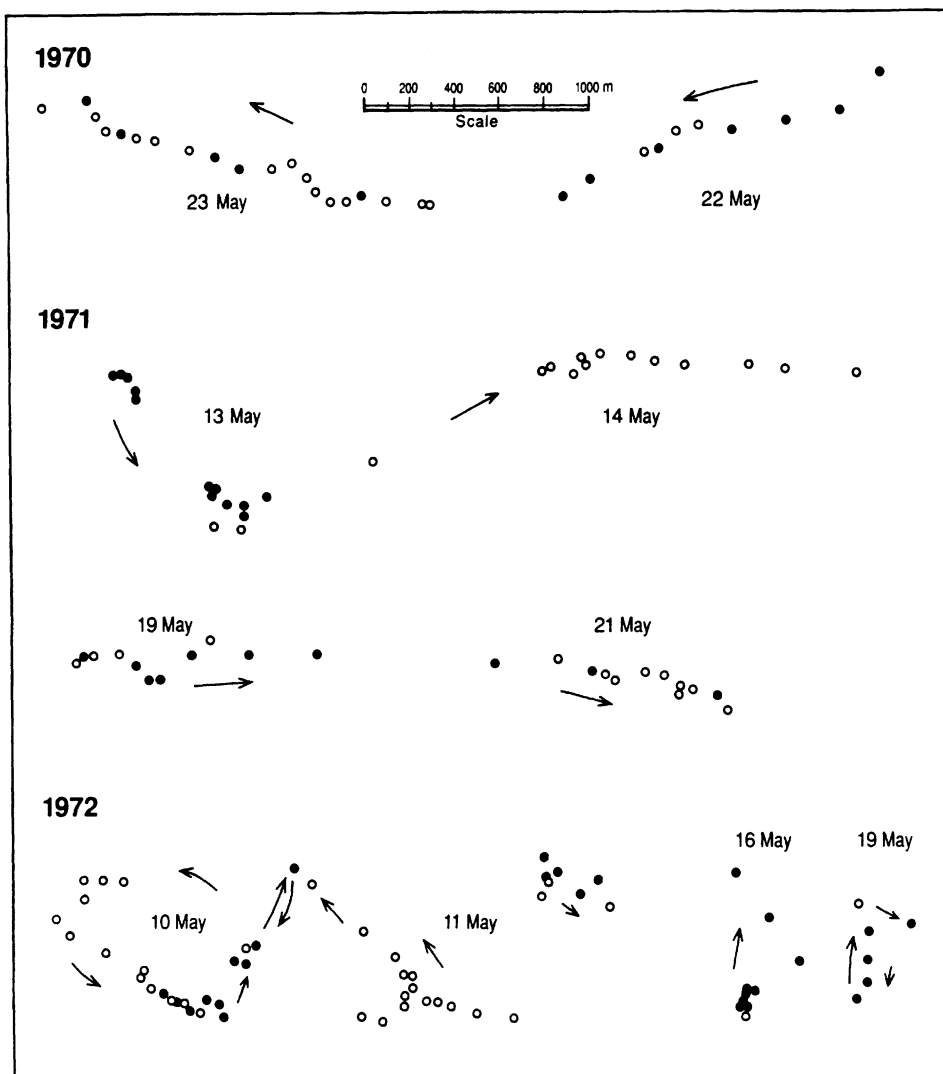


Fig. 2. Distribution of excavated (filled circles) and untouched ant mounds (open circles) along the tracking routes of brown bears in the study area (1970–72). Arrows indicate the wandering direction of the bear.

suggests little influence from temperature on ant occurrence. Variations in ambient temperature during collecting should therefore not have seriously influence our estimations of quantity.

### Ant Mounds Used for Food

Of the 143 ant mounds recorded along the tracking routes, 63 (44%) were excavated by bears. Of these, 54 (86%) were known to have been used for food. The percentage of excavated ant mounds was very similar in the 3 years (40, 44, 46%), but the frequency of excavations along the route varied considerably (Fig. 2). While excavated ant mounds were evenly distributed in 1970, they were found in clusters on 13 May 1971 and 16 and 19

May 1972. We also observed long stretches of tracks where no ant mounds were excavated (e.g. >1000 m on 14 May 1971). There was no difference in elevation between excavated and untouched ant mounds during any year.

Base diameter of untouched ant mounds ( $\bar{x} = 133$  cm) was larger than the excavated ones ( $\bar{x} = 121$  cm;  $P = 0.04$ ,  $n = 103$ ). Height and volume of untouched ant mounds were not significantly different from the excavated ones ( $P = 0.25$  and  $0.08$ , respectively,  $n = 103$ ). Of mounds with similar or larger height than base diameter, 7 were excavated and 2 were untouched.

The vegetation cover was significantly greater on the excavated than on untouched ant mounds ( $P = 0.02$ ,  $n =$

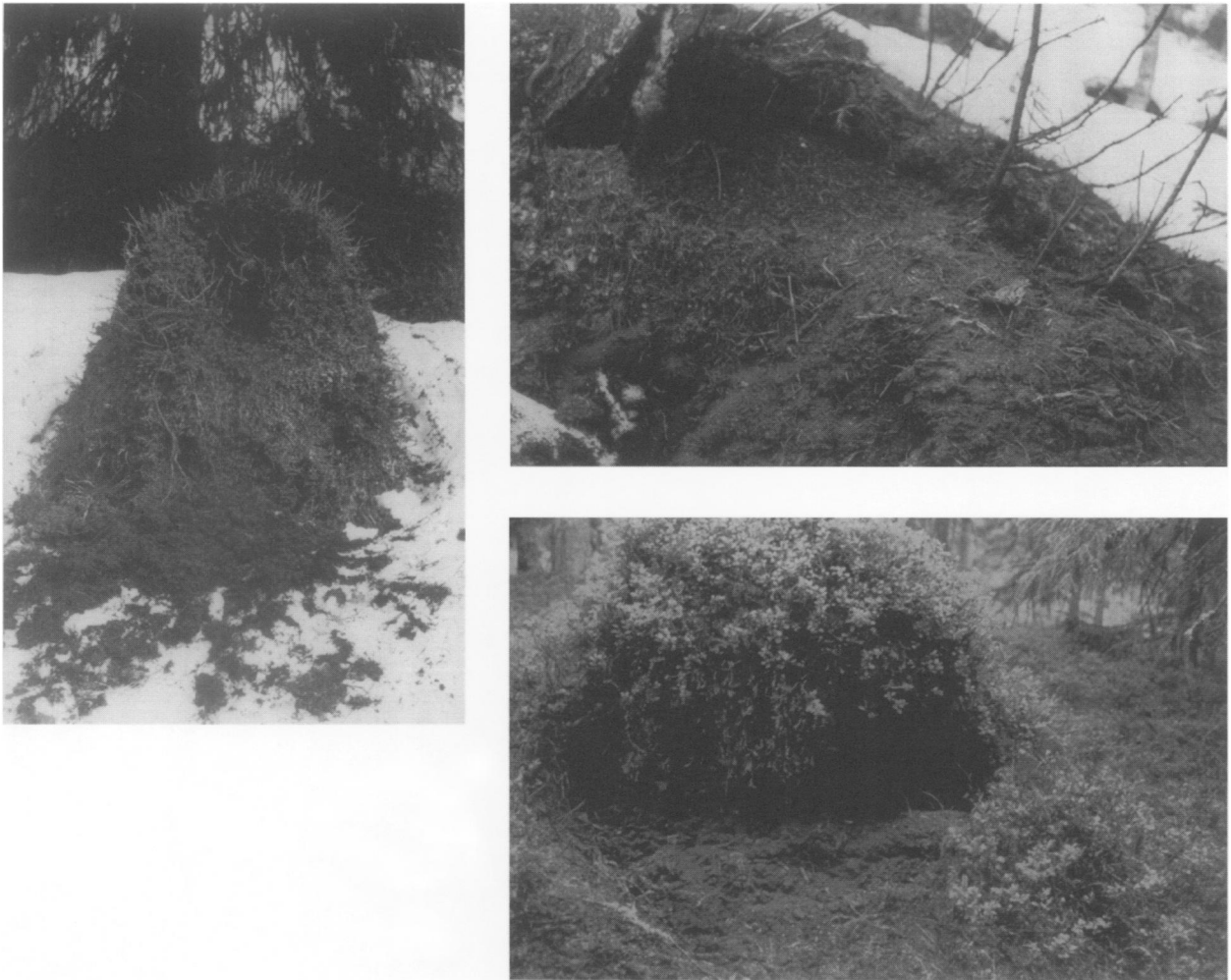


Fig. 3. Photos of 3 types of ant mounds used by brown bears in Scandinavia. A: Ant mound used for food, Vassfaret, 1970. B: Fully excavated ant mound used as day bed, Vassfaret, 1971. C: Ant mound used as winter den, Härjedalen, Sweden, 1976. (Photos by K. Elgmork).

76). The quantity of ants was greater in excavated than in untouched mounds ( $P = 0.03$ ,  $n = 113$ ).

### Handling of Ant Mounds Used for Food

The excavation of ant mounds always occurred in the upper part of the mound (Fig. 3A). No excavations were observed around the lower part or at the base of the mound. In most instances the excavations were concentrated on one side, often the side away from a nearby tree. The excavation depth into the mound varied from a few cm up to 60 cm. Mean excavation depth was 24 cm (CI = 20–29 cm,  $n = 59$ ).

The excavations were deeper in 1972 and 1971 than in 1970 ( $P < 0.05$ ,  $n = 59$ ); this depth was positively associated with the quantity of ants ( $P = 0.0009$ ,  $n = 58$ ).

The greatest contribution to this association was in 1972. Excavation depth was also positively associated with vegetative cover ( $P = 0.05$ ,  $n = 31$ ).

A bear was observed excavating 3 ant mounds the evening of 30 April 1974. The first was only touched and abandoned. The bear stayed at the other 2 mounds for about 9 minutes each, presumably eating ants.

That the bears ate ant mound material was evident from the scats full of dead ants found along the track. One bear excrement was found on average for every 5 ant mounds excavated.

### Ant Mounds Used for Day Beds

Nine additional mounds were thoroughly excavated and used as day beds (Fig. 3B). The mean base diameter of

the mounds used as day beds (139 cm, CI = 116–162, range = 85–180,  $n = 9$ ) was not greater than the mean diameter (126 cm) of other excavated mounds ( $P = 0.21$ ,  $n = 112$ ). Mounds used as day beds were located at higher elevations ( $\bar{x} = 816$  m) than other excavated mounds ( $\bar{x} = 770$  m;  $P = 0.002$ ,  $n = 122$ ). These mounds may also have been used for food before being totally dug out.

## DISCUSSION

In the northern part of Eurasia, brown bears use large ant mounds for 3 purposes: for nutrition, as day beds, and for winter dens (Fig. 3C). Digging for nutritional purposes is centered at the apex or upper sides of the mound and may be correlated with the behavior of the ants. In spring, on warmer days, ants concentrate in dense clusters at the top of the mound (Rosengren et al. 1987). When ants exhibit this behavior, they are readily accessible to bears, which may explain some of the shallow diggings observed in many mounds. The ant workers also shift brood up and down through the system of chambers and galleries with the pupae normally concentrated in the drier upper layers. The excavation depths recorded were deep enough to reach the central part of many of the mounds, where the ants concentrate during cold weather because the temperature is highest there (Coenen-Stass et al. 1980, Rosengren et al. 1987).

Wikan (1983) observed brown bears eating from ant mounds in Finnmark County, Norway. After a bear had excavated the top of an ant mound, the ants concentrated in the depression and were eaten by the bear. The ants seemed to irritate the bear—it shook its head, blew in its nose, sneezed, and put its forepaws above its head. It stayed at each ant mound only a few minutes even if ants were still present.

Ant mounds excavated for food were different from those left untouched. The excavated mounds were smaller, had greater vegetation cover, and greater ant densities. The vegetation cover on the ant mounds was influenced by light conditions and was greater in exposed than in sheltered places. As exposed mounds were more easily discovered by bears, this may explain the greater vegetation cover on the excavated mounds.

One of the most significant associations was found between excavation depth and ant quantity, especially in 1972. Excavation depth was also positively associated with the volume of the ant mound, again especially in 1972. Tentatively, bears may be stimulated by the sight of great ant quantity and thus dig deeper in the ant mound to secure the catch. It is interesting that this association was strongest in 1972. There was no great difference in

mean temperature and snow cover in the 3 years of study based on official meteorological data, except for a colder April in 1970 and more precipitation in May 1972. In spring 1972, however, ant mounds were excavated at relatively higher altitudes where lower temperature occurred. This may have caused the ants to stay deeper in the ant mounds and explain why the excavation depth was greatest and the abundance of ants smallest in 1972.

Mounds completely excavated for use as day beds were larger and located at higher altitudes than those used for food. Because temperatures decrease with increasing elevation, bears at higher elevation may need additional insulation on snow covered ground. When bears prepared a winter den (Fig. 3C), the ant mound was excavated from the base near the ground (Elgmork 1981).

The use of ant mounds for nutrition and day beds was common, while the use of mounds as winter dens varied locally. In Scandinavia winter dens in ant mounds are common in Sweden, in Hedmark county in south eastern Norway, and in far northern Finnmark (Wikan 1983). Elsewhere in Norway no recent observations seem to be on record, and historical records are scarce (Collett 1912, Danevad 1978). The regional differences may be due to lack of other suitable winter den sites.

Björklund (1996) reported an additional use of ant mounds by bears in Sweden. Bears resting on ant hills may benefit from the formic acid sprayed by the ants on the fur, which acts as a repellent against ectoparasites.

Tracking radiomarked brown bears on snow in spring in Sweden has shown that females excavate many more ant mounds per km than males, which pass through the area more rapidly (Jon Swenson, Norwegian Institute for Nature Research (NINA), Trondheim, pers. commun., 1995). Therefore, the frequent excavation pattern we observed (Fig. 2) provides evidence that a bear using ant mounds was a female, probably the last surviving individual in the Vassfaret region of Norway.

## LITERATURE CITED

- AUNE, E.I. 1978. Vegetasjon i Vassfaret, Buskerud/Oppland med vegetasjonskart i 1:10,000. Kongelige norske Videnskabers Selskab Mus. Rep. Bot. Ser. 8:1–67. (In Norwegian with English summary.)
- BJÖRKLUND, A. 1996. I björnens rike. Siljans Sågverks AB, Siljan, Sweden. 88pp. (In Swedish.)
- COENEN-STASS, D., B. SCHAARSCHMIDT, AND I. LAMPRECHT. 1980. Temperature distribution and calorimetric determination of heat production in the nest of the wood ant, *Formica polyctena* (Hymenoptera, Formicidae). *Ecology* 61:238–244.
- COLLETT, R. 1912. Norges Pattedyr. Aschehoug & Co.

- Kristiania, Norway. 744pp. (In Norwegian).
- DANEVAD, H. 1978. Bjønn og bjønnejakt i Drangedal etter 1850. Norsk Skogbruksmuseum, Særpubl. 3. 158pp. (In Norwegian.)
- EKMAN, S. 1910. Norrlands jakt och fiske. Norrlands Handbibliotek 4:1-481. (In Swedish.)
- ELGMORK, K. 1976. A remnant brown bear population in southern Norway and problems of its conservation. *Int. Conf. Bear Res. Manage* 3:281-297.
- . 1978. Human impact on a brown bear population. (*Ursus arctos* L.). *Biol. Conserv.* 13:81-103.
- . 1981. Rev og bjørn i maurtuer. (Brown bear and red fox in ant mounds). *Fauna* 34:147-149. (In Norwegian with English summary.)
- , O. BREKKE, R. SELBOE, AND S. UNANDER. 1978. Post-hibernation activity and habitat selection in a small remnant brown bear population (*Ursus arctos* L.) in southern Norway. *Viltrevy* 10(5):113-144.
- , AND J. KAASA. 1992. Food habits and foraging of the brown bear *Ursus arctos* in central south Norway. *Ecography* 15:101-110.
- ESSENDROP, I. 1761. *Physisk Oeconomisk Beskrivelse over Lier Præstegield*. København, Denmark. 208pp. (In Danish.)
- HAGLUND, B. 1968. De stora rovdjurens vintervanor. II. *Viltrevy* 5(6):213-361. (In Swedish with English summary.)
- KALETSKAYA, M.L. 1973. On the ecology of the brown bear in the Darwin Nature Reserve. *Contrib. Darwin Nature Reserve* 11:13-40. (In Russian.)
- LINNÉ, C. VON. 1748. *Föreläsningar över Djur*. Cited in *Ordbok över svenska språket*, bd.17. Svenska Akademien. (In Swedish.)
- NILSSON, S. 1820. *Skandinavisk Fauna. Del 1: Däggande Djuren*. Lund, Sweden. 419pp. (In Swedish.)
- PONTOPPIDAN, E. 1753. *Norges Naturlige Historie*. København, Denmark. 464pp. (In Danish.)
- ROSENGREN, R., W. FORTELIUS, K. LINDSTRÖM, AND A. LUTHER. 1987. Phenology and causation of nest heating and thermoregulation in red wood ants of the *Formica rufa* group studied in coniferous forest habitats in southern Finland. *Ann. Zool. Fennici* 24:147-155.
- SEMENOV-TIAN-SHANSKII, O. 1972. The brown bear in the Lapland Reserve, USSR. *Aquilo Ser. Zool.* 13:98-102.
- SHTAREV, YU. F. 1972. On the ecology and conservation of the brown bear in the south-eastern part of the Oka-Kljazma-forest. Pages 90-93 in *Acad. Sci. USSR. Nauka. Moscow*. (In Russian.)
- STORM, G. 1881. *Samlede Skrifter af Peder Claussøn Friis. A.W. Brøgger, Kristiania, Norway*. (In Danish.)
- WIKAN, S. 1983. *Bjørn, ulv, jerv. Rovviltforskning idag. Tiden Norsk Forlag, Oslo, Norway*. 164pp. (In Norwegian.)
- WILLE, H.J. 1786. *Beskrivelse over Sillejords Præstegield i Øvre-Telemarken i Norge*. Gyldendals Forlag, København, Denmark. 292pp. (In Danish.)