

Phenology and habitats of *Carabus glabratus* Paykull (Coleoptera, Carabidae) in NE Finland

Erkki Pulliainen, Juhani Itämies, Päivi Jussila & Paavo Tunkkari

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476 individuals of *Carabus glabratus* were collected in the years 1989–90 with pit-fall traps in the Värriötunturi fell terrain in NE Finland. The catch in 1990 was about twice as great as in the previous year. The tertiary sex ratio was even. The main habitat was Scots pine forest 370 m a.s.l., but the species also occurred in abundance in the mountain birch forest zone, in spruce forest, on a *Nardus stricta* sloping fen and on the shore of Lake Kuutsjärvi, whereas the treeless summit of the fell was almost totally avoided. The main activity period was at the end of June and the beginning of July, the males occurring over a shorter period. Daily catches closely followed the temperature curves.

Erkki Pulliainen, Juhani Itämies, Päivi Jussila & Paavo Tunkkari, Department of Zoology, University of Oulu, and Värriö Subarctic Research Station, University of Helsinki, SF-90570 Oulu, Finland

1. Introduction

Carabus glabratus (Paykull) is a large black carabid occurring widely over northern and central Europe (Harde et al. 1984). Perhaps due to its prominent appearance and size it has been an object of considerable research. Its phenology has been examined both in northern England (Houston 1981) and in central Norway (Refseth 1984), and its daily activity pattern has been followed under natural conditions in the laboratory by Grüm (1966), Thiele & Weber (1968) and Neudecker (1971). The mortality rates (Grüm 1975) and age (Houston 1981) of the species are well known. Some hints on its habitats, especially in the subarctic zone, are to be found in a paper by Forsskåhl (1972), but it seems that more information is needed on its life in subarctic conditions.

The purpose of the present paper is to provide records on phenological and habitat data emerging from two years of trapping in northern Finland.

2. Material and methods

The research was carried out in the Värriö Nature Reserve in the district of Salla, NE Finland. The main area was around Lake Kuutsjärvi, close to the Värriö Subarctic Research Station (67°45'N, 29°37'E) (Fig. 1).

The material was gathered in connection with the trapping of small mammals in 1989–90 (Kemppainen 1990). 10 pit-fall traps 19 cm diameter × height 20 cm were placed in two rows about ten metres apart in each of six habitats. Water was used as the trapping liquid. The traps were emptied daily before noon.

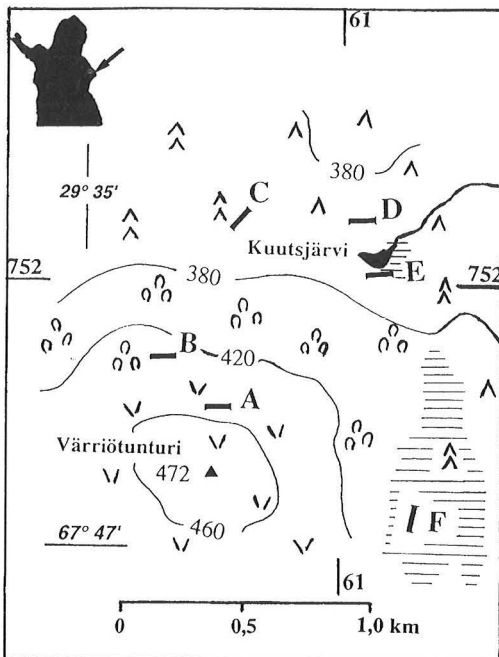


Fig. 1. Sites investigated in the Värriötunturi fell area, NE Finland (A–F refer to the habitats; black lines show the location of the trap lines in the terrain; see also text). Finnish uniform grid system (27°E;752:61) is given. Other values = m a.s.l.

The habitats were as follows:

- A. Fell summit (450 m a.s.l.). Treeless northern side of the fell, rocks dominating. Gradient about 30°. Ground vegetation layer characterized by lichens.
- B. Mountain birch forest zone (415 m). Located below habitat A. The percentage cover of the birch (*Betula pubescens* ssp. *czerepanovii*) is about 20%, and the gradient about 20°. The trapping line was close to a boulder field of area 600 m². The ground layer is rich in *Dicranum* mosses and *Empetrum* and is covered by a large amount of leaf litter.
- C. Spruce forest (355 m). Norwegian spruce is dominant, with a percentage cover of 20% compared with 10% for birch. There are also single trees of Scots pine and sallow *Salix caprea* present, together with willow bushes and junipers. The field layer is dominated by *Vaccinium myrtillus*, *Hylocomium splendens*

and *Pleurozium schreberi*. The trap site was in rather flat terrain.

- D. Pine forest (370 m). On the southern slope of the fell of Kotovaara. The percentage cover of pine is 10%. The ground layer is dominated by *P. schreberi*. The proportion of pathways and stones is large (40%), and there was a clear-felled area at one end of the trapping line.
- E. Marshy shore (340 m). The trapping line was at the edge of a forest about two metres from the shore of Lake Kuutsjärvi. The canopy cover of spruce is about 20%, that of *Betula nana* 70%. *Sphagnum* species occupy a high proportion of the ground layer.
- F. Fen (410 m). Dominated by *Nardus stricta* (over 50%). The forest is about 15–20 m away from the trapping line. There are some birches, pines, spruces and junipers present, with a rich *Polytrichum* sp. vegetation.

3. Results

The total catch for 1990 was almost twice that of the previous year (Table 1). The tertiary sex ratio was even in both years (1989 – 84 males/78 females; 1990 – 165/149). *Carabus glabratus* occurred most abundantly in the traps located in the pine forest, and it obviously avoided the treeless summit of the Värriötunturi fell. Altogether it has a fairly wide spectrum of habitats (Table 1).

The first specimens were caught on 18 June in both years, but the active period of the species had possibly commenced before the start of our trapping in 1989, because the weather conditions were already favourable on 14 June (Fig. 2). The phenological pattern of both sexes was similar, except that the last single females were caught later in the summer on average. The main activ-

Table 1. Total catches of *Carabus glabratus* in six habitats in the Värriötunturi fell area, NE Finland (A–F refer to habitats investigated; see text).

	A	B	C	D	E	F	Total
1989	0	27	26	74	15	20	162
1990	4	58	49	105	30	68	314
Total	4	85	75	179	45	88	476

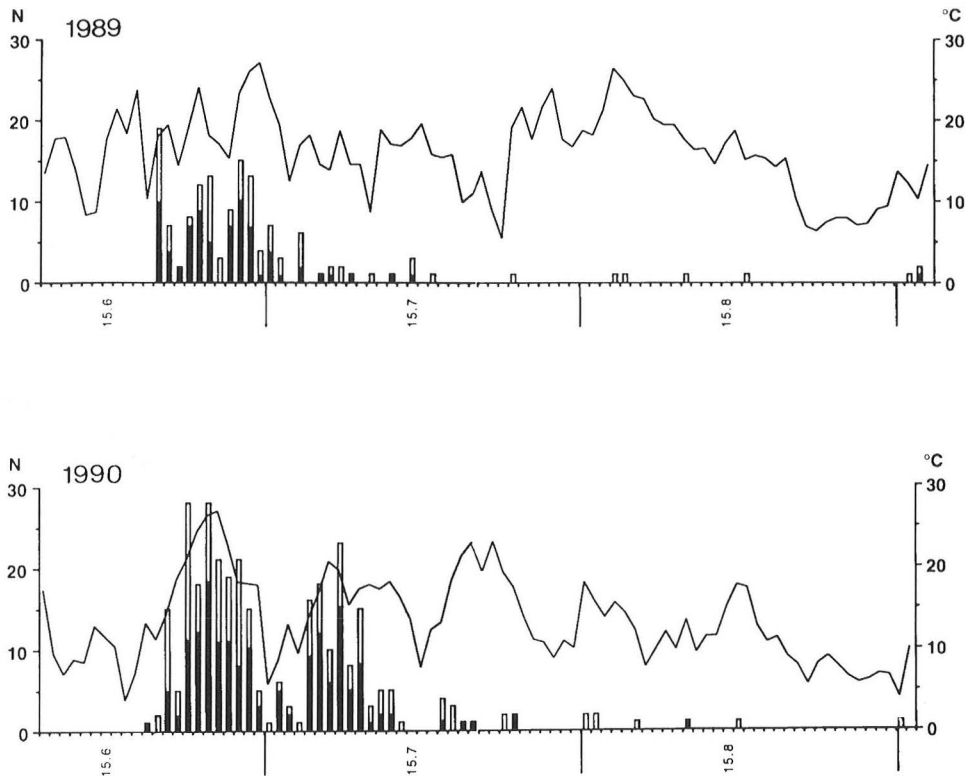


Fig. 2. Total catch of *Carabus glabratus* and daily maximum temperatures in 1989 and 1990 in the Värriötunturi fell area, NE Finland. Black = males, white = females.

ity period in 1990 was interrupted by exceptionally cold weather for a few days, and thus lasted about four weeks altogether, while in 1989 the most active phase covered only two weeks. Later on in the summer only single specimens were found even though temperature conditions were favourable. Long periods of heavy rain caused a drop in temperature and were thus reflected in a decrease in the activity of *C. glabratus*.

4. Discussion

Carabus glabratus seems to occupy a variety of habitats in subarctic terrain according to our observations, just as Forsskåhl (1972) found the species in several biotopes around Lake Kilpisjärvi in NW Finnish Lapland, most of his findings being from a mesic heath forest. Other finds also confirm the wide spectrum of habitats where *C. glabratus* thrives (see e.g. Lindroth 1942, 1949,

Freude et al. 1976, Houston 1981, Refseth 1984, Harde 1984 and Niemelä et al. 1988).

While pine forest was the most favoured habitat in our material, *C. glabratus* also occurred in many other places, although scarcely at all on the treeless summit of Värriötunturi fell. Since both sexes inhabited these sites equally, we can assume that all of these habitats are suitable for the species. Given that this species needs humid habitats (as stated by Lindroth 1942, 1949), a number of local vegetation types fulfil its requirements in relative terms in this respect.

The main activity period of mature males and females in northern England was in June, continuing into July, and both freshly emerged individuals and resorbing adults were still found in August and even in September (Houston 1981). In central Norway the most active phase was at the end of June and the beginning of July (Refseth 1984). The phenological pattern found in the Värriötunturi fell area seems to coincide well

with earlier observations except that the active period was somewhat more concentrated.

Daily temperatures below 10°C during the period of most abundant occurrence reduced the catch markedly, whereas once this main activity period had ended not even major rises in temperature could increase the number of active individuals even though the summer was still continuing. Lauterbach (1963) pointed out the importance of temperature for catches of Carabidae, which was also evident here, while Harde et al. (1984) mentioned that *C. glabratus* is also active by day in rainy weather.

The life cycle and daily activity pattern of this species need more thorough investigation. If the individuals live longer than one year, why are they active only for a short period of time around mid-summer? Why do they not make use of the rest of the summer? What are their main prey items? Do they live for three years here in subarctic conditions as stated for elsewhere (see Houston 1981 and Refseth 1984)? Where do they spend the rest of the summer and autumn?

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