Parastenocaris glacialis (Crustacea: Copepoda, Parastenocarididae) *in the Faroe Islands*

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Úrtak

Fram við føroyskum vøtnum og áarløkum eru her og har heilt smá sand-og eyrstrekki. Kortini rúma hesi strekki stundum interstitiskum dýrum, sum halda til ímillum kornini á hesum sandunum. Leitað varð eftir tí harpacticida smákrabbadýrinum, *Parastenocaris glacialis* Noodt, sum frammanundan er funnið í Fennoskandia, í Íslandi og í Spitsbergen. Hetta dýraslagið varð funnið í vøtnum og á smáum sandum við áarbakkar í Streymoy, Vágum og á Sandi. Ikki er spurningurin loystur enn, hvussu hetta lítla og viðkvæma slag (0.35 mm til longdar) er komið til Føroya. Ávísir møguleikar verða havdir á lofti.

Abstract

Faroese freshwater lakes and brooks have very small stretches of sand/gravel scattered along their shores. In spite of this, these stretches sometimes contain exclusively interstitial animals, living among the sand grains in the small beaches. A search was made for the harpacticid crustacean, *Parastenocaris glacialis* Noodt, which has previously been found in Fennoscandia, in Iceland, and on Spitzbergen. The species was found in lakes and small sand banks in brooks in Streymoy, Vágar, and Sandoy. The question of how this small and delicate species (0.35 mm long) has reached the Faroes is still unresolved. Certain alternatives are discussed.

Introduction

One family of harpacticoids, Parastenocarididae, (Crustacea: Copepoda, Harpacticoida) does almost exclusively occur in interstitial habitats (i.e., living in the water-filled interstices between sand grains in sandy beaches along lake shores, sand banks in rivers and brooks, and sometimes in the hyporheal habitat under river bottoms or in subterranean springs).

The distribution of the species of this genus is interesting, since many of the numerous species occurring in Central Europe do not appear to cross the southern limit of the Würm ice (the last glaciation). This indicates that such subterranean species disperse rather poorly (e.g., Delamare Deboutteville, 1960). This is also shown by the fact that one of the dominant species in Fennoscandia, *Parastenocaris phyllura* Kiefer, does not seem to occur above the Highest Shore Line (HSL) (Enckell, 1969: Fig.3), while it is not uncommon in brackish water in Baltic beaches. The other dominant species in the area, *Parastenocaris glacialis* Noodt, does, however, occur from the sea level to high altitudes and may be found on the mountain heath in small isolated pools lacking in- and outlets. It is widespread in Fennoscandia and also occurs in Iceland and on Spitzbergen (Fig. 1, from Enckell, 1969), and probably on Novaja Zemlja, Borutzky, 1952. There are only scattered finds south

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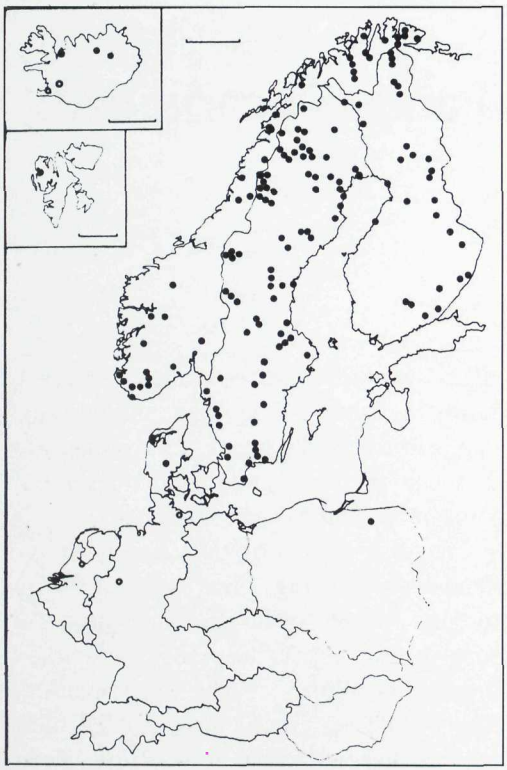

Fig. 1. Localities containing Parastenocaris glacialis *in Fennoscandia, Iceland and Spitzbergen. Reprinted with permission of Oikos.*

of Fennoscandia (and the species has not been looked for in the British Isles) and moreover the species does not endure brackish water, which makes an immigration to Fennoscandia after the last glaciation via the coastal regions seem unlikely.

Since *P. glacialis* has been found in Fennoscandia, in Iceland and on Spitzbergen, it was found natural to ask whether it has reached the Faroe Islands, which have a short immigration history for plants and animals (Enckell, 1988). Therefore, during other field work, a number of sandy stretches in lake and brook beaches were sampled for the species. A number of voucher specimens of *P. glacialis* have been deposited at the Museum of Natural History, Tórshavn, Faroe Islands.

The species

Parastenocaris glacialis is a small harpacticoid copepod, about 0.35 mm long (Fig. 2). It lives in the interstices between sand grains in beaches and probably feeds by scraping microalgae from the sand grain surfaces. Like other members of the family, but unlike other harpacticoids, it moves by

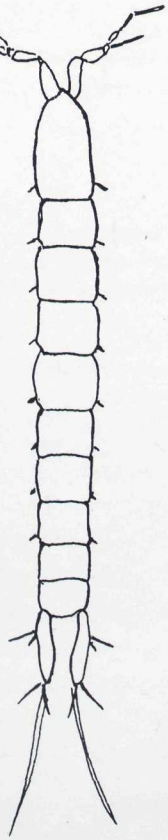

Fig. 2. General habitat of Parastenocaris glacialis *from the dorsal side. The animal is ca. 0.35 mm long.*

crawling over the sand grains, not by swimming. In northern Sweden it appears to have one generation per year. It reproduces in June-July in Lake Torneträsk (northern Sweden) and the nauplii mature in about two months (Enckell, 1969). The conditions seem to be similar in the Faroes, since both nauplii, metanauplii and adults were found during the sampling in July, 1995. In Fennoscandia live animals may be found in ice-covered beaches during the winter, which indicates a certain cold resistance.

Methods

Interstitial water was filtered from small stretches of sandy/gravelly beaches according to the method of Chappuis (1942). A plankton net with mesh size of 25 µm was used. Samples were sorted in the laboratory under a magnification of 20-25X. The occurrence of other animal groups was noted (see Results).

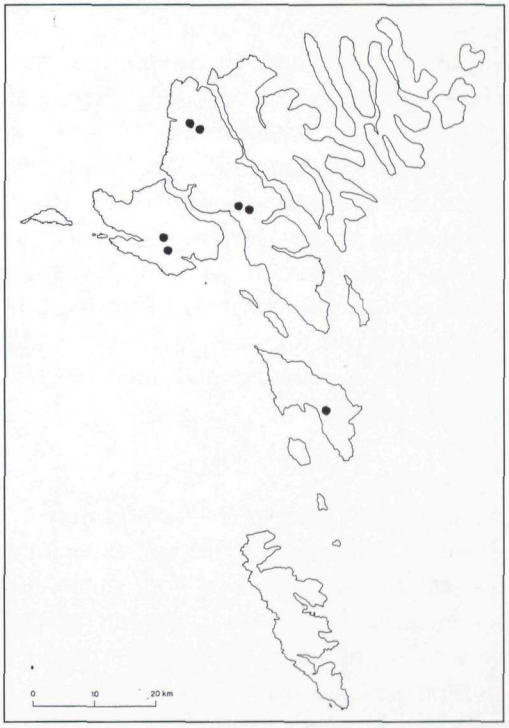

Fig. 3. Sites in the Faroes containing Parastenocaris glacialis. *For names of lakes and brooks, see main text.*

Results

Sandy or sandy/gravelly beaches are not common in Faroese lakes or brooks. Very often a thin layer of sand/gravel overlies a compact layer of peat, which completely shuts out any transport of subsoil water to the sand. Altogether 12 sites were sampled, and *P. glacialis* was found in seven of these (Leynarvatn and Mjøvuvatn, 18 July 1995, on Streymoy; Saksunarvatn and Dalsá, 20 July 1995, on Streymoy; Sørvágsvatn at Ivarsheyggjur and Skjatlá, 26 July 1995, on Vágar; and Lítluvatn, 27 July 1995, on Sandoy - see Fig. 3). Samples from Toftavatn (Eysturoy), Hovsvatn (Suðuroy, and Stóravatn, Sandsvatn and Heimara Helsavatn (Sandoy) did not yield any specimen of *P. glacialis*, which of course does not preclude the species' occurrence in these water bodies.

The accompanying fauna in the beaches varied very much. All beaches contained nematodes and oligochaetes, and most also ciliates. Rotatoria, Ostracoda, Hydracarina, Copepoda Cyclopoida and Copepoda Harpacticoida occurred in a few beaches, while only the samples from Sørvágsvatn, Skjatlá and Leynarvatn contained Tardigrada. A large part of this fauna does most probably not belong to the true interstitial

fauna, but has entered from the free water outside the beaches. *Parastenocaris glacialis* seems to be the only truly interstitial species in these assemblages.

In most of the small beaches only a few specimens of *P. glacialis* were found, while the beaches at Sørvágsvatn (Skjatlá and especially Sørvágsvatn at Ivarsheyggjur) contained dense populations. Possible further studies on this unique fauna should preferably concentrate on these beaches and this lake.

Discussion

As mentioned above, *P. glacialis* may be found in very small water bodies lacking in- and outlets, and also high up in the mountains in Fennoscandia. Apparently the species is limited to the northern parts of Europe (and probably Asia) and is adapted to cool-temperate conditions. The ability to disperse is low among the *Parastenocaris* species (as evidenced by the distribution of *P. phyllura* in Fennoscandia, Enckell, 1969). Resting stages are not known from any species and the means of dispersal are unknown. A single species has been reported from plankton, so dispersal in open water seems unlikely. Dispersal upstream in a water course may be possible in the hyporheal habitat (Tilzer, 1968). Moreover, species restricted to fresh water, like *P. glacialis*, must have greater difficulties to disperse than species able to occur in brackish water (e.g., in the Baltic).

It appears that some moss- and plant-living harpacticoid species have resting stages facilitating dispersal. One *Parastenocaris* species (*P. brevipes*) is found both in *Sphagnum* bogs and in subterranean habitats.This might indicate that the ability to form resting stages is not completely absent in the genus. Possibly the occurrence on isolated islands like Iceland, Spitzbergen and the Faroes in the north, and Tenerife and New Caledonia in the south (Noodt, 1968) indicates such a possibility.

The period of ice recession after the last Ice Age was characterized by meltwater streams and rivers, and dammed lakes (Brinck, 1966). The periglacial fauna - to which *P. glacialis* probably belonged - contained eurythermal and cold-stenothermal species. Bare sandy and gravelly surfaces were common. These areas, which were extensive in the protocratic era during the ice regression, exist i.e. as sandy beaches today. An opportunistic species might very well have followed the retreating ice towards the north in Fennoscandia (e.g., *P. glacialis*). Likewise the species might have rafted on ice floes on the surface fresh water following the break-up of the ice-encrusted sand/gravel/soil to islands in the North Atlantic, like the Faroes (see Enckell, 1988, for a discussion of this possibility)

This type of dispersal presupposes a tolerance to low temperatures. Many interstitial animals endure freezing, and Jansson (1968) reported living animals in samples of frozen sand from the Baltic (including *Parastenocaris phyllura*). Enckell (unpubl.) found both *P. phyllura* and *P. glacialis* in samples of frozen sand from Swedish lakes and the specimens survived the melting of the ice. These two species are also regularly found under the ice in the

beaches in winter, at temperatures around the freezing point. The frozen state, although not normal, thus does not seem to pose a lethal threat to these species.

In northern Sweden *P. glacialis* reproduces during June-July (Enckell, 1969) and the nauplii mature in about two months. During this period both nauplii, metanauplii and adults can be found together. The conditions seem to be similar in the Faroes, since nauplii, metanauplii and adults were found together in, e.g., Leynarvatn and Sørvágsvatn.

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