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Planctonic Crustacea from the Estuaries in the Firth of Puck

by

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Two rivers run into the Firth of Puck. Along the bottom of an ancient valley, Puck-Karwia, flows the river Plutnica, and along another ancient valley, Leba-Reda-Rewa, the river Reda brings its waters into the Firth. The shores of the estuaries are low and flat, swampy and turfy.

The Firth of Puck constitutes the western (inner), part of the Bay of Puck and is separated from it by a shallow ridge, Ryf Mew. The Firth forms a shallow basin of 105 km² and its mean depth amounts to only 3 m. The maximum depth 8.4 m is called Jama Chalupska.

In the estuaries of the above-mentioned rivers, where the salinity oscillates during one year between 1 and 7 ‰, two ecological groups of plankton compete or co-exist: a fresh-water group and a brackish-water group. The existence of marine species either in the estuaries or in the Firth has never been observed.

This paper deals exclusively with microplankton, and above all with Cladocera and Copepoda, and with their sub-groups Calanoidea and Cyclopoidea.

The investigations were carried out in 1958, 1962-1965 and 1967 on board a motor boat and from the land, by means of a pontoon, or wading the water. Samples were collected with a plankton net of the Apstein type, made of mill-gauze No.25.

The fresh-water species were represented by:-

Cladocera:	<u>Bosmina longirostris</u>
	<u>Alona affinis</u>
	<u>A. rectangula</u>
	<u>Diaphanosoma brachyurum</u>
	<u>Chydorus sphaericus</u>
Copepoda Cyclopoidea:	<u>Eucyclops serrulatus</u>
	<u>Megacyclops viridis</u>
	<u>Halicyclops magniceps</u>
	<u>H. neglectus</u>
	<u>Mesocyclops leuckarti</u>
	<u>Eudiaptomus graciloides</u>
	<u>Macrocyclus albidus</u>
	<u>Cyclops strenuus</u> (groups)

Besides, dead or even partially decomposed individuals, as well as excuvia, were found. They were generally not determinable, although they belonged to the same ecological group. Some of them resembled:-

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Cladocera:	<u>Alonella nana</u>
	<u>Daphnia cucullata</u>
	<u>D. cristata</u>
	<u>Leptodora kindti</u>
Copepoda Cyclopoidea:	<u>Acanthocyclops biscuspidatus</u>
	<u>A. bisestosus</u>
	<u>A. vernalis</u>
	<u>Ectocyclops phaleratus</u>
Calanoidea:	<u>Eurytemora lacustris</u>

The brackish-water species were represented by:-

Cladocera:	<u>Bosmina coregoni maritima</u>
	<u>Evadne nordmanni</u>
	<u>Podon polyphemoides</u>
Copepoda Calanoidea:	<u>Acartia bifilosa</u>
	<u>A. tonsa</u>
	<u>Eurytemora</u> sp.
	<u>Temora longicornis</u>
	<u>Centropages hamatus</u>

The number of individuals of particular fresh-water species in the area investigated was rather small, since these species are principally restricted to the estuaries proper and do not spread over great distances.

In the Firth of Puck they remain as long as the water-masses brought into the Firth by the rivers have not lost their peculiarity, i.e. when the salinity of mixed waters do not exceed 5 ‰. This would occur in a distance of about 200 to 300 m off the river mouths in calm weather.

In case of strong southern winds, these species, following the water-masses, may spread over a considerable area of the Firth of Puck and find tolerable conditions far from the river mouths, in lagoons, on turfy meadows, in turf-pits and other cavities that occur in the surroundings of the Firth, for example near Swarzewo, Chalupy, and even Jastarnia. They penetrate either across the reef Ryf Mew at high sea-level, or through the deepening in the reef, the so-called Glebinka, which is an artificially dug passage for fishing cutters. Afterwards, they are probably transported by the Sambia Current towards the Jastarnia's shore along the internal side of the Hela-peninsula (Table 1).

The fresh-water species were mainly caught in the period from June to September. In other months they were sampled only sporadically.

The brackish-water species make up the main part of the planktonic fauna in the Firth of Puck, and are very abundant there. It was observed that they show a great tolerance with respect to salinity, as they would be found in estuaries as well.

From among the brackish-water species within the estuarine plankton community, two species from the genus Acartia predominated: Acartia bifilosa and A. tonsa., followed by the species of the genus Eurytemora. As to Eurytemora, it has been ascertained that some species such as Eurytemora hirundoides, E. hirundo, E. affinis, E. velex (E. lacustris) undergo seasonal variations, and that a far-going cross breeding takes place.

As a result of strong western or north-western winds, and particularly by those from the north, the water-masses of the Firth of Puck are pressed into the river mouths and even relatively far up into the rivers, bringing the above-mentioned species with them. This is especially the case in the Roda river.

In the Bay of Puck the appearance and development of particular brackish-water species depend mainly on the season. Thus, the appearance of Acartia bifilosa, which occurs during the whole year, reaches its peak of development in high summer. Acartia tonsa appears in May, but its maximum development falls in August, when this species sometimes even prevails over the others. It disappears completely from the Firth's waters as late as in November.

Generally taken, the microplankton is extremely poor during the winter period both in respect of the number of individuals belonging to particular species, and of the species composition. The thermophile forms of Copepoda, as well as Acartia tonsa, and the whole group of Cladocera are absent.

In spring, the activity of reproduction is more and more intensive, together with the increase in temperature within the whole community of planktonic animals. Firstly, the young stages of copepods develop more abundantly, which is the case for the nauplii and copepodites of orders I and II, and in the final period of spring the young stages of Cladocera are dominant. The most intensive development of the microplankton, however, falls in summer (Acartia tonsa and A. bifilosa, as well as the Cladocera species). In autumn the occurrence rapidly decreases and the development cycle comes to an end.

It may be emphasized that hitherto the presence of young stages of the fresh-water species have not been found, neither in the Firth of Puck nor in the estuaries. Nor has any case been observed where some of the fresh-water species would reproduce in estuaries or in more distant parts of river courses, and neither nauplii nor the copepodites of the orders I and II of species belonging to this ecological group have ever been discovered in such places. To sum up, it may be said that in the estuaries the fresh-water species are more numerous than those of the brackish-water; the latter, however, are the most abundant numerically, so they determine the biological character of this peculiar environment.

Species	Firth of Puck						
	Estuaries		Open area	Shores of lagoon, turfy meadows, turf-pits and cavities			
	Reda	Plutnica		Puck	Swarzewo	Chalupy	Jastarnia
	1-7 ‰		6-7 ‰	1.5-3 ‰			1.5-4 ‰
Cladocera							
<u>Bosmina cor. maritima</u>	x	x	xx	-	-	-	-
<u>Evadne nordmanni</u>	x	x	xxx	-	-	-	-
<u>Podon polyphemoides</u>	x	x	xxx	-	-	-	-
<u>Podon intermedius</u>	-	-	xx	-	-	-	-
<u>Podon leuckarti</u>	-	-	x	-	-	-	-
<u>Alona affinis</u>	x	x	x	x	-	-	-
<u>Alona rectangula</u>	x	x	x	-	-	-	-
<u>Diaphanosoma brachyurum</u>	x	x	x	x	x	x	-
<u>Chydorus sphaericus</u>	xx	xx	x	x	x	x	x
<u>Bosmina longirostris</u>	x	x	x	x	-	-	-
Copepoda							
<u>Acartia bifilosa</u>	x	x	xxx	-	-	-	-
<u>Acartia tonsa</u>	x	x	xxx	-	-	-	-
<u>Acartia longiremis</u>	-	-	x	-	-	-	-
<u>Eurytemora sp.</u>	xx	xx	xxx	x	x	x	x
<u>Temora longicornis</u>	x	x	x	-	-	-	-
<u>Centropages hamatus</u>	-	-	x	-	-	-	-
<u>Eucyclops serrulatus</u>	xx	x	x	x	x	x	-
<u>Megacyclops viridis</u>	x	xx	x	x	x	x	x
<u>Halicyclops magniceps</u>	x	x	x	-	x	-	-
<u>Halicyclops neglectus</u>	x	x	x	-	x	-	-
<u>Mesocyclops leuckarti</u>	xx	xxx	x	-	-	-	-
<u>Eudiaptomus graciloides</u>	xx	x	x	-	-	x	-
<u>Macrocyclus albidus</u>	x	xx	x	x	-	-	-
<u>Cyclops strenuus (group)</u>	x	xx	x	x	-	-	-

x = scarce or sporadic
 xx = numerous
 xxx = very numerous or abundant

Table 1. Occurrence of more important species of microplankton in the area of investigation.

Species	Years				
	1958-1963	1964	1965	1966	1967
Cladocera					
<u>Bosmina cor. maritima</u>	+	+	+	+	+
<u>Evadne nordmanni</u>	+	+	+	+	+
<u>Podon polyphemoides</u>	+	+	+	+	+
<u>Podon intermedius</u>	+	+	+	+	+
<u>Podon leuckarti</u>	+	+	+	+	+
<u>Alona affinis</u>	+	+	+	+	+
<u>Alona rectangula</u>	+	+	+	+	+
<u>Diaphanosoma brachyurum</u>	+	+	+	+	+
<u>Chydorus sphaericus</u>	+	+	+	+	+
<u>Bosmina longirostris</u>	-	-	-	-	+
<u>Alonella nana</u>	-	-	-	-	+
<u>Daphnia cuculatta</u>	-	-	-	-	+
<u>Daphnia cristata</u>	-	-	-	-	+
<u>Leptodora kindti</u>	-	-	-	-	+
Copepoda					
<u>Acartia bifilosa</u>	+	+	+	+	+
<u>Acartia tonsa</u>	+	+	+	+	+
<u>Acartia longiremis</u>	+	+	+	+	+
<u>Eurytemora sp.</u>	+	+	+	+	+
<u>Temora longicornis</u>	+	+	+	+	+
<u>Centropages hamatus</u>	+	+	+	+	+
<u>Eucyclops serrutatus</u>	+	+	+	+	+
<u>Megacyclops viridis</u>	+	+	+	+	+
<u>Halicyclops magniceps</u>	+	+	+	+	+
<u>Halicyclops neglectus</u>	-	-	-	-	+
<u>Mesocyclops leuckarti</u>	+	+	+	+	+
<u>Eudiaptomus graciloides</u>	+	+	+	+	+
<u>Macrocyclus albidus</u>	-	-	-	-	+
<u>Cyclops strenuus (group)</u>	-	-	-	-	+
<u>Acanthocyclops biscuspidatus</u>	-	-	-	-	+
<u>Acanthocyclops bisestosus</u>	-	-	-	-	+
<u>Acanthocyclops vernalis</u>	-	-	-	-	+
<u>Ectocyclops phaleratus</u>	-	-	-	-	+
<u>Eurytemora lacustris</u>	-	-	-	-	+

+ Present

- Absent

Table 2. Occurrence of planctonic crustaceans in the area of investigation.