

INVESTIGATIONS ON NEMATODES IN THE EMS-DOLLART ESTUARY

by

L. A. BOUWMAN

Laboratorium voor Microbiologie,
Rijksuniversiteit Groningen, Haren, Nederland

SUMMARY

Heavy pollution of the canals in the Dutch province of Groningen with effluent from many potato flour-mills and straw board factories causes much irritating stink. This obliged the government to consider other means of getting rid of the effluent. Being less expensive than clearance of the effluent, the construction of a pipeline from the industrial area to the Ems-Dollart estuary was proposed to solve this problem. Lack of knowledge about the biological effects of an increased discharge of organic waste materials directly into the estuary, forced the government to initiate the formation of a research group : « Biological Research Ems-Dollart Estuary » (BOEDE). The research team includes microbiologists, phyco-logists and zoologists and is supposed to describe relevant biological processes in the estuary and to predict possible shifts in the ecosystem caused by changing the discharge of effluent. Meiofauna is one of the subjects investigated. Research started with a survey of nematodes in the area between the island of Borkum and Nieuwe Statenzijl.

This paper describes observations on nematode populations in the area that is influenced directly by the effluent. The area is situated in the south-east of the Dollart, near the waste water outlet at Nieuwe Statenzijl, and consists of tidal mudflats. The sediment is silty, very rich in organic matter and covered with a film of brown coloured diatoms. Regularly anaerobic water masses pass by. The black sulfide layer is located near the sediment surface at a depth of three mm. The extremely thin oxidized sediment layer is mainly colonized by bacteria, nema-todes and oligochaetes. This region lacks macrofauna, while meiofaunal organisms such as copepods, which are abundant in other parts of the estuary, disappear during the flourmill campaign. From this thin zone of oxidized sediment nematodes have been isolated and identified throughout a year ; 100 to 200 nematodes were identified eight times. The isolations included seven to ten different species which is a very low number compared with samples from other parts of the estuary. Dis-tribution of specimens over the species was very uneven. Dominances of 40 to 95 % have been found of the following species : *Eudiplogaster pararmatus*, *Hypodontolaimus geophilus*, *Theristus setosus* and *Anoplostoma viviparum*. A special survey of this area was carried out to detect if pollution effected the meiofauna. From Sep-tember on the discharge of effluent increases because the factories start processing the new potato harvest. Six sediment samples were taken at distances of 500 m among themselves, on a line from Nieuwe Statenzijl to Emden. The first sampling

station was located at a distance of one km from the effluent outlet into the Dollart, the sixth station two and a half km farther in the direction of Emden (Fig. 1).

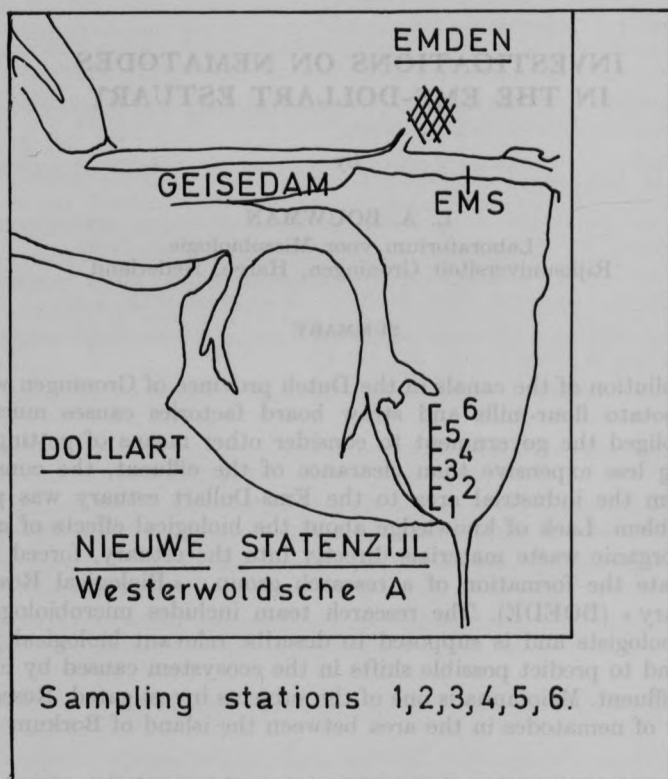


Fig. 1. — Map of the Dollart with the sampling stations.

Samples were taken in September, just before the increased effluent discharge reached the estuary and in October and November when the effluent could have effected the meiofauna already. At the first sampling station a vertical distribution of nematodes has been observed as described above : low diversity communities, restricted to the upper sediment zone of about three mm and no fauna at all in the anaerobic layers. However, in the September samples from station two, a zone below the superficial sediment has been recognized which is colonized mainly with the nematode species *Sabatieria vulgaris*. At the other stations the same phenomenon has been observed. The dominant colonisation by this species of the zones just below the superficial sediment has been noticed in all muddy areas of the estuary. In October and November, during the flourmill campaign, the species *Sabatieria vulgaris* practically disappeared from the stations two and three respectively, while at the other stations the numbers of specimens did not fluctuate very much (Table 1). It seems that the species investigated prefers semi-aerobic conditions, available in the layer below the upper three mm of the sediment in muddy areas. These conditions shift from semi-aerobic to anaerobic during the flourmill campaign at the stations two and three ; consequently the species *Sabatieria vulgaris* disappears.

TABLE 1
Sabatieria vulgaris specimens/cm³

Station number	1	2	3	4	5	6
September	2	115	69	56	72	80
October	4	18	44	65	95	86
November	0	10	3	96	80	—

SUMMARY

The ecophysiology of any group of animals is best approached by analyzing the responses of organisms to individual environmental factors as well as to combinations of factors. Very little has been done along these lines in marine nematodes and very few studies of a more general nature have emerged. The following topics of recent interest should be mentioned, however:

1) Temperature

Resistance studies revealed relationships between upper lethal temperature and the patterns of distribution in various species. A closer analysis of this relationship may prove fruitful in shedding light on niche specialization and related problems. *Respiration-temperature curves* represent another means of interpreting habitat-organism relationships since usually there is some connection between Q_{10} -values and the range of optimum temperature experienced by species in nature. One case of *anomalous acclimation* of oxygen consumption has been reported. Optimum developmental temperatures appear to be a characteristic of all the species living in a particular habitat — which is not true for the upper lethal temperatures of these species. A very striking phenomenon is the ability of some inhabitants of temperate beaches to carry on with developmental processes at subzero temperatures and even in a frozen condition.

2) pO_2

In the few species analyzed oxygen consumption conforms to pO_2 in the case of *Beolagus brevix*, assisted by the presence of haemoglobin in the muscles, down to very low values. Acclimation of metabolism to low pO_2 is possible. No sign of an oxygen debt was detected. Close to anoxic conditions most species become immobile, but at least one species, *Paracanthysium tozeri*, turned out to be a true anaerobe, being equipped with very peculiar mitochondria.

3) pH

Resistance studies revealed close correspondences between lethal alkaline pH and maximum pH experienced by various species in their habitat. This indicates that there is very little *Lyssa's* alkaline resistance, at least in the inhabitants of a subtropical beach.