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POPULATION DENSITIES AND CHARACTERISTICS OF MEIOBENTHOS IN DIFFERENT SUBSTRATES IN THE KIEL BAY

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Quantitative grab samples were studied to elucidate the following:

1. Composition of meiobenthos of different substrates and abundance of the most important groups (Nematoda, Copepoda, *etc.*).
2. Communities (associations) of Copepoda characteristic of certain types of substrates (clean sands, soft bottom, mixed bottom).
3. Productivity of different substrates.

The quality of the substrates seems to be the most important ecological factor as regards the composition of the meiobenthos. Nematoda are the dominant group in soft bottoms, mixed bottoms and middle to fine sands. In coarse sands and gravel Harpacticoidea are dominant. Other groups — Ostracoda, Tardigrada, Acari — are scarce in all types of substrates compared with Nematoda and Harpacticoidea. Gastrotricha prefer middle to fine sands but vary greatly in numbers.

Specific associations of Harpacticoidea can be distinguished. More or less fine sands are characterized by a »*Kliopsyllus holsaticus* coenosis». Coarse sands are populated by a greater number of species: most of them are substrate-specific (Mesopsammon), but none is dominant. Soft bottoms are generally populated by fewer species, their associations being completely different from those of sands.

The »productivity» is given here as numbers of individuals/m². Finer sands contain an average of 560 000, coarse sands 380 000 and mixed bottoms 471 000 —1 478 000 individuals/m².

The most important ecological factor for the composition of the meiobenthos in the sublittoral of the Kiel Bay is not diminished salinity but rather the type of substrate (Remane 1933, McIntyre 1969). In order to evaluate its influence on the occurrence of various groups of the meiobenthos, quantitative samples of different substrates have been studied. Substrates with many different grain sizes, comprising mixed sand, coarse sand, gravel and mud, have been examined at various localities in the Kiel Bay. The samples have partly been taken with a Reineck box grab, partly by divers (localities shown in the map of the Kiel Bay).

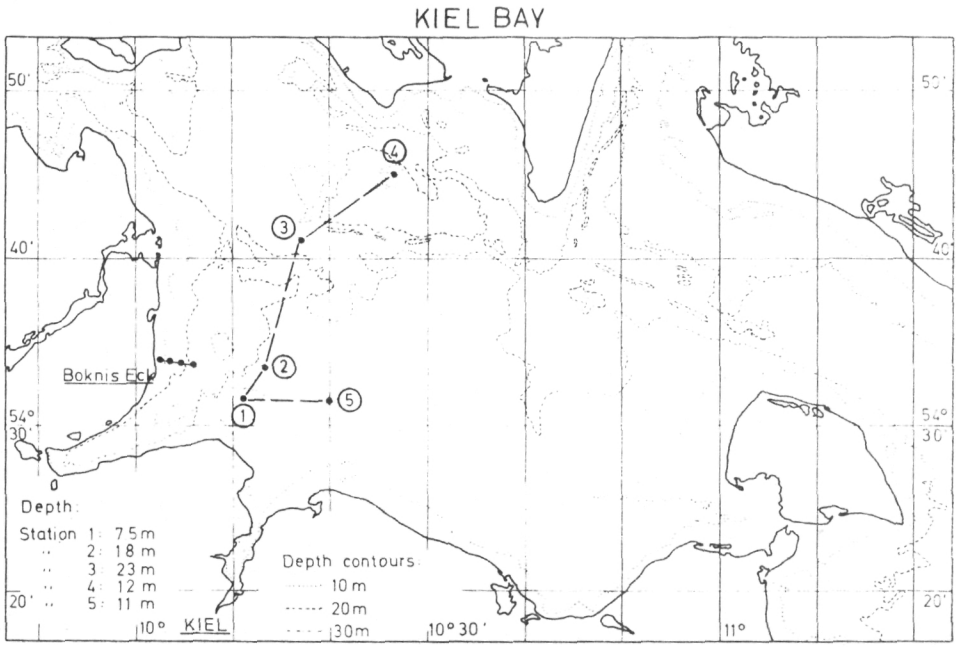

Fig. 1. Study area and sampling stations

SUBSTRATE

The following substrates are distinguished:
— Mixed sand- coarse sand/gravel.
— »Pure» medium fine sand and coarse sand
— Muddy fine sand
— Mud (with a high proportion of faecal pellets).

The quantities of »pure» sand examined were 10 $cm^2 \triangleq 20$ cm^3; all the other samples had the same area but a volume of 50 cm^3. This difference is due to the fact that the samples from the different localities were taken at different times.

The texture of these substrates determined the composition of the meiobenthos. We shall start by comparing the composition of the fauna of the »pure» medium fine sand with that of the coarse sand. The two types of sand differ in respect to the two dominant groups of the meiobenthos — Nematoda and Harpacticoidea. The number of harpacticoids rises with increasing grain size. In »pure» coarse sand and gravel harpacticoids are more numerous than nematodes. The latter predominate in medium fine sand and in finer substrates. The relation of the number of individuals is more or less constant between nematodes and harpacticoids for each type of substrate. The other groups play only minor roles. Ostracoda, Tardigrada and Halacaridae

are found on medium fine sand in small numbers only; on coarse sand at least tardigrades and halacarides are more numerous. The number of ostracods, unlike that of nematodes and harpacticoids, is very high in both substrates.

COLONIZATION

All these groups of the meiofauna show more or less constant relations as regards their numbers on the different substrates. Gastotrichs decidedly prefer medium fine sand; their numbers may vary considerably. Sometimes they are more numerous than harpacticoids, sometimes there are only a few individuals.

The meiobenthos of muddy fine sand and of mud is less diversified. 85 %—100 % of the fauna are nematodes, the rest are harpacticoids and occasionally a few halacarides and ostracods. This is illustrated by Fig. 2.

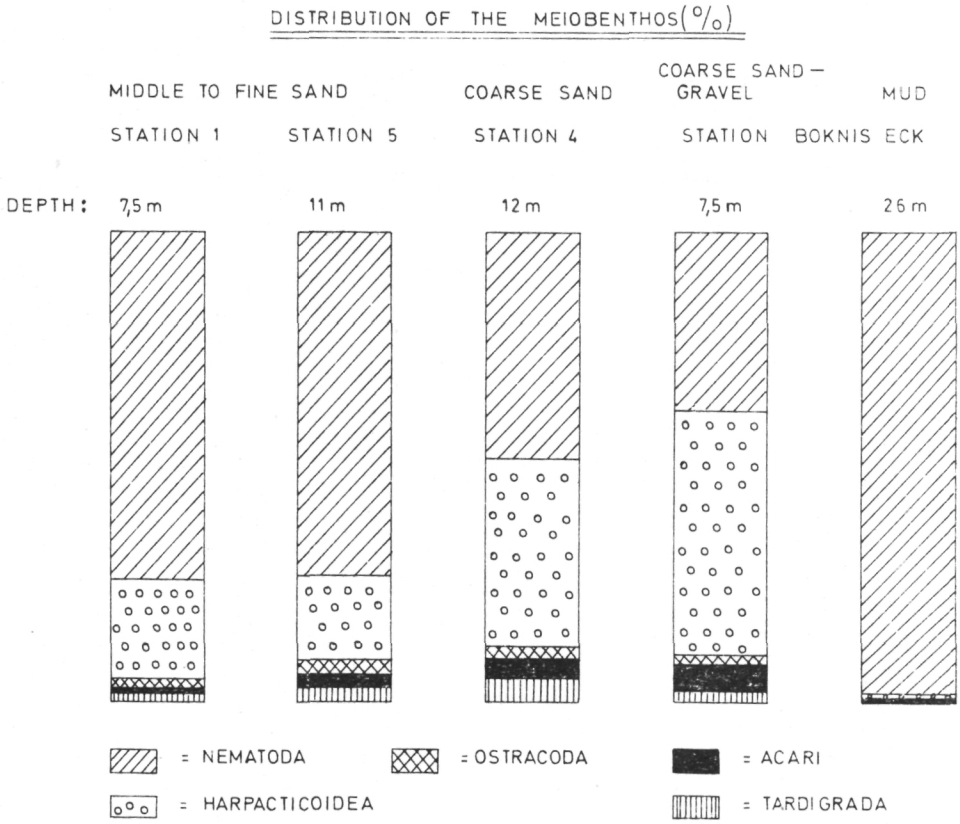

Fig. 2. Distribution of the meiobenthos (%)

TABLE 1. Individuals/10 cm²

Station	Depth(m)	Substrate	n(max.)	n(min.)	Ø	n-cores
Boknis eck	7.5	Coarse sand/gravel	682	264	473	6
»	15	Medium sand	1 043	326	684	6
»	20	Mixed bottom	1 911	1 059	1 485	6
»	26	Mud	1 010	822	916	6
1	7.5	Medium to fine sand	1 143	94	618	12
2	18	Mixed bottom	541	375	458	3
3	23	Mixed bottom	447	284	365	3
4	12	Coarse sand	768	111	489	10

It is not easy to compare the faunal composition discussed above with results obtained by other authors, since the substrates, geographical areas, and physico-chemical conditions differ in each case. It can, however, be concluded that in »pure» coarse sands and in gravel harpacticoids are more numerous than nematodes (*cf.* Coull 1969). All the other substrates examined are characterized by the predominance of nematodes. This is in accordance with the results of many other authors (Wieser 1960, McIntyre 1964, Wigley & McIntyre 1964, Muus 1967, Guille & Soyer 1968, Coull 1969, Stripp 1969, Tietjen 1969 and Gerlach 1971). These statements are valid only for the sublittoral zone.

THE HARPACTICOID POPULATIONS OF DIFFERENT SUBSTRATES

Different substrates in the Kiel Bay are typically populated by particular harpacticoid species. Species associations can be defined relatively well for fairly homogeneous substrates. Quantitative samples should be taken regularly at the same spot if possible.

The samples were taken over a period of one year (one sample per month); the localities were fixed by Decca values. Qualitative studies of the harpacticoid fauna along German shores have been carried out by Klie (1929, 1934, 1949, 1950), Kunz (1935, 1936, 1938, 1949, 1954) and Noodt (1952, 1953, 1956, 1957). A quantitative study has been performed by Schmidt (1968) when investigating the fauna of a sandy beach.

The »pure» sublittoral sands examined, *i.e.* medium fine sands (two localities) and coarse sand (one locality), show an approximately constant spectrum as regards species of harpacticoids.

The medium fine sand is characterized by the »*Kliopsyllus holsaticus* association», which also includes *Scottopsyllus minor*, *Evansula pygmaea*, *Paraleptastacus espinulatus*, *Leptastacus laticaudatus* and *Rhizothrix minuta*. A number of other species are also represented but never in great quantity. They are all interstitial species.

The coarse sand can be less clearly characterized. It is richer in species and the harpacticoids are bigger ones, such as *Paramphiascopsis longirostris*, *Amphiascoides debilis*, *Mesochra inconspicua*, *Nitocra typica;* Laophontidae are also common.

Completely different species and associations are found on soft bottoms (here only muddy fine sand is considered; no harpacticoids are found on pure mud). The following observations are based on only three samples per locality. Typical species are *Danielssenia typica* (mostly abundant), *Stenhelia gibba*, *Typhlamphiascus typhlops*, *Halectinosoma gothiceps*, *Enhydrosoma curticauda*, *E. sarsi* and *E. longifurcatum*. These species were present in all the samples. It may be noted that the instable salinities of the Kiel Bay influence the variety of species as compared with other regions. The total number of species in the Kiel Bay is already considerably reduced. Further details of the harpacticoid populations of mixed sediments in the Kiel Bay are given by Becker (1970).

POPULATION DENSITY

Population density is regarded here as a measure of production. As can be expected, »production» is different in different substrates. The profile at Boknis Eck is from near the shore, where there is a strong current; the other ones are farther from the shore. The sparser populations recorded in muddy fine sand at a greater distance from the shore cannot be ascribed to the lower number of samples. They are probably explained by the fact that the current near the shore causes higher population densities (*cf.* Table 1).

The population densities of the meiobenthos of the Kiel Bay are probably not very different from those of other regions. The average numbers of individuals per square metre are: in coarse sand/gravel 380 000, in medium to fine sand 560 000—623 000, in muddy fine sand 471 000—1 478 000 and in mud 760 000. These values seem to correspond with those of other authors (Gerlach 1971 and Stripp 1969, for the North Sea) notwithstanding some uncertainties as regards methods, length of cores and number of groups of animals examined.

REFERENCES

Becker, K. H. 1970: Beitrag zur Kenntnis der Copepoda Harpacticoidea sublitoraler Weichböden in der Kieler Bucht. *Kieler Meeresforsch.* 26: 56—73.

Bodin, Ph. 1967: Catalogue des nouveaux Copepodes Harpacticoides marins. *Mém. Mus. natn. Hist. Paris, Série A Zoologie* 1: 1—76.

Coull, B. C. 1969: Shallow water meiobenthos of the Bermuda Platform. *Oecologia* 4(4):

Gerlach, S. A. 1971: On the importance of marine meiofauna for benthos communities. *Oecologia* 6: 176—190.

Guille, A. & Soyer, J. 1968: La faune benthique des substrate meubles de Banyuls-sur-Mer. Premières données qualitatives et quantitatives. *Vie Milieu* 19 (2 B): 323—360.

Klie, W. 1929: Die Copepoda Harpacticoidea von Helgoland. *Helgoländer wiss. Meeresunters.* 16 (9): 1—20.

Klie, W. 1929: Die Copepoda Harpacticoidea der südlichen und westlichen Ostsee mit besonderer Berücksichtigung der Sandfauna der Kieler Bucht. *Zoolog. Jahrb.* 57 (3/4): 329—386.

—»— 1949: Harpacticoiden (Cop.) aus dem Bereich von Helgoland und der Kieler Bucht I. *Kieler Meeresforsch.* 6: 1—40.

—»— 1950: Harpacticoiden (Cop.) aus dem Bereich von Helgoland und der Kieler Bucht II. *Kieler Meeresforsch.* 7: 76—128.

Kunz, H. 1935: Zur Ökologie der Copepoden Schleswig-Holsteins und der Kieler Bucht. *Schr. naturw. Ver. Schlesw.-Holst.* 21 (1): 84—132.

—»— 1936: Neue Harpacticoiden (Crust. Cop.) von Helgoland. *Kieler Meeresforsch.* 1: 352—358.

—»— 1938: Die sandbewohnenden Copepoden von Helgoland I. *Kieler Meeresforsch.* 2: 223—254.

—»— 1949: Die sandbewohnenden Copepoden von Helgoland II. *Kieler Meeresforsch.* 6: 3—10.

—»— 1954: Beitrag zur Kenntnis der Harpacticoiden der Deutschen Bucht. *Kieler Meeresforsch.* 10 (2): 224—228.

Lang, K. 1948: Monographie der Harpacticoiden. Bd I und II. Lund.

McIntyre, A. D. 1964: Meiobenthos of sub-littoral muds. *J. mar. biol. Ass. U.K.* 44: 665—674.

—»— 1969: Ecology of marine meiobenthos. *Biol. Rev.* 44: 245—290.

Muus, B. J. 1967: The fauna of Danish estuaries and lagoons: Distribution and ecology of dominating species in the shallow reaches of the mesohaline zone. *Meddn. Danm. Fisk.-og Havunders.* N.S. 5 (1): 3—316.

Noodt, W. 1952: Marine Harpacticoiden (Cop.) aus dem eulitoralen Sandstrand der Insel Sylt. *Abh. math.-naturw. Kl., Akad. Wiss. Mainz*, Jahrg. 1952 (3): 103—142.

—»— 1953: Bemerkenswerte Copepoda Harpacticoidea aus dem Eulitoral der deutschen Meeresküste. *Zool. Anz.* 151 (1/2): 8—20.

—»— 1957: Zur Ökologie der Harpacticoidea (Crust. Cop.) des Eulitorals der deutschen Meeresküste und der angrenzenden Brackgewässer. *Z. Morph. Ökol. Tiere* 46: 149—242.

Schmidt, P. 1968: Die quantitative Verteilung und Populationsdynamik des Mesopsammons am Gezeitensandstrand der Nordseeinsel Sylt. *Int. Revue ges. Hydrobiol.* 53 (5): 723—779.

Stripp, K. 1969: Jahreszeitliche Fluktuationen von Makrofauna und Meiofauna in der Helgoländer Bucht. *Veröff. Inst. Meeresforsch. Bremerh.* 12: 65—94.

Tietjen, J. H. 1969: The ecology of shallow water meiofauna in two New England estuaries. *Oecologia* 2: 251—291.

Wieser, W. 1960: Populationsdichte und Vertikalverteilung der Meiofauna mariner Böden. *Int. Revue ges. Hydrobiol.* 45: 487—492.

Wigley, R. L. & McIntyre, A. D. 1964: Some quantitative comparisons of offshore meiobenthos and macrobenthos south of Martha's Vineyard. *Limnol. Oceanogr.* 9 (4): 484—493.