HOKKAIDO UNIVERSITY

Title	Meiobenthos of a Shallow-Water Sandy Bottom in Ishikari Bay, Hokkaido : A General Account (With 3 Text-figures and 2 Tables)
Author(s)	ITÔ, Tatsunori
Citation	北海道大學理學部紀要, 21(3), 287-294
Issue Date	1978-12
Doc URL	http://hdl.handle.net/2115/27639
Type	bulletin (article)
File Information	21(3)_P287-294.pdf

Instructions for use

Hokkaido University Collection of Scholarly and Academic Papers : HUSCAP

Meiobenthos of a Shallow-Water Sandy Bottom in Ishikari Bay, Hokkaido: A General Account

By

Tatsunori Itô

Zoological Institute, Hokkaido University

(With 3 Text-figures and 2 Tables)

During a period from June to November in 1977, a quantitative investigation of subtidal meiobenthos has been carried out at a sandy bottom off Oshoro in Ishikari Bay, west side of Hokkaido. The primary aim of the study was not ecological approach to the whole meiobenthos but to get information about bio-ecology of certain harpacticoids inhabiting there. The result will be reported elsewhere after some new taxa including a new genus are published.

Aside from the result on the harpacticoids at which I aimed, I believe that to publish the data about the whole meiobenthos obtained is of certain significance because our knowledge about marine meiobenthos of Japan remains too poor. In the following, monthly change of the meiobenthos collected during the half-year period is reported together with notes on smaller macrobenthic animals which coexist with the meiobenthos, although it is uncertain whether the change represents a typical mode in this area because the available data have been obtained from only the half-year survey in a single year (see Coull and Fleeger, 1977).

Method

1. *Sampling station and its environment.* Monthly sampling was carried out at a station off Oshoro in Ishikari Bay, west side of Hokkaido, northern Japan (Fig. 1). The station was established at a sandy bottom of a gentle slope of a depth of 25 m, about 20 meters distant from the skirt of a steep cliff. No macroscopic vegetation was found on the bottom. Other general characteristics of the physical and biological environment of this area have been described by Motoda (1971).

Water temperature was measured with a mercury thermometer laid on the bottom. Water temperature was not measured in August since the thermometer had been broken when we reached the bottom.

Granulometry was performed for the sands of two additional core samples, each taken in October and November, with a series of six sieving meshes, 2 mm, 1 mm, 0.5 mm, 0.25 mm, 0.125 mm, and 0.063 mm openings. Particles larger than 2 mm were represented by a

Jour. Fac. Sci. Hokkaido Univ. Ser. VI, Zool. 21(3), 1978.

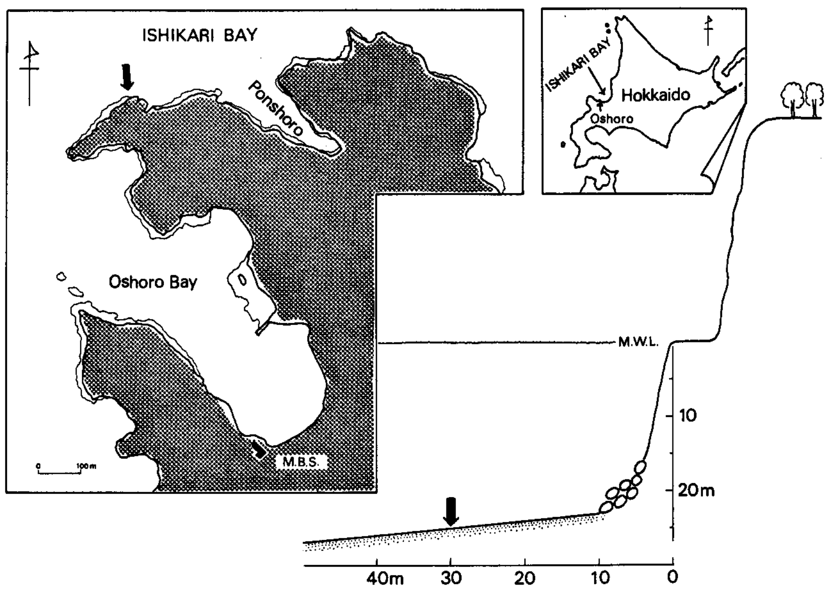

Fig. 1. Location of the sampling station.

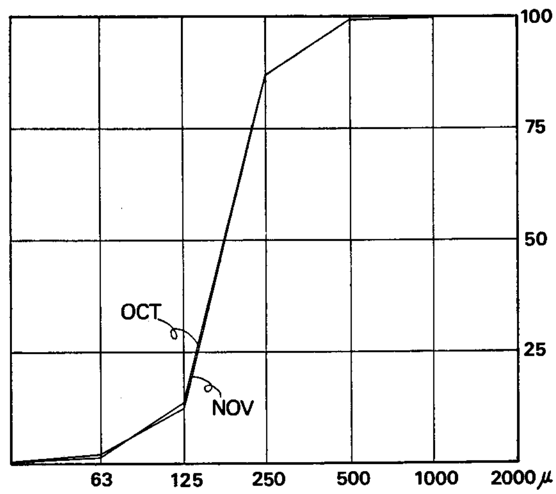

Fig. 2. Cumulative curves of particle size.

few pieces of broken bivalve shells, and they were far less than one per cent of dry weight of the whole sediment (0.027% in Oct., 0.265% in Nov.). Granulometric nature is almost identical between these samples (Fig. 2). The median grain size of the sands smaller than 2 mm is about 0.180 mm.

2. *Sampling procedure.* Field work to take samples was performed with the aid of SCUBA. Regular quantitative samples were taken with a kind of hand-operated corer. The corer is a cylindrical brass tube which circumscribes an area of 20 cm^2 and is 5 cm long, and its top is covered with a piece of stretched nylon gauze (mesh number of the Japanese Standard NXXX25: 40 μ opening) through which excess water overlying sediment readily overflows without washing aside flocculent surface layer (cf. McIntyre, 1971, p. 152). Six cores were taken from the bottom within an area of 1 m$\times$1 m at each occasion, since I had initially intened to take five cores, which cover 100 m^2, for regular estimation and one extra core which had been expected to be used as a spare sample when any severe sampling error was noticed. The extra one was also included in the calculation of density of animals together with the other five ones, although no severe error was found.

In August, a core of a length of 10 cm was taken by using a two-jointed corer of the same diameter; the core obtained was separated into two cores of a length of 5 cm in order to know vertical difference of meiofaunal density.

Animals were extracted from the cores by means of decanting and sieving method, using a bucket filled with 2 litters of filtered sea water and a sieving net made of nylon gauze of mesh number NXXX25. Decanting and sieving treatment was repeated at five times for each sample. The animals extracted were finally preserved in a 5% neutralized formalin — sea water solution after observation for my initial intention about harpacticoid bioecology.

In order to estimate the efficiency of the decanting and sieving treatment employed, a direct examination of residual sands treated (a sample collected in June) was carried out with a dissecting microscope. The efficiency was estimated as 100% for harpacticoids and 43.9% for nematodes. In the data given in the following, the individual numbers of nematodes with asterisk represent the duplicate numbers, as the extraction efficiency is assumed simply as 50%.

Before going further, I would like to express my sincere gratitude to Professor Mayumi Yamada, Hokkaido University, for his kind reading of the manuscript. Sincere thanks are also due to Messrs. K. Kito and Sh. Hiruta who assisted me in submarine work, and to Messrs. Sh. Kubota and K. Shinta who supported our diving. This work was supported in part by a grant from the Itô Science Foundation.

Results and Discussion

1. *Vertical distribution.* Differences of meiofaunal and macrofaunal abundances between upper 5 cm and lower 5 cm within a core of a length of 10 cm which was collected in August are shown in Table 1. More than 90% of the total meiofauna is restricted within the upper 5 cm; within the length of this core, about 98% of harpacticoids are confined.

This result coincides well with previous reports that, in subtidal sediment, harpacticoids or most of meiobenthos except for nematodes are confined within upper a few centimeters (McIntyre, 1964; Tietjen, 1969; Dinet, 1973; Arlt, 1973a; Juario, 1975); therefore, the cores of a length of 5 cm seem to provide us with enough good estimation, at least, for harpacticoids.

On the other hand, this core of upper 5 cm contains only 88.2% of nematodes, and it is apparent that nematodes often penetrate into sediment below 5 cm. At five stations on the Bermuda platform, Coull (1970) found that 66.9% of all the fauna collected was restricted in the upper 2 cm of sediment in core samples of a length of 10 cm and 1.9% was present below 7 cm. In sublittoral mud at a depth of 35 m off Banyuls-sur-Mer, nematodes lived within upper 8 cm of the sediment, and the density maxima were confined in the first or the second centimeter layer (Boucher, 1972). Juario (1975) found that 70–80% of nematodes were

Table 1. Vertical difference of meiofaunal and macrofaunal abundances found in a sample collected on August 11, 1977 (individual number/20 cm²).

	0–5 cm	5–10 cm	Total
Meiofauna			
Nematodes*	760	102	862
Harpacticoids	225	4	229
Turbellarians	10	2	12
Kinorhynchs	0	0	0
Acari	1	0	1
Ostracods	1	2	3
Benthic cyclopoids	1	0	1
Bivalve larvae	2	0	2
Others	3	0	3
Total	**1003**	**110**	**1113**
Macrofauna			
Polychaetes	2	1	3
Amphipods	10	1	11
Tanaids	1	0	1
Cumaceans	1	0	1
Total	**14**	**2**	**16**

restricted within upper 2 cm in his samples, which were 8–10 cm long, collected from silty sand bottom of the German Bight; further, he observed no seasonality in the vertical distribution. McIntyre (1971), however, found that several meiofaunal groups were present even in the deepest section of the cores of a length of 23 cm which were collected from sandy grounds at 1 to 8 m depth off Scotland. Even if these reports are considered, it can reasonably be estimated that the present study made by using of cores of a length of 5 cm covers at least 80% of nematode populations.

2. *Abundance and temporal fluctuation.* Meiofaunal abundance at each month is shown in Table 2, and is illustrated in Fig. 3. Total meiofunal abundance varied between 103000 ind./m² in June and 525000 ind./m² in August.

No table referring to all values of meiofaunal abundances previously recorded from various seas is presented here since useful tables have already been compiled by the following authors, Wieser (1960), McIntyre (1969, 1971), Stripp (1969 b), Coull (1970) and Juario (1975); other data which are not included in those tables have been published by some authors, for example, Arlt (1973 b), Dinet (1973, 1974), Scheibel (1973, 1976), Scheibel and Noodt (1975) and Thomassin et al. (1976).

Table 2. Mean number of individuals of meiobenthic animals per one core (20 $cm^2 \times 5$ cm), and percentages of nematodes and harpacticoids for each month.

	June	July	Aug.	Sept.	Oct.	Nov.
Nematodes*	186.33	527.33	815.00	515.67	392.33	297.33
Harpacticoids	13.50	152.00	216.67	151.33	214.00	301.67
Turbellarians	2.00	9.33	5.67	3.33	2.67	1.67
Kinorhynchs	0.83	1.17	1.50	0.33	0.00	2.50
Acari	1.33	4.33	3.00	1.00	1.17	1.00
Ostracods	1.00	0.17	1.33	2.00	0.00	0.50
Benthic cyclopoids	1.17	0.00	2.00	5.50	5.50	4.67
Bivalve larvae	0.00	0.00	0.17	2.00	19.33	11.00
Others	0.00	0.17	6.33	2.00	0.67	0.67
Total	**206.16**	**694.50**	**1051.67**	**683.16**	**635.67**	**621.01**
Nematodes %	90.38	75.93	77.50	75.48	61.72	47.89
Harpacticoids %	6.55	21.89	20.60	22.15	33.67	48.58

The values obtained from the present study are almost the same magnitude as those of Wigley and McIntyre (1964) at depths of 69–179 m off New England (394000 ind./m^2), Soyer (1971) at a depth of 35 m off Banyuls-sur-Mer (614000 ind./m^2), Scheibel (1973) at depths of 7–12 m in Kiel Bay (542180 to 385920 ind./m^2 for medium fine sand and 385300 ind./m^2 for the coarser sand), and Thommasin et al. (1976) at coral sands of Madagascar (315000 to 609500 ind./m^2). Although Stripp (1969 a) investigated the meiofauna in a similar habitat of a depth of 25 m (St. Ng) in the German Bight with using of a coarser mesh (100 μ opening), his result through 12 months shows higher densities than that obtained in the present study.

As can be predicted from previous studies, nematodes are the dominant group, and harpacticoids the subdominant in the result of the present study too. More than 95% of total meiofauna are occupied always by nematodes and harpacticoids (mean, 96.9%); therefore, fluctuation of total meiofauna depends upon abundances of either nematodes or harpacticoids, or both.

Kikuchi (1966) reported a result of his tentative survey of meiofauna carried out near the low tide mark of Amakusa, southern Japan. His result shows a total of 586 individuals of copepods and nematodes combined were present within an area of 10 cm^2. Although this value is almost equal to the value obtained in August in the present study, the proportion of copepods in his result is significantly low.

Some of previous works on seasonal changes of meiofaunal abundance show the presence of at least one maximum in summer (Tietjen, 1969; Stripp, 1969 a;

Scheibel, 1973; Juario, 1975). The maximum value obtained from the present study in August corresponds with such the summer peak observed in other seas.

After August, the number of nematodes gradually decreased, whilst harpacticoid population increased from September till November when harpacticoids shared

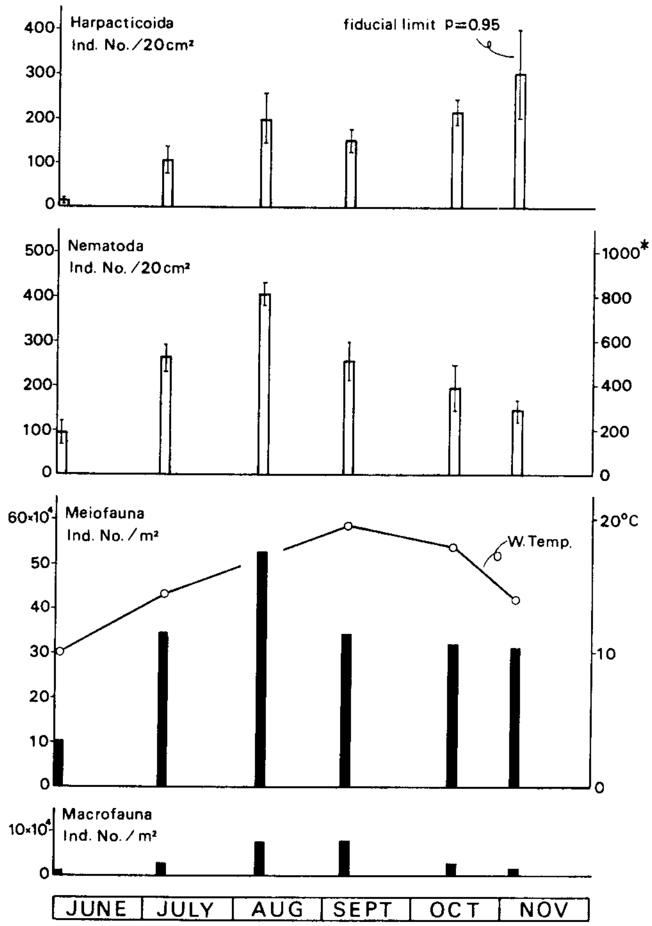

Fig. 3. Temporal fluctuations of individual numbers of Harpacticoida, Nematoda, total meiofauna, and total macrofauna.

about 49% of the total meiofauna. Due to this inverse correlation between nematodes and harpacticoids, decrease of the abundance of total meiofauna towards winter is slowed. The change of harpacticoid density found in the present study through six months is similar to that reported by Dinet (1972) who carried out a quantitative investigation of harpacticoids at Monasteriou near Marseille for more than one year.

As shown in Table 2, turbellarians occurred continuously during the six months, with a low peak in July. Kinorhynchs, acari, ostracods and benthic cyclopoids were also present in most months, though their numbers were always small.

Bivalves appeared in increased numbers during fall and early winter; most of them are larvae of *Mactra sinensis* Philippi *carneopicta* Pilsbry. In the Niantic and Pettaquamscutt estuaries in southeastern New England, Tietjen (1969) found significant peaks in abundance of bivalves in late summer and early fall.

The column 'others' in Table 2 includes polychaetes and archiannelids. They are of little significance in individual number.

3. *Macrofauna*. Macrofaunal abundance is shown in Fig. 3. Macrofauna which includes amphipods, polychaetes, tanaids, cumaceans, hydroids, and some of occasional animals, such as echinoid larvae, exhibits a low summer peak like in the meiofauna. Amphipods and polychaetes were continuously present every month. The maximum value for amphipods was obtained in August (mean, 10 ind. per core).

During July and August a total of eight individuals of a hydroid, *Euphysa* sp., were collected. Although the density is not high, they must participate a particular role as a predator in the meiofaunal community.

Summary

1. A quantitative study of meiofauna was carried out on a sandy bottom of a depth of 25 m off Oshoro in Ishikari Bay, Hokkaido, during a period from June to November in 1977. The total meiofaunal abundance varied between 103000 ind./m^2 in June and 525000 ind./m^2 which was the maximum value obtained in August.

2. Nematodes and harpacticoids constituted more than 95% of the meiofauna every month, and were most abundant in August and November, respectively.

References

Arlt, G. 1973 a. Vertical and horizontal microdistribution of the meiofauna in the Greifswalder Bodden. Oikos, Suppl. **15**: 105–111.

——— 1973 b. Jahreszeitliche Fluktuationen der Meiofauna im Greifswalder Bodden. Wiss. Z. Univ. Rostock **22**: 685–692.

Boucher, G. 1972. Distribution quantitative et qualitative des Nématodes d'une station de vase terrigène côtière de Banyuls-sur-Mer. Cah. Biol. Mar. **13**: 457–474.

Coull, B. C. 1970. Shallow water meiobenthos of the Bermuda platform. Oecologia (Berl.) **4**: 325–357.

——— and J. W. Fleeger 1977. Long-term temporal variation and community dynamics of meiobenthic copepods. Ecology **58**: 1136–1143.

Dinet, A. 1972. Étude écologique des variations quantitatives annuelles d'un peuplement de Copepodes Harpacticoïdes psammiques. Tethys **4**: 95–112.

——— 1973. Distribution quantitative du meiobenthos profond dans la région de la dorsale de Walvis (Sud-Ouest Africain). Mar. Biol. **20**: 20–26.

——— 1974. Données quantitatives sur le meiobenthos bathyal de La Mer de Norvège. Orgon **1**: 13–14.

Juario, J. V. 1975. Nematode species composition and seasonal fluctuation of a sublittoral meiofauna community in the German Bight. Veröff. Inst. Meeresforsch. Bremerh. **15**: 283–337.

Kikuchi, T. 1966. An ecological study on animal communities of the *Zostera marina* belt in Tomioka Bay, Amakusa, Kyushu. Publ. Amakusa mar. biol. Lab. **1**(1): 1–106.

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

——— 1969. The ecology of marine meiobenthos. Biol. Rev. **44**: 245–290.

——— 1971. Observations on the status of subtidal meiofauna research. In: Proceedings of the first international conference on meiofauna, ed. by N.C. Hulings. Smithson. Contr. Zool. **76**: 149–154.

——— and D. J. Murison 1973. The meiofauna of a flatfish nursery ground. J. mar. biol. Ass. U.K. **53**: 93–118.

Motoda, S. 1971. Oshoro Marine Biological Station, Hokkaido University, Japan. Bull. Plankton Soc. Japan **18**(1): 32–94. (In Japanese with English summary)

Scheibell, W. 1973. Quantitative-ökologische Untersuchungen am uferfernen Mesopsammon in der Kieler Bucht. Kiel. Meeresforsch. **29**(1): 58–68.

——— 1976. Quantitative Untersuchungen am Meiobenthos eines Profils unterschiedlicher Sedimente in der westlichen Ostsee. Helgoländer wiss. Meeresunters. **28**: 31–42.

——— and W. Noodt 1975. Population densities and characteristics of meiobenthos in different substrates in the Kiel Bay. Merentutkimuslait. Julk./Havsforskningsinst. Skr. **239**: 173–178.

Soyer, J. 1971. Bionomie benthique du plateau continental de la côte catalane française. V.-Densités et biomasses du méiobenthos. Vie Milieu, Sér. B. **22**: 351–424.

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

——— 1969 b. Das Verhältnis von Makrofauna und Meiofauna in den Sedimenten der Helgoländer Bucht. *Ibid.* **12**: 143–148.

Thomassin, B. A., M.-H. Vivier and P. Vitello 1976. Distribution de la méiofaune et de la macrofaune des sables coralliens de retenue d'eau épirécifale du Grand Récif de Tuléar (Madagascar). J. exp. mar. Biol. Ecol. **22**: 31–53.

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

Wieser, W. 1960. Benthic studies in Buzzards Bay. II. The meiofauna. Limnol. Oceanogr. **5**: 121–134.

Wigley, R. and A. D. McIntyre 1964. Some quantitative comparisons of off-shore meiobenthos and macrobenthos, south of Martha's Vineyard. *Ibid.* **9**: 485–493.