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MACROBENTHOS OF A SUBLITTORAL SANDBANK IN THE SOUTHERN BIGHT OF THE NORTH SEA

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(Figs. 1–3)

The benthic fauna of a linear sandbank, the Kwinte Bank, in the Belgian coastal waters of the North Sea was sampled on ten stations in September 1978. Density and species composition of the macrofauna and sediment characteristics have been studied. The Kwinte Bank shows a gradient from finer sediments in the south to coarser sediments in the north, resulting from the tidal current pattern in the region, and can be considered as a biogeographical island as the bank is surrounded by a region of much finer sediments.

The macrofauna consists of 73 identified species and has an average density of 4910 ind./m^2 and an average diversity of 2·5 bits/ind. Interstitial polychaetes predominate and among those *Hesionura augeneri* is the most abundant species. Two species groups can be distinguished and can be correlated with sediment characteristics. Both species number and density of the macrofauna increase with increasing grain size whereas diversity decreases due to the predominance of *H. augeneri* in coarser sediments.

The macrobenthic fauna of the Kwinte Bank is clearly related to the fauna of the open sea zone of the Southern Bight, in spite of the fact that the bank is situated in the transition zone between open and coastal waters.

INTRODUCTION

In the Southern Bight of the North Sea, off the Belgian coast, exists a series of parallel sublittoral sandbanks, the Flemish Banks, situated in a southwest–northeastern direction, 15–25 km long and 3–6 km wide. They are separated by channels, 4–6 km wide, and rise about 25 m above the surrounding sea-floor (Fig. 1). These sandbanks resulted from the accumulation of sandy deposits of glacial origin sedimented by the giant stream draining the waters from the present Rhine, Meuse, Scheldt and Thames before the Flandrian marine transgression about 12000 years ago. When from boreal times onwards the North Sea became slowly inundated, a connexion existed with the small English Channel which gradually enlarged, resulting in the very strong tidal currents which are responsible for the present geomorphology of the region.

The system of the Flemish Banks is to be considered as an island of coarser sediment in a region characterized by fine-grained and silty sediments (see Govaere *et al.* 1980 for a further description of the Southern Bight area). The benthic fauna of that region and of the sediments further off-shore has been the subject of ongoing research that is part of a comprehensive study initiated by the Belgian Government in 1970. Data have been published by Heip & Decraemer (1974), Jensen (1976), Govaere (1978), Heip *et al.*

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(1979), Govaere *et al.* (1980), Willems & Claeys (in the Press) and Vincx (1981). A large amount of unpublished data has been assembled in Government Reports (Van Damme & Heip, 1977; Govaere, Thielemans & De Boever, 1977; Vanosmael *et al.* 1979) and theses (Jensen, 1974; Degadt, 1976; Bisschop, 1977; Vanosmael, 1977; Govaere, 1978; Rappé, 1978; Van Steen, 1978; Claeys, 1979; Kerckhof, 1980).

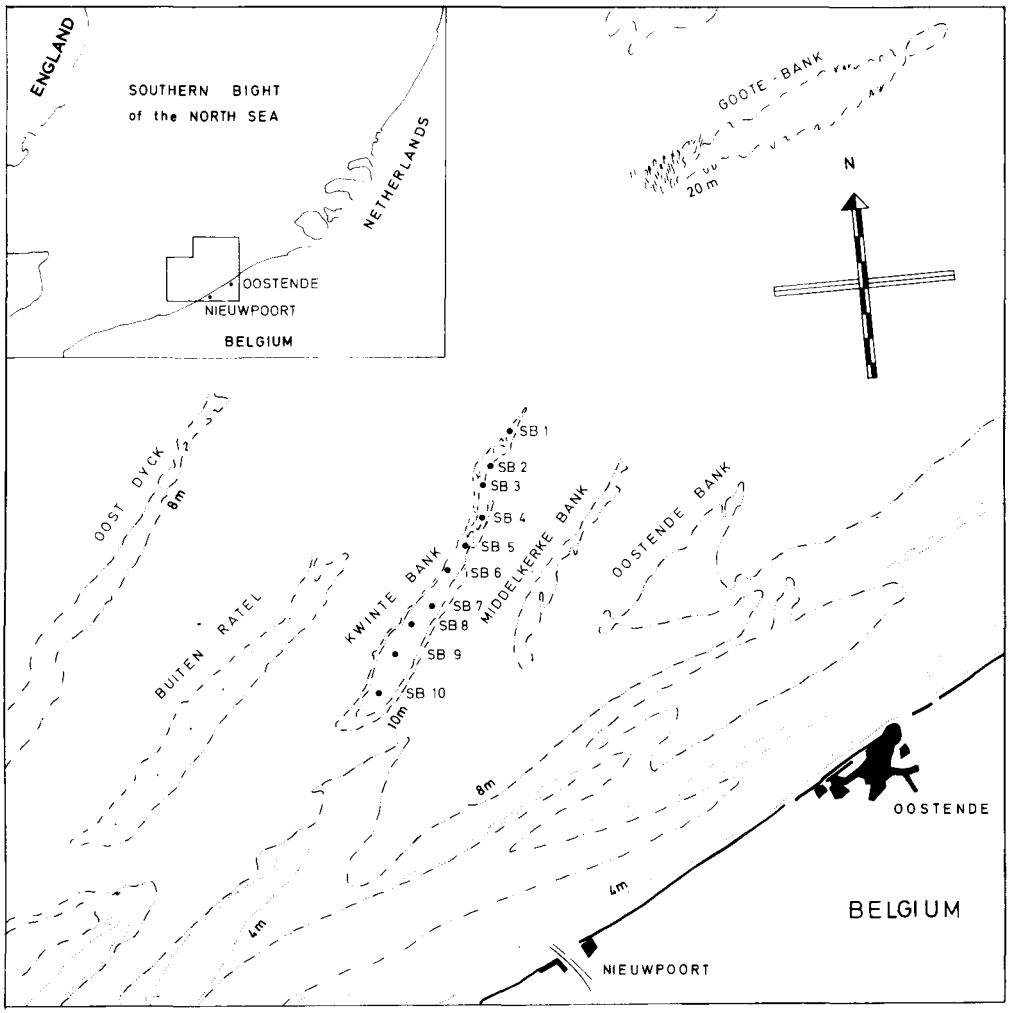


Fig. 1. Map of the study region.

In spite of this intense research, the sandbanks themselves had never been investigated until commercial interest in sand and gravel exploitation began. This made necessary an assessment of the impact of large-scale human interference through the exploitation of several million tons of sediment annually. Therefore, baseline data were collected from 1977 onwards. Apart from their use in management, these data are useful in an ecological context as the sandbanks are extremely interesting ecological habitats. They can be considered as islands and their fauna can be compared to that of the surrounding

region, which is well known. Furthermore, the sandbanks are stressed, high-energy environments in the sublittoral and subject to extreme physical disturbance through the very strong tidal currents.

This paper and two of Willems *et al.* (1982) are the first published reports on the fauna of one of the Flemish Banks. They present a comprehensive picture of the total benthic fauna of the Kwinte Bank in September 1978.

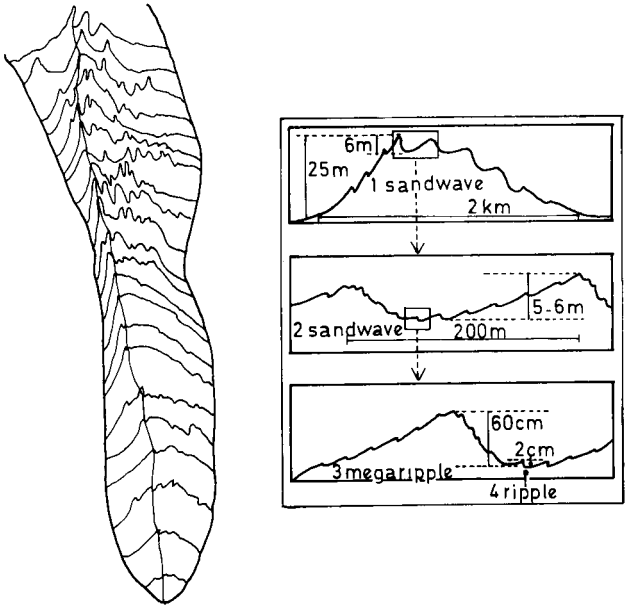


Fig. 2. Morphology of the Kwinte Bank. Longitudinal view and cross-sections on three different scales (after Bastin, 1974).

MATERIAL AND METHODS

Description of the study area

The Kwinte Bank is located about 12 km off the Belgian coast, between Nieuwpoort and Oostende (Fig. 1). It is bordered by two channels, the Kwinte on its western and the Negenvaam on its eastern side.

The following description is based on observations by Bastin (1974). In cross-section, the Kwinte Bank is asymmetric with a steep northwestern and a gentle southeastern slope. The upper sediment layer is characterized by sandwaves, megaripples and small sandripples, occurring on different scales (Fig. 2). The sandwaves are most developed in the northeastern part and reach an amplitude of up to 8 m. The top of these sandwaves as well as the megaripples and the small sandripples are continually broken down and rebuilt by strong currents, and this process is visible at the water surface by the appearance of suspended patches of sediment. Particularly during storms, the whole top of the sandbank is completely destroyed and rebuilt afterwards as a result of the current pattern typical for the sandbank system, which has been described by Houboult (1968) and Bastin (1974).

The sediment of the bank consists of fine to coarse sands and shows a gradient from fine sediments in the south to coarser sediments in the north. However, the distribution of the sediments can be very patchy locally. Many small patches, with a mixture of coarse sand and shell, occur on the slopes of the sandwaves and are due to strong erosion. The bottom of the depressions (−20 m) between the sandwaves of the northeastern part consists of finer sediments enriched with some mud, and they are characterized by an abundant fauna.

Sampling

Samples were collected on 5 September 1978 at ten stations (SB 1 to SB 10) covering the whole length of the sandbank (Fig. 1). The stations were located using a Decca Navigator; the coordinates are given in Table 1. Sampling was carried out by means of a Van Veen grab (0·1 m^2); samples were immediately fixed with 7 % formalin.

The fauna was elutriated in the laboratory using an adaptation of the Barnett technique used in meiofauna research. The samples are placed at the closed end of a horizontal trough (L 6 m, W 15 cm, H 15 cm) open at the other end and washed out with a water current over a 250 μm sieve. The heaviest organisms (molluscs) are left behind on the trough after elutriation and were picked out by hand. The use of a 250 μm sieve instead of the usual 0·5 or 1 mm sieves was decided after preliminary investigations had demonstrated the importance of interstitial polychaetes in the sandbank fauna. Three replicates were examined. All the animals in the replicates were identified and counted.

Approximately 20 g of homogenized substrate was used for grain size analysis of the sand fraction according to Buchanan & Kain (1971). The wet-sieved fraction smaller than 62 μm was used as a measure of mud content. The amount of organic material was determined by loss of weight on ignition at 550 °C.

Faunal affinities among the stations were examined by use of the Czekanowski qualitative similarity coefficient (Sørensen, 1948):

$$S = \frac{2a}{2a+b+c},$$

where a is the number of species present in both stations, b and c are the number of species presence in stations 1 and 2 only. The stations were clustered by flexible sorting ($\beta = -0{\cdot}25$) (Clifford & Stephenson, 1975) and arranged in an affinity dendrogram (Ordana program of Bloom, Santos & Field, 1977, as adapted by Govaere, 1978).

Species diversity was measured by the Brillouin index

$$H = \frac{1}{N}\log_2 \frac{N!}{N_1!N_2!\ldots N!_n}$$

proposed by Margalev (1958). Evenness $J = H/H_{max}$, where $H_{max} = \log_2 S$ was calculated after Pielou (1966).

RESULTS

Sediment analysis

Depth, grain size analysis and organic material content are given in Table 1.

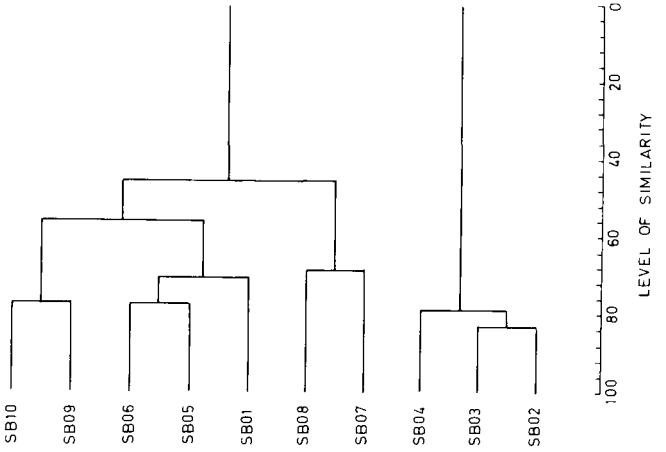
The median particle diameter of the sand fraction varies between 185 and 645 μm. According to the Wentworth scale (Buchanan & Kain, 1971) the stations can be arranged as follows: coarse sand, SB 3, SB 5; medium sand, SB 2, SB 4, SB 6; fine sand, SB 1, SB 7, SB 8, SB 9, and SB 10. All the sediments are very well sorted except for SB 3, which is well sorted. The mud content and organic material content are generally low (< 5%, except SB 2: 7·16%) and the gravel content varies between 0 and 11%.

Fauna

Densities (Table 2) of the macrofauna range from 500 ind./m^2 (SB 8) to 15330 ind/m^2 (SB 4). The mean value is 4910 ind./m^2. The lowest values are recorded in the fine-sediment stations, whereas higher values are found in the coarser deposits, mainly due to the large number of interstitial Polychaeta and Archiannelida. On the Kwinte Bank, Polychaeta are dominant and make up between 44% (SB 7) and 83% (SB 5) of the macrofauna. Only at SB 8 are they less important (28%); in this station Crustacea show

Table 1. *Coordinates and sediment characteristics of the ten stations on the Kwinte Bank*

Station	Coordinates		Depth	Median particle diameter		Sorting		Mud (%)	Gravel (%)	Organic
	N. lat.	E. long.	(m)	(ϕ)	(μm)	QD ϕ	Sk ϕ	< 63 μm	> 200 μm	matter (%)
SB 1	51° 20′ 30″	2° 41′ 40″	15·0	2·09	234	0·38	−0·19	1·61	6·84	3·94
SB 2	51° 19′ 45″	2° 41′ 00″	16·0	1·41	375	0·38	+0·25	0	10·62	7·16
SB 3	51° 19′ 20″	2° 40′ 45″	15·0	0·61	654	0·28	+0·07	0·30	3·42	3·51
SB 4	51° 18′ 40″	2° 40′ 45″	16·0	1·32	402	0·30	+0·02	0·05	1·13	1·81
SB 5	51° 18′ 00″	2° 40′ 10″	13·5	0·95	517	0·24	−0·11	0	0·24	2·92
SB 6	51° 17′ 30″	2° 39′ 30″	15·0	1·83	281	0·36	+0·25	0·14	2·21	1·69
SB 7	51° 16′ 42″	2° 38′ 57″	10·0	2·41	188	0·41	+0·37	0·12	0	4·64
SB 8	51° 16′ 20″	2° 38′ 15″	14·0	2·28	205	0·40	+0·36	0	0	1·00
SB 9	51° 15′ 35″	2° 37′ 35″	14·0	2·24	211	0·39	+0·32	0·15	0	1·99
SB 10	51° 14′ 48″	2° 37′ 08″	14·0	2·12	230	0·38	+0·33	0·26	0	1·39



	Group II	Group I
Median particle diameter (μm)	188–517	375–654
Mud < 63 μm (%)	0–1·61	0–0·30
Gravel > 2000 μm (%)	0–6·84	1·13–10·62
Density (N/0·1 m²; S.E.)		
Polychaeta	175 ± 46	757 ± 130
Archiannelida	29 ± 10	117 ± 24
Oligochaeta	9 ± 3	37 ± 16
Nemertinea	22 ± 4	35 ± 10
Mollusca	7 ± 5	66 ± 32
Crustacea	13 ± 3	2 ± 1
Echinodermata	0·1 + 0·1	29 ± 24
Total macrofauna	254 ± 55	1043 ± 165
Total species number		
Polychaeta	24	28
Archiannelida	4	4
Mollusca	8	12
Crustacea	16	10
Echinodermata	2	2

Species composition (relative dominance > 1 %)

	D (%)	*F* (%)	*FT* (%)		*D* (%)	*F* (%)	*FT* (%)
Hesionura augeneri	54·8	100	100	*Hesionura augeneri*	54·2	100	100
Protodriloides chaetifer	8·9	71	70	*Protodrilus* sp. A	10·2	100	90
Microphthalmus listensis	5·0	71	80	**Sphaerosyllis bulbosa*	7·7	100	30
Nephtys cirrosa	2·8	100	100	*Macrochaeta helgolandica*	4·7	100	60
Protodrilus sp. A	2·4	86	90	*Spisula* spp.	3·5	100	70
Spisula spp.	2·3	57	70	*Holothuroidea sp. A	2·8	67	20
Bathyporeia elegans	2·2	86	70	*Caecum glabrum*	2·1	33	20
Spio filicornis	1·4	100	100	*Glycera capitata*	1·3	100	70
Tanaissus lilljeborgi	1·3	86	70	*Microphthalmus listensis*	1·2	100	80
Ophelia borealis	1·2	100	90				

Fig. 3. Dendrogram resulting from clustering based on Czekanowski-index applied to macrobenthic species of ten stations of the Kwinte Bank; main sediment characteristics, density, species number and species composition according to the clusters; *D*, relative dominance (> 1 %), *F*, frequency within each group; *FT*, frequency based on all stations of the sandbank; species marked with an asterisk are exclusive for each group.

Table 2. *Density (N) and relative abundance (A) of macrofauna on ten stations*

Mean and standard error of three observations; +, < 1 individual.

	SB 1		SB 2		SB 3		SB 4		SB 5		SB 6	
	N	A	N	A	N	A	N	A	N	A	N	A
Polychaeta	230±99	69·3	542±55	72·1	682±329	80·7	1047±151	68·3	602±64	82·8	181±87	64·8
Archiannelida	18±14	5·5	160±58	21·3	104±34	12·3	87±28	5·7	68±14	9·4	31±11	11·1
Oligochaeta	26±13	7·7	16±8	2·1	15±3	1·8	80±42	5·2	20±6	2·8	15±3	5·3
Nemertinea	21±10	6·3	20±10	2·6	24±6	2·9	62±25	4·0	26±4	3·6	42±19	15·0
Mollusca	34±31	10·3	13±4	1·8	19±1	2·2	165±67	10·8	2±1	0·3	6±3	2·2
Crustacea	3±1	0·8	0	0	+	0·1	5±2	0·3	8±2	1·2	5±1	1·6
Echinodermata	+	0·1	+	0·1	0	0	86±69	5·6	0	0	+	0·1
Total	332±132		751±119		845±358		1533±60		727±94		280±69	

	SB 7		SB 8		SB 9		SB 10		Mean	
	N	A	A	A	N	A	N	A	N	A
Polychaeta	22±5	42·8	14±3	27·7	67±24	50·8	105±49	50·6	349±70	71·1
Archiannelida	+	1·9	0	0	27±19	20·4	61±46	29·5	56±12	11·4
Oligochaeta	0	0	+	0·6	+	0·5	+	0·3	17±6	3·5
Nemertinea	8±0·3	15·9	4±2	7·4	23±5	17·8	27±15	12·9	26±4	5·3
Mollusca	+	1·9	0	0	2±1	1·2	+	0·5	24±11	4·9
Crustacea	10±6	37·4	32±7	64·3	12±4	9·4	13±6	6·1	10±2	2·0
Echinodermata	0	0	0	0	0	0	0	0	9±7	1·8
Total	52±8		50±9		131±41		207±104		411±91	

a relative abundance of 64%. The high density of macrobenthic organisms in station SB 4 is striking. Not only Polychaeta are well represented (10470 ind./m²); Nemertinea (620 ind./m²), Mollusca (1650 ind./m²) and Echinodermata (860 ind./m²) are abundant in comparison with the other stations.

Table 3. *Diversity, evenness and number of species in ten stations of the Kwinte Bank*

	Macrofauna			Polychaeta		
	H	J′	S	H	J′	S
SB_1	2·02	0·95	29	0·95	0·26	15
SB_2	2·28	1·44	29	1·44	0·35	19
SB_3	2·10	1·33	34	1·33	0·31	22
SB_4	2·61	1·37	42	1·37	0·32	21
SB_5	1·55	0·65	25	0·65	0·19	12
SB_6	3·16	2·21	27	2·21	0·74	10
SB_7	3·28	2·69	24	2·69	0·93	12
SB_8	2·53	1·83	16	1·83	0·95	8
SB_9	2·05	2·02	24	2·02	0·65	11
SB_{10}	2·43	1·22	20	1·22	0·38	11

In this study, 37 species of Polychaeta, 4 species of Archiannelida, 12 species of Mollusca, 17 species of Crustacea and 3 species of Echinodermata have been found (Table 3). Complete species lists including relative abundance per station are available on request.

In all stations *Hesionura augeneri* is the most dominant species, representing almost 55% of the macrofauna. In stations SB 1, SB 2, SB 3, SB 4 and SB 5 this species reaches numbers of 2000 (SB 1) to 7700 (SB 4) ind./m², whereas in the southern area it is less abundant: between 20 (SB 8) and 790 (SB 10) ind./m²). Other dominant species on the Kwinte Bank are, in descending order: *Protodrilus* sp., Nemertinea spp., Oligochaeta spp., *Protodriloides chaetifer*, *Macrochaeta helgolandica*, *Spisula* spp., *Microphthalmus listensis*, *Glycera capitata*, *Nephtys cirrosa*, *Bathyporeia elegans*, *Polygordius appendiculatus*, *Spio filicornis*, *Tanaissus lilljeborgi* and *Ophelia borealis*.

Fig. 3. represents the dendrogram resulting from the normal (Q) analysis, applied to all stations using all species except the Oligochaeta, Nemertinea and those recorded in one station only (with a frequency of 10%). Two major station groups can be distinguished. Group I contains three stations, SB 2, SB 3 and SB 4 (coarse to medium sand); group II contains the other stations, SB 1, SB 5, SB 6, SB 7, SB 8, SB 9 and SB 10. These stations, except SB 5 and SB 6, are characterized by fine sand. The same groupings are obtained using Polychaeta only. Group I includes 53 species and group II has 48 species. In group I 14 species out of 28 Polychaeta, 6 species of 11 Mollusca and 3 species out of 8 Crustacea are restricted to this group.

The dominant species in group I are: *Hesionura augeneri*, *Protodrilus* sp. A, *Sphaerosyllis bulbosa*, *Macrochaeta helgolandica*, *Spisula* spp., Holothuroidea sp. A, *Caecum glabrum*, *Glycera capitata* and *Microphthalmus listensis* (Fig. 3). The species restricted to this group and occurring in all the stations are : *Sphaerosyllis bulbosa*, *S. hystrix*, *Protodorvillea kefersteini*, *Ophryotrocha gracilis*, *Aonides paucibranchiata* and *Polycirrus medusa*.

In group II 9 species out of 23 Polychaeta, 1 species out of 6 Mollusca and 9 species out of 14 Crustacea are restricted to that group. Species which are dominant: *Hesionura augeneri*, *Protodriloides chaetifer*, *Microphthalmus listensis*, *Nephtys cirrosa*, *Protodrilus* sp. *A*, *Spisula* spp., *Bathyporeia elegans*, *Spio filicornis*, *Tanaissus lilljeborgi* and *Ophelia borealis* (Fig. 3). Species exclusive to group II and occurring with high frequency (> 70%) are *Spiophanes bombyx* and *Scolelepis bonnieri*. The increasing importance of Crustacea in group II is remarkable ($\bar{N}_{I}$ = 20 ind./,^{2} and $\bar{N}_{II}$ = 131 ind./m^2).

Many of the commoner species show significant differences in density between the clusters, as determined by the Wilcoxon's U-test (Siegel, 1956). The exceptions are the *Microphthalmus* spp., *Nephtys longosetosa*, *Scoloplos armiger*, *Scolelepis bonnieri* and *Ophelia borealis* among the polychaetes, *Protodriloides chaetifer* among the archiannelids, *Caecum glabrum* and *Abra alba* among the molluscs, *Pseudocuma longicornis*, *Tanaissus lilljeborgi* and *Megaluropus agilis* among the crustaceans.

Diversity of the macrofauna is on average significantly higher in the northern part of the sandbank. Diversity is low at stations SB 1, SB 2, SB 3, SB 4, SB 5 and SB 10 and this can be explained by the dominance of *Hesionura augeneri*. In station SB 8 *Bathyporeia elegans* is dominant.

DISCUSSION

Density

There is little published information on macrobenthos from offshore sandy bottoms, particularly sandbanks (Tyler & Shackley, 1980). Densities of macrofauna from the Kwinte Bank (10400 ind./m^2 in group I and 2400 ind./m^2 in group II) are generally high. McIntyre (1978) summarized data from sublittoral sediments: between 824 and 1007 ind./m^2 for fine sandy substrates, between 640 and 1557 ind./m^2 for coarse sands and 926 ind./m^2 for gravel. Dicks (1976) found 2719 ind./m^2 for Ekofisk in the western North Sea, Rachor & Gerlach (1978) recorded 2716–13176 ind./m^2 for September–October samples of the German Bight over several years. Older values are much lower: Hagmeier (1923) recorded 116 ind./m^2 in the German Bight and 173 ind./m^2 in the N. Borkum and NNW Ems estuary. Blegvad (1922) found 90 ind./m^2 in the southern North Sea; Petersen (1918) recorded 284 ind./m^2 in the Kattegat; and Stripp (1969) found between 315 ind./m^2 (coarse sand) and 690 ind./m^2 (medium sand) in the Helgolander Bight.

An intensive study of the Southern Bight of the North Sea was made by Govaere (1978) and Govaere *et al.* (1980). Three major zones were distinguished based on macrofaunal differences: an open sea zone, a transition zone and a coastal zone. Macrofaunal densities found in the open sea zone (2072 ind./m^2) and transition zone (1613 ind./m^2) are lower than those found in the Kwinte Bank, which is geographically located in the transition zone, but has a sediment similar to the open sea zone.

Comparison of densities found in the Kwinte Bank with those recorded in literature is difficult because we have used a sieve with a small mesh size (250 μm). Small organisms such as interstitial polychaetes will be retained by our sieve, which was especially chosen as interstitial polychaetes proved to be very important in the sandbank system.

Species composition

Difficulties arise also in comparing the composition of the macrofauna of the Kwinte Bank with that of similar biotopes, for the reasons mentioned above. Interstitial polychaetes are generally not recorded or they are considered to belong to the meiofauna, although species such as *Hesionura augeneri* may easily attain a length of 1 cm. The segregation in two station groups is partially due to the larger number of interstitial polychaete species in group I and partially to Mollusca (more abundant in group I) and Crustacea (more abundant in group II).

The numerically dominant species in the open sea zone, adjacent to the Kwinte Bank, are in descending order: *Spiophanes bombyx* (constituting more than 50% of the total fauna), *Hesionura augeneri*, *Nephtys cirrosa*, *Eteone longa*, *Bathyporeia guilliamsoniana*, *Echinocardium cordatum*, *Scolelepis bonnieri*, *Glycera capitata*, *Anaitides subulifera*, *Spisula elliptica* and *Echinocyamus pussilus* (Govaere *et al.* 1980). Species found exclusively in the open sea zone are: *Anaitides subulifera*, *Ophiura affinis*, *Tellina pygmaea*, *Echinocyamus pusillus*, *Branchiostoma lanceolatum*, *Exogone hebes*, *Macrochaeta helgolandica* and *Streptosyllis arenae*. Of these only *Branchiostoma lanceolatum* and *Exogone hebes* were not found on the Kwinte Bank in this or previous studies (unpublished). Govaere *et al.* (1980) note *Ophelia borealis* as one of the dominant species of the transition zone, but they also found it in the open sea zone. On the Kwinte Bank *O. borealis* is found 90% of all stations but with rather low densities.

The macrofauna of the Kwinte Bank thus resembles that of the open sea zone of the Southern Bight. This is also reflected in the number of species, which is 23 sp./m^2 for the open sea and 14 sp./m^2 for the transition zone, whereas it is 34 sp./m^2 for group I and 23 sp./m^2 for group II of the Kwinte Bank. Species number is thus nearly identical in group II and the open sea zone, which are also very similar in sediment composition. The Kwinte Bank can therefore be considered as a biogeographical island in the transition zone.

The species composition of the Kwinte Bank is roughly comparable to the 'boreal off-shore sand association' described by Petersen (1914), and also partially to the 'boreal off-shore gravel association' of Jones (1950). As has been indicated by Govaere (1978) for the communities of the Southern Bight, such an association of species is often better characterized by less frequent species than by dominant ones, and the interstitial polychaetes and archiannelids, especially, seem to be very characteristic of the communities described by Petersen (1914) and Jones (1950). In this study we can report *Hesionura augeneri*, *Microphthalmus similis*, *M. listensis*, *Streptosyllis arenae*, *S. websteri*, *Sphaerosyllis bulbosa*, *S. hystrix*, *Protodorvillea kefersteini*, *Ophryotrocha gracilis* and *Macrochaeta helgolandica*. These species are only rarely recorded in ecological studies.

Hesionura augeneri is the most common interstitial polychaete on the Kwinte Bank, where it represents almost 55% of the macrofauna. It occurs in the highest densities in the coarsest sediments (between 4000 ind./m^2 in SB 2 and 7880 in./m^2 in SB 4) but it also inhabits fine sands (between 20 ind./m^2 in SB 8 and 1980 ind./m^2 in SB 1). Two other interstitial polychaetes are also very common: *Sphaerosyllis bulbosa* is restricted to group I where it occurs with high densities in SB 2 (220 ind./m^2), SB 3 (470 ind./m^2) and SB 4 (1717 ind./m^2), *Microphthalmus listensis* occurs over the whole bank but with a

preference for fine and medium sands; a maximum of 330 ind./m² was found in SB 9.

Nephtys cirrosa is found in all stations with a maximum of 120 ind./m² at SB 6. This species prefers fine and medium sand. It has been found by Tyler & Shackley (1980) to be one of the few macrofauna species on a sandbank in Swansea Bay. Many authors (Clark & Haderlie, 1960; Gibbs, 1969; Clark, Alder & McIntyre, 1962; Amoureux, 1968; Hamond, 1966; Wolff, 1973; Kirkegaard, 1969) mention a strong influence of the sediment type on the distribution of the genus *Nephtys*. Although very similar in appearance, *Nephtys cirrosa* and *N. hombergii* appear to occupy distinct and separate habitats (Clark & Haderlie, 1960). The first species is found in clean sand, whereas the second is more frequent in fine deposits. Indeed, *N. hombergii* has never been recorded on the ridge of the Kwinte Bank, either in this study or in previously taken samples. It is only found in grabs from the surrounding channels where silt is present (unpublished results). *Nephtys cirrosa* seems to prefer a high-energy environment, as opposed to *N. hombergii*, which was also observed by Hamond (1966). Alheit (1978) also mentions oxygen supply correlated with high energy and salinity as important factors determining the distribution of *Nephtys* species in the North Sea.

Other polychaetes are the widespread species *Glycera capitata*, with highest densities in the coarser deposits (between 100 and 210 ind./m²); *Spio filicornis*, in all stations but with low densities (between 10 and 90 ind./m²). *Macrochaeta helgolandica*, first reported from the Southern Bight by Govaere (1978), reaches highest densities in medium and coarse sands (between 300 and 710 ind./m²) but also in the fine sand stations of group II (between 3 and 100 ind./m²).

Three important species of Archiannelida are recorded: *Polygordius appendiculatus*, *Protodriloides chaetifer* and a species of the genus *Protodrilus*. On the Kwinte Bank *P. appendiculatus* shows a preference for coarse and medium sands (group I) and its highest densities are recorded from SB 2 (130 ind./m²) and SB 4 (120 ind./m²). *Protodriloides chaetifer* reaches densities of 560 ind./m² (SB 5 and SB 10) and occurs in fine medium and coarse sands.

The mollusc *Spisula elliptica* is common in muddy sand, muddy gravel, fine sand and shell gravel, whereas *Spisula solida* prefers sandy bottoms (Tebble, 1966). On the Kwinte Bank *Spisula solida* is indeed more abundant than *S. elliptica* and the highest densities are recorded from SB 3 (97 ind./m²) and SB 4 (53 ind./m²).

Within the Crustacea, *Tanaissus lilljeborgi* and *Bathyporeia elegans* are the most common species on the Kwinte Bank. They both show a preference for fine sand. The highest densities are found in station SB 7 and SB 8 with values of 60 ind./m² and 80 ind./m² for *T. lilljeborgi* and 100 ind./m² and 190 ind./m² for *B. elegans* respectively.

It is characteristic of the sandbank system that sessile, tube-building polychaetes are represented by a small number of individuals only, whereas the dominant forms are mobile and quickly burrowing organisms such as *Hesionura*, *Microphthalmus* and *Nephtys* which are able to withstand the sometimes extreme physical disturbance of the sediment caused by the strong tidal currents. Withers & Thorp (1978) have already pointed out that the ability of small crustaceans and polychaetes to re-enter the sediment rapidly after having been washed out is of great importance for their persistence in the system.

Species diversity

Govaere *et al.* (1980) found mean diversity values of 3·28 bits/ind. for the open sea and 2·58 bits/ind. for the transition zone. Mean diversity of the macrofauna on the Kwinte Bank in September 1978 was 2·50 bits/ind., which is lower than diversity in the open sea zone, even more so when considering that diversity is near maximum during that month and that Govaere *et al.* (1980) used a larger mesh-width. Although the Kwinte Bank has a fauna which is essentially comparable to that of the open sea zone, the more stressed nature of the habitat is clearly reflected in a lower diversity of the community.

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