The ecology of sandy beaches in Natal

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Data from an ecological survey of four sandy beaches on the Natal coast of South Africa are presented. Physical parameters such as beach profile, particle size, moisture, Eh and carbonate content, as well as abundance, composition, biomass and distribution of both macrofauna and meiofauna were investigated. A survey of the surf and swash zone mysids was also made. Natal beaches may be divided into two general types: (i) moderately exposed beaches of medium sand north of Blythdale with diverse meiofauna and typical sand beach macrofauna communities, and (ii) very exposed beaches of coarse sand south of Blythdale with true intertidal macrofauna often absent and a meiofauna dominated by large archiannelids.

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'n Studie van vier sandstrande aan die Natalse kus is gemaak. Aspekte wat ondersoek is, sluit o.a. die volgende fisiese eienskappe in: strandprofiel, sandkorrelgrootte, voginhoud, Eh en karbonaatinhoud. 'n Studie is ook gemaak van die bevolkingsgetalle, samestelling, biomassa en verspreiding van die makro- en meiofauna, asook van die brander- en spoelsone Mysidacea. Natalse strande kan in twee hooftipes verdeel word, nl., beskutte en onbeskutte strande. Eersgenoemde word gekenmerk deur 'n middelmatige sandkorrelgrootte met 'n verskeidenheid meiofauna en tipiese sandstrand makrofauna. Hierdie strande word hoofsaaklik noord van Blythdale aangetref. Die onbeskutte strande kom suid van Blythdale voor en word gekenmerk deur 'n growwe sandkorrelgrootte, asook die afwesigheid van tussengety makrofauna. Die meiofauna-gemeenskappe bestaan hoofsaaklik uit groot Archiannelida.

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Relatively little work of a synecological nature has been done on South African beaches. The most notable works are those of Day (1959) on Langebaan lagoon, Brown (1971a, b) and Brown & Talbot (1972) on the Cape Peninsula beaches. MacNae & Kalk (1958) provide species lists for sandy beach macrofauna from Inhaca Island, Mozambique. More recently work on the beaches of Algoa Bay has been published (McLachlan 1977a, b, c), these studies being the first to include both macro- and meiofaunal components. Meiofauna are regarded as being both qualitatively and quantitatively significant on sandy beaches (McLachlan 1977c) and ecological studies of such systems should take this into account. Some work has also been done on the chemistry, pollution and meiofauna of Natal beaches (Oliff, Berrisford, Turner & Ballard 1967). In view of the paucity of information regarding the composition, distribution and abundance of macro- and meiofauna on south and east coast beaches, it was decided to undertake a survey of selected beaches from northern Natal to Cape Agulhas. This was intended to provide baseline data but not to investigate seasonal changes, as such changes have been shown to be small in the East Cape. The survey would also provide necessary comparative data for work recently completed in the East Cape. This paper reports on four beaches in Natal as well as giving general information on two other beaches.

Methods

Sampling areas

Samples were taken in December 1978 from four beaches in Natal, chosen to give as wide a coverage of the coast as possible (Figure 1). The beaches were at Sodwana Bay (32°44′25″E/27°25′45″S), St. Lucia, just north of the estuary(32°25′45″E/28°15′35″S),Blythdale (31°16′20″E/29°16′25″S) and Kelso, south of Durban (30°40′30″E/30°16′30″S). On average these beaches are separated by 100 km of coastline.

Physical and chemical features

Beach profiles were obtained according to Day (1969) from the foredunes out into the surf. Along each transect measurements of physical parameters were made at HWST, MW and LWST. Such measurements included temperature (thermistor), Eh (platinum and calomel electrodes), salinity (refractometer) and moisture (Speedy

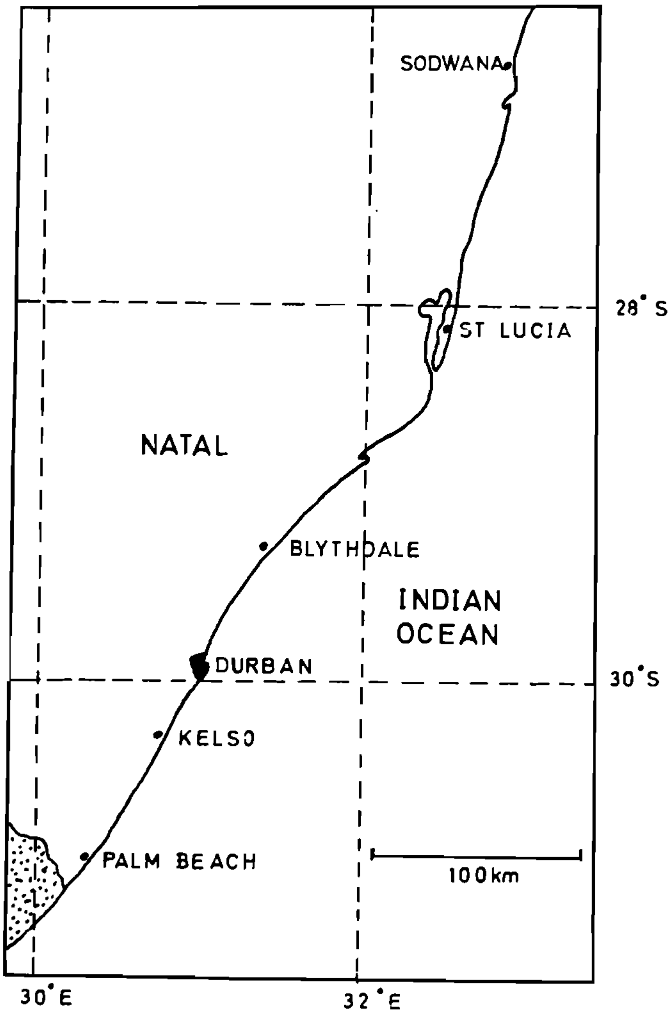

Figure 1 Map of the Natal coast showing the location of the beaches visited.

Moisture Tester: Thomas Ashworth, England). Apart from Eh and salinity, measurements were made at 30 cm intervals from the sand surface to the low-tide water table at each tidal level. Eh and salinity were measured only at the surface and at the water-table depth. In addition, samples of sand were taken for substrate analysis from the top 30 cm at each level. The analyses were done by wet sieving through 0,5-phi interval sieves (Morgans 1956, Hulings & Gray 1971). A quantity of sand was acid-treated (conc. HCl) to determine carbonate content.

Macrofauna

Surveys of macrofauna were undertaken at a number of points (5 – 7) along the transect at each beach (Figures 2 – 5). Sampling was done with a net or dredge (1,5-mm mesh) while 1 – 2 m^2 was sampled at points by digging 0,25-m^2 quadrats to a depth of 25 cm and passing the sand through a 4-mm sieve. The number of samples varied between three and four per transect, depending on beach slope. All samples were fixed in 10% formaldehyde pending laboratory identification. Dry mass was determined by drying at 90 °C for 24 h. In the case of molluscs the shells were first removed.

Bentho-planktonic mysids were collected with a sledge which skims off and filters the surface layer (0,5 cm) of sand. A full description of the apparatus is given in Wooldridge (In press). Sampling was carried out along a transect perpendicular to the water line and starting at the lowest level of the swash. Along each transect a series of consecutive 10-m tows were made. The number of tows varied between one and three and was dependent on beach slope and the degree of wave turbulence. On very coarse beaches (Blythdale and Kelso) it was not possible to operate the sledge and a rectangular sieve (500 mm ×

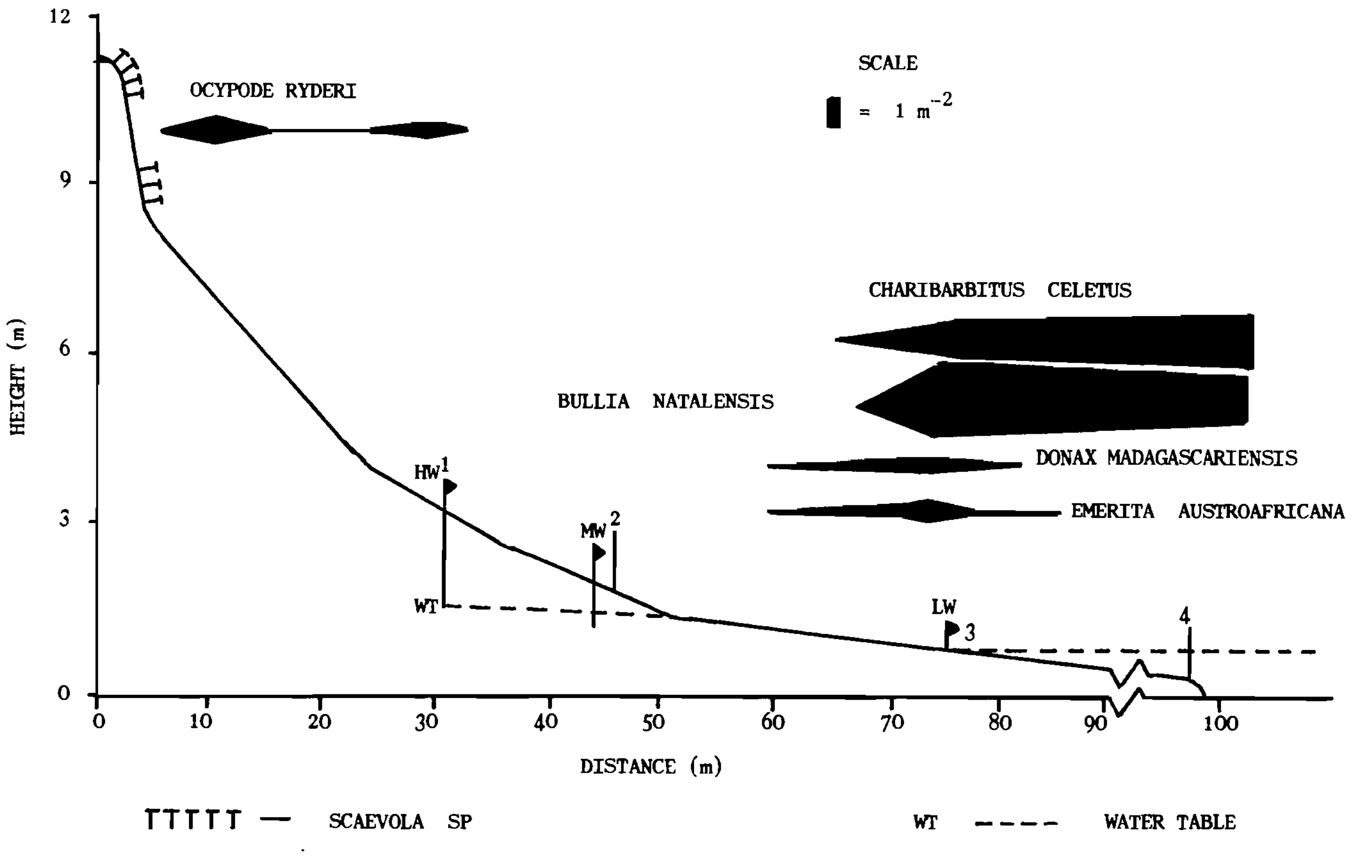

Figure 2 Beach profile at Sodwana Bay sampling area showing the meiofauna sampling sites and the distribution of the macrofauna.

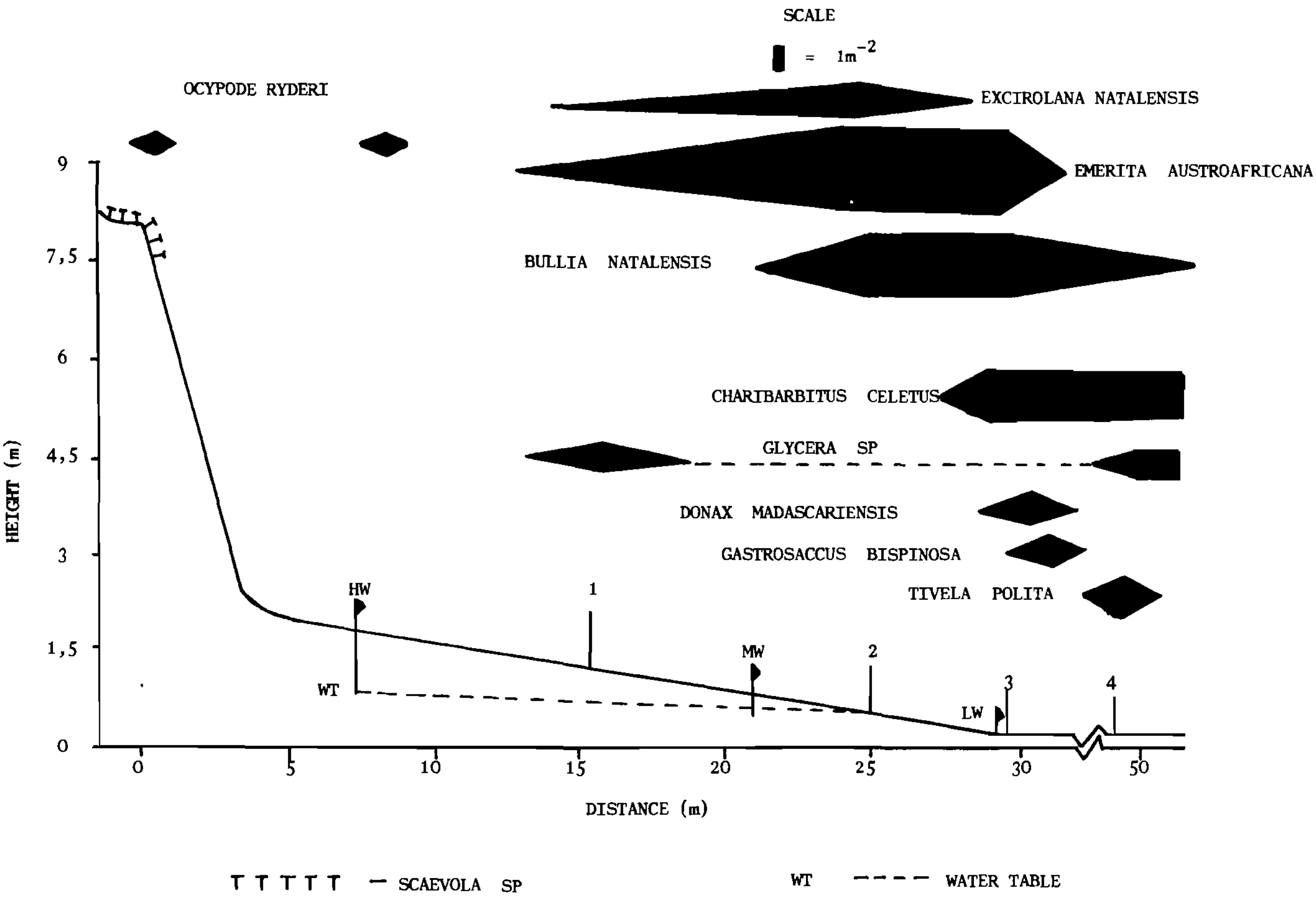

Figure 3 Beach profile at St Lucia sampling area showing the meiofauna sampling sites and the distribution of the macrofauna.

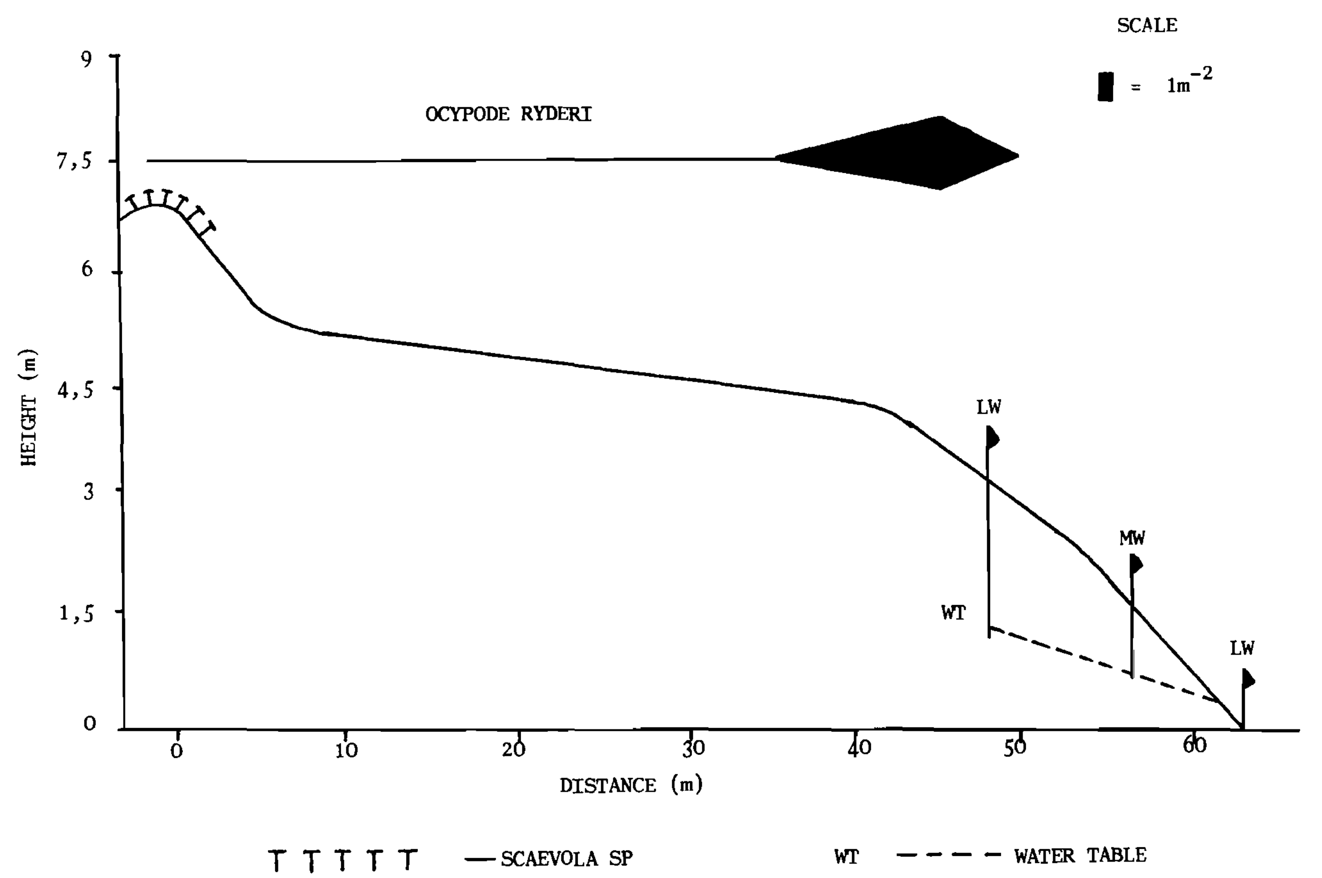

Figure 4 Beach profile at Blythdale showing the meiofauna sampling sites and the distribution of the macrofauna.

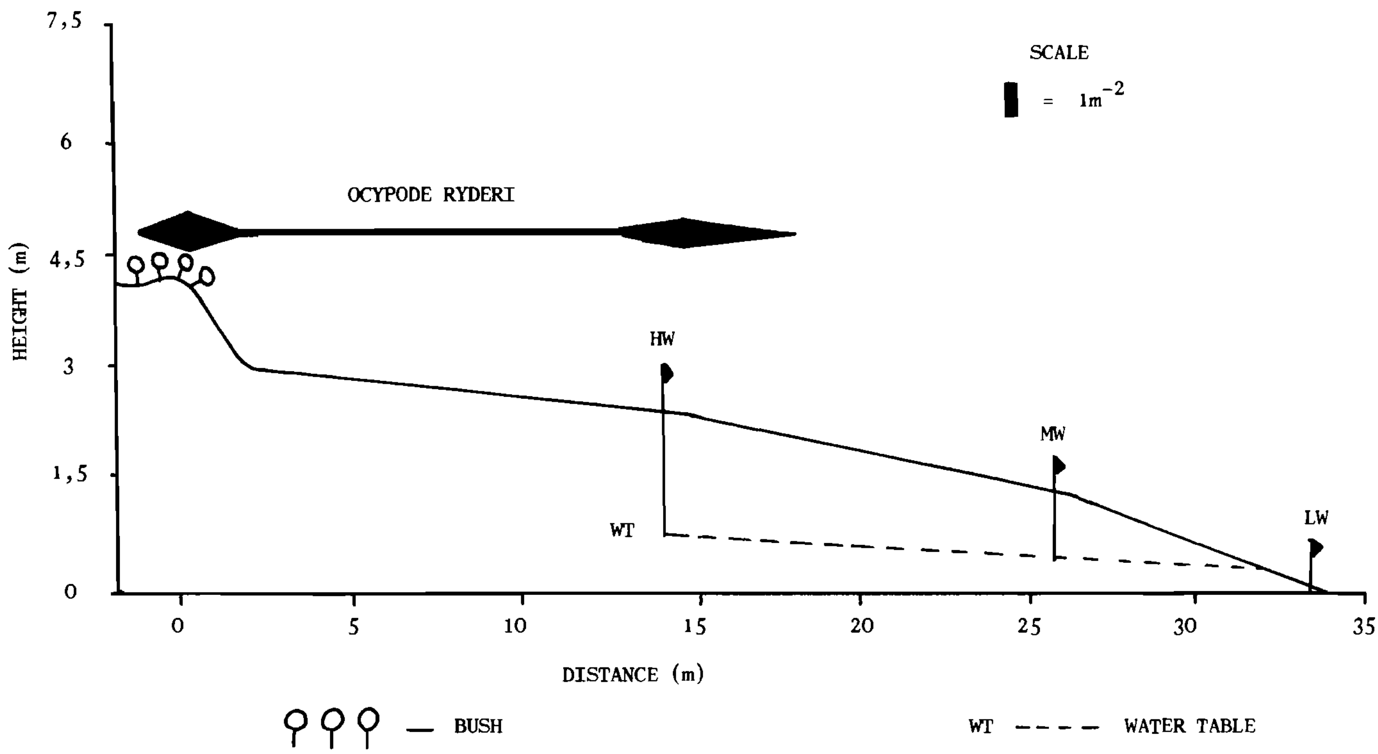

Figure 5 Beach profile at Kelso showing the meiofauna sampling sites and the distribution of the macrofauna.

250 mm, aperture size 1,5 mm) was used instead. Animals collected were preserved in 5% formaldehyde.

In the laboratory mysids were examined under a stereomicroscope fitted with an eye-micrometer. Animals were measured (anterior tip of the carapace to posterior tip of telson, excluding spines) and separated into six breeding classes (Wooldridge In press). Between 50 and 60 individuals of known length were oven-dried at 60 °C to constant mass, weighed on a Sartorius electronic microbalance and the length/mass regression equations calculated.

Meiofauna

Meiofauna was collected from three tidal levels where physical and chemical parameters were measured. Sampling was done by means of a hand-held copper corer 30 cm in length and 10 cm^2 in internal cross-sectional area. Four replicate samples were taken every 30 cm and down to about 30 cm below the low-tide water table. Each 30-cm section was cut into two 15-cm pieces and kept in glass jars prior to extraction. At Blythdale and Kelso the 30-cm sections were retained whole due to the great depth of the water table (2 – 3 m). 100 ml of a 7% $MgSO_4$ solution was added to relax the animals. A further 100 ml of 0,025% Rose Bengal solution in 10% buffered formaldehyde was added after 10 min to kill and stain the animals. Extraction was done by decantation and sieving through a 0,45-μm sieve. After four decants animals were stored in 80-ml plastic bottles for counting in the laboratory. Initial testing of the extraction procedure was done by plotting the number of animals extracted after each decanting against the number of decants and examining the remaining sand. It was found that less than 5% of the total number of animals extracted remained in the sand after four decants. Dry mass was determined by drying a number of specimens on preweighed cover-slips at 60 °C for 24 h and weighing to the nearest 1 μg on a microbalance.

Results

Figures 2 – 5 show beach profiles of the areas studied as well as positions of the meio- and macrofauna sampling sites and water-table depths. At Sodwana Bay the beach was concave with an average intertidal gradient of 1:18. The steepest part of the beach, between MW and HW, had a gradient of 1:10. HW (the high-tide swash line) was approximately 2,3 m above LW (the low-tide swash line). The fore-dunes above HW were vegetated with *Scaevola thunbergii*.

The beach at St Lucia was also concave but sloped more evenly with a gradient of 1:14. Above HW a series of *Scaevola*-covered fore-dunes about 8 m high were backed by high forested dunes. On this beach HW was 2 m above LW.

In contrast, the beaches closer to Durban were steep with coarse substrates. At Blythdale the intertidal area was narrow with a gradient of 1:5 and HW was 3 m above LW. Above HW the beach flattened and a gradient of 1:80 was measured. The fore-dunes rose to about 7 m above LW and were capped by *Scaevola thunbergii*. Further inland low forested dunes were present.

At Kelso, south of Durban, the beach was of coarse sand with an intertidal gradient of 1:8. Open fore-dunes were absent while the dunes behind were vegetated with bush.

The intertidal distances were 48 m; 25 m; 15 m and 20 m at Sodwana, St Lucia, Blythdale and Kelso respectively. Exposure to wave action is such that the northern beaches (Sodwana and St Lucia) were classified as 'exposed' and both rated 14 on a scale of 20 points

(McLachlan 1980). The southern beaches (Blythdale and Kelso) were classified as very exposed and both rated 17,5.

Substrate analysis at each of the four beaches and the percentages of carbonate determined by acidification are given in Table 1. At Sodwana Bay the higher tidal levels were composed of medium to fine sand which was fairly well sorted. At LW, however, the median particle size increased and fell within the range of coarse sand (Morgans 1956). The sand was poorly sorted but the low skewness values indicated no preferential sorting of sizes. A similar pattern was evident at St Lucia, except that medium sand also occurred at LW, and the substrate was well sorted.

In contrast, the substrate at Blythdale was coarse and the median particle size increased from 600 μm at HW to 1050 μm at LW. Low quartile deviations and skewness values, however, indicate good sorting. Similarly, at Kelso beach, particle size was coarse and increased from 890 μm at HW to 1140 μm at LW. The substrate at LW was poorly sorted and a negative skewness value indicates that there was better sorting of particles smaller than the median. North Natal beaches contain approximately six times more carbonate than the southern beaches. At Sodwana Bay the sand was 10,2% carbonate while only 1,1% carbonate was present at Blythdale.

Table 2 gives the profiles of various physical and chemical parameters on each beach. The profiles of temperature and moisture are largely subject to prevailing weather conditions. At Sodwana and St Lucia the weather was fine, and temperatures at the surface at HW were about 35 °C. There was a rapid decrease with depth and at 90 cm the temperature was 25 °C. At Blythdale and Kelso, however, the weather was overcast and surface temperatures were just over 22 °C and remained fairly constant with depth. All the areas studied were highly oxidized as indicated by the high Eh values. The lowest recorded value was +280 mV, indicating good oxygenation even at a depth of 190 cm at HW on both Blythdale and Kelso beaches.

Macrofauna

Figures 2 – 5 show intertidal distribution of macrofauna on each beach. There is a considerable difference between the northern and southern beach faunas. On the former, 11 species were recorded (Figures 2 & 3) and include the mysid *Gastrosaccus bispinosa*, the mole crab *Emerita austroafricana*, the plough shell *Bullia natalensis*, the wedge clam *Donax madagascariensis* and the teleost *Charibarbitus celetus*. The ghost crab, *Ocypode ryderi* was present on all beaches and its burrows extended from HW into the vegetated dunes.

Although three species, *Ocypode ryderi, O. ceratopthalmus* and *O. madagascariensis* occur along this coast (Berry, pers. comm.) only the first was collected on the open beaches studied. On the south coast no macrofauna was found below HW and only *O. ryderi* occurred supralittorally. Table 3 lists macrofauna abundance and biomass values for the four beaches. This shows a greater number of species on the northern beaches. Five and nine species were recorded at Sodwana and St Lucia respectively while on the southern beaches only one species, *O. ryderi*, was present. Highest macrofauna biomass occurred at Sodwana (86,9 g dry mass m-strip^{-1}), and was largely due to ghost crabs. At St Lucia biomass was only 10% of this value.

No mysids were recorded at Blythdale or Kelso, probably as a result of the coarse substrate (Brown & Talbot 1972). Similarly, coarse substrate at Sodwana Bay head-

Table 1 Substrate analysis of sand from high water (HW), mid water (MW) and low water (LW) on four Natal beaches. All data in phi-units except where otherwise indicated. Also given is the percentage carbonate at MW on each beach

Beach and tidal level		Mdϕ	Qdϕ	Skqϕ	Mz	σI	sk	Carbonate %
Sodwana Bay	HW	1,80	0,275	0,025	1,84	0,395	0,130	–
	MW	1,75	0,290	0,060	1,77	0,452	−0,220	10,23
	LW	0,70	0,853	−0,050	0,49	0,995	−0,080	–
Beach mean	(μm)	400			431			
St Lucia	HW	2,00	0,310	0,040	2,04	0,412	0,190	–
	MW	1,73	0,310	0,015	1,72	0,490	−0,018	9,89
	LW	1,80	0,300	0,000	1,78	0,510	−0,091	–
Beach mean	(μm)	289			279			
Blythdale	HW	0,54	0,340	−0,005	0,53	0,490	−0,015	–
	MW	0,25	0,325	0,025	0,29	0,490	0,090	1,11
	LW	−0,10	0,140	0,015	−0,07	0,340	−0,160	–
Beach mean	(μm)	864			876			
Kelso	HW	0,18	0,395	0,125	0,33	0,633	0,350	–
	MW	0,10	0,380	0,100	−0,22	0,604	−0,799	2,00
	LW	−0,21	−0,220	−0,850	−0,21	0,230	0,490	–
Beach mean	(μm)	992			936			

Mdϕ: arithmetic mean; Qdϕ: quartile deviation; Skqϕ: skewness; Mz: graphic mean; σI: inclusive graphic standard deviation; sk: inclusive graphic skewness

Table 2 Profiles of physical and chemical parameters on four sandy beaches in Natal

Beach, tidal level		and depth (cm)	Eh (mV)	Temperature °C	Salinity ‰	Moisture %
Sodwana	HW	2	–	39,6	–	2
		30	–	27,5	–	9
		60	–	27,0	–	19
		90	+360	26,0	27	26
	MW	2	–	32,5	–	18
		30	+395	27,2	32	25
	LW	2	+400	26,5	36	24
St Lucia	HW	2	–	35,5	–	5
		30	–	28,0	–	13
		60	–	26,8	–	16
		75	+300	26,0	37	23
	MW	2	–	29,5	–	15
		20	+280	26,0	37	29
	LW	2	+290	26,0	35	23
Blythdale	HW	2	–	21,7	–	–
		45	–	23,0	–	–
		75	–	23,5	–	–
		105	–	23,8	–	–
		135	–	24,0	–	–
		165	–	24,0	–	–
		195	+280	24,0	25	18
	MW	2	–	22,4	–	–
		25	–	23,0	–	–
		55	–	23,2	–	–
		80	+400	–	32	13
Kelso	HW	2	–	22,0	–	–
		30	–	22,9	–	–
		60	–	23,0	–	–
		90	–	22,5	–	–
		120	–	22,5	–	–
		150	+280	22,8	36	26
	MW	2	–	22,0	–	–
		30	–	22,5	–	–
		70	+400	22,8	37	18
	LW	2	+300	23,0	34	34

land precluded mysids. Substrate particle size decreased away from the headland to the centre of the bay where both *Gastrosaccus bispinosa* and *G. longifissura* were recorded (substrate medium to fine sand, 250 μm).

Mysid biomass of 253 mg m-strip^{-1} was recorded at Palm Beach while values of 95,9 mg m-strip^{-1} and 7,1 mg m-strip^{-1} were recorded in the outer Sodwana Bay areas. These values were calculated from the following length/mass relationships:

$\log_{10}$ mass(mg) = 3,0 $\log_{10}$ length(mm) – 2,795 for *G. bispinosa*;

$\log_{10}$ mass(mg) = 2,74 $\log_{10}$ length(mm) – 2,513 for *G. longifissura*.

Meiofauna

Figures 6–9 show density and intertidal distribution of the various meiofaunal groups on each beach. Table 4 gives the individual dry mass values and Table 5 gives the total numbers and biomass values per metre-strip of beach. At Sodwana Bay the highest density of meiofauna occurred in the surface layer at MW ($1,08 \times 10^6$ m^{-2}). Nematodes were the most numerous single group and accounted for 26% of numbers while the remainder was dominated by turbellarians, harpacticoids and mystacocarids. The nematodes and harpacticoids were present in greatest densities near the surface at MW. The total biomass of meiofauna at Sodwana Bay was 21 g dry mass per metre-strip.

There was generally less meiofauna at St Lucia than at Sodwana Bay and organisms were concentrated at HW at a depth of 50 cm where the density ws $0,95 \times 10^6$ m^{-2}. At MW and LW nematodes were the largest single group accounting for 28% and 43% of total numbers respectively. At HW, however, turbellarians were dominant (36%). Total biomass was 10,4 g dry mass per metre-strip.

A large meiofaunal assemblage was found at Blythdale and Kelso despite the physical conditions. The meiofauna was most numerous at MW on both beaches reaching densities of $2,0 \times 10^6$ m^{-2} and $3,74 \times 10^6$ m^{-2} at Blythdale and Kelso respectively. Harpacticoids and archiannelids were dominant and turbellarians were also repre-

Table 3 Macrofauna abundance (Nos/m-strip) and dry biomass (g/m-strip) on four Natal beaches. Distance and beach profile given in Figures 2–5. Species not collected in quantitative samples are excluded

	Sodwana Bay		St Lucia		Blythdale		Kelso	
Species	Abundance	Biomass	Abundance	Biomass	Abundance	Biomass	Abundance	Biomass
Glycera sp.	–	–	25	0,68	–	–	–	–
Gastrosaccus bispinosa	–	–	4	0,001	–	–	–	–
Excirolana natalensis	–	–	6	0,04	–	–	–	–
Emerita austroafricana	11	5,60	115	0,78	–	–	–	–
Ocypode ryderi	10	62,80	1	3,38	3	18,25	5	33,08
Bullia natalensis	112	14,90	7	0,04	–	–	–	–
Donax madagascariensis	11	0,38	19	0,08	–	–	–	–
Tivela polita	–	–	21	3,50	–	–	–	–
Charibarbitus celetus	57	3,25	12	0,25	–	–	–	–
Total	201	86,93	250	8,751	3	18,25	5	33,08

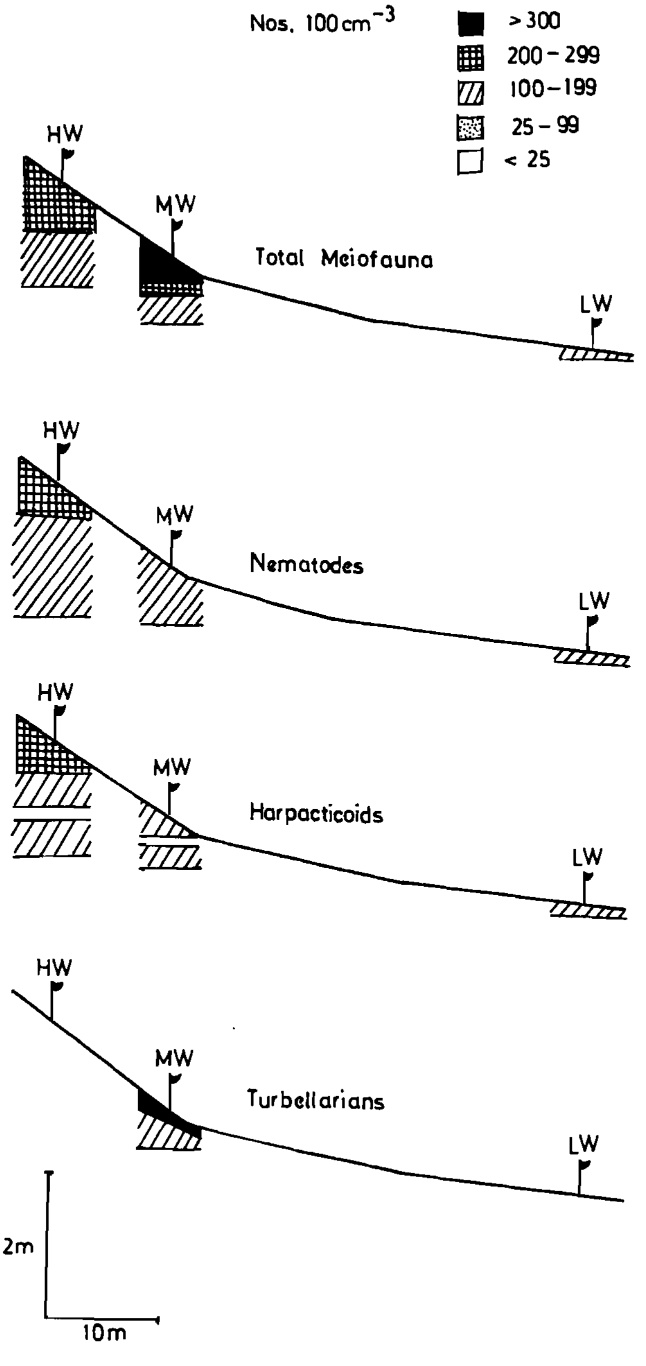

Figure 6 Density (per 100 cm^3) and intertidal distribution of meiofauna at Sodwana Bay headland.

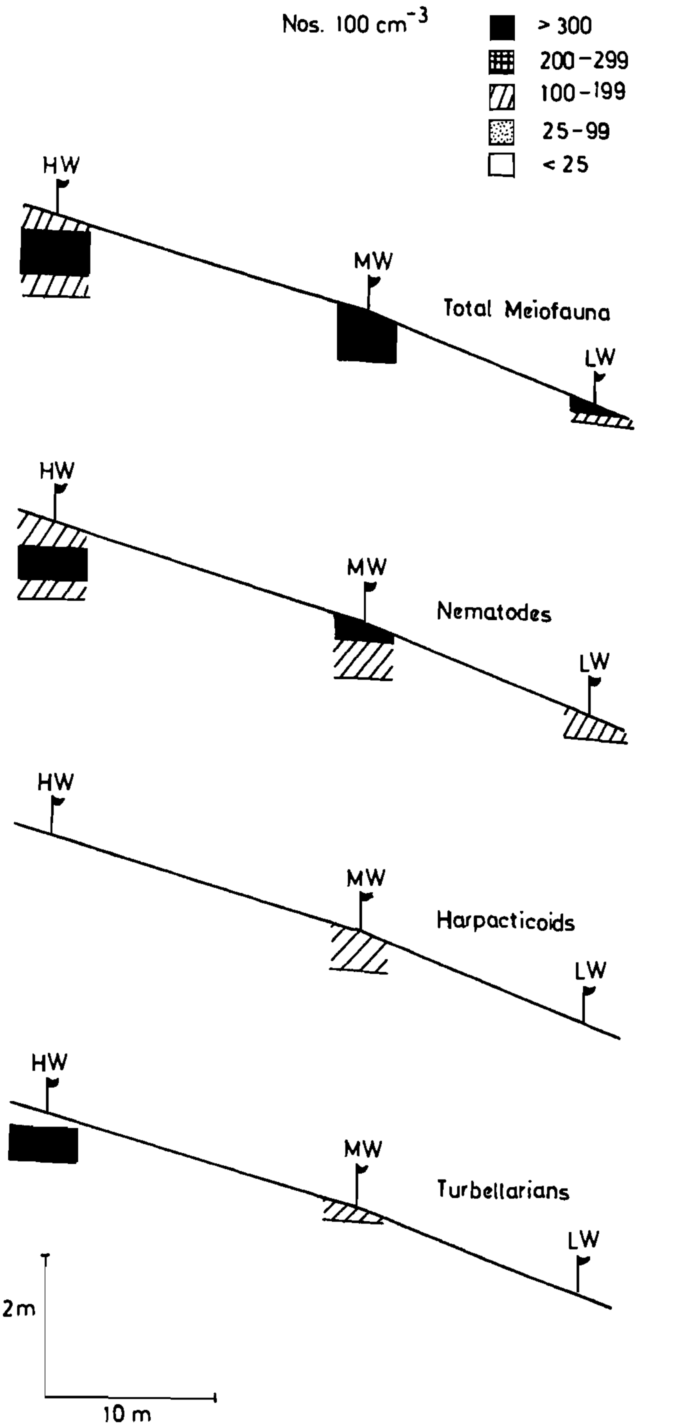

Figure 7 Density (per 100 cm^3) and intertidal distribution of meiofauna at St Lucia sampling area.

Table 4 Individual dry mass measurements for meiofauna from four sandy beaches in Natal

Taxon	Biomass (μg)
Nematodes	0,87 (Sodwana Bay and St Lucia)
	0,90 (Blythdale and Kelso)
Interstitial harpacticoids	0,50 (Blythdale)
Burrowing harpacticoids	0,90[a]
Turbellarians	0,50[a]
Gastrotrichs	0,30[a]
Archiannelids	3,30 (Sodwana Bay and St Lucia)
	42,60 (Blythdale and Kelso)
Oligochaetes	1,00[a]
Polychaetes	1,00[a]
Mystacocarids	0,45[a]

[a]Estimates based on East Cape samples

sented in fairly high numbers at MW, but were present deeper in the sand than the archiannelids. Total biomass values at Blythdale and Kelso were 26 g and 107 g dry mass per metre-strip respectively.

Table 5 Total meiofauna numbers and dry mass (g/m-strip) on four Natal sandy beaches

Beach	Numbers	Biomass
Sodwana Bay	$3{,}50 \times 10^7$	21,0
St Lucia	$0{,}75 \times 10^7$	10,4
Blythdale	$2{,}35 \times 10^7$	25,9
Kelso	$6{,}07 \times 10^7$	106,8

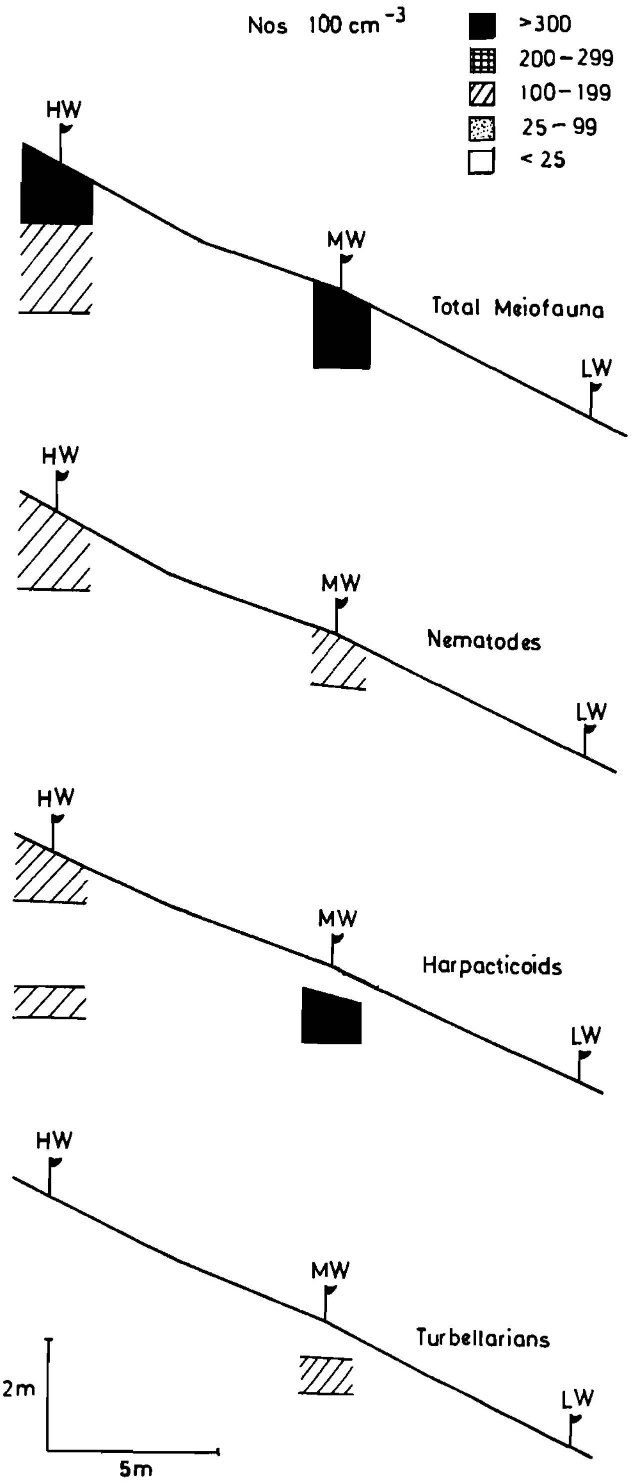

Figure 8 Density (per 100 cm^3) and intertidal distribution of meiofauna at Blythdale.

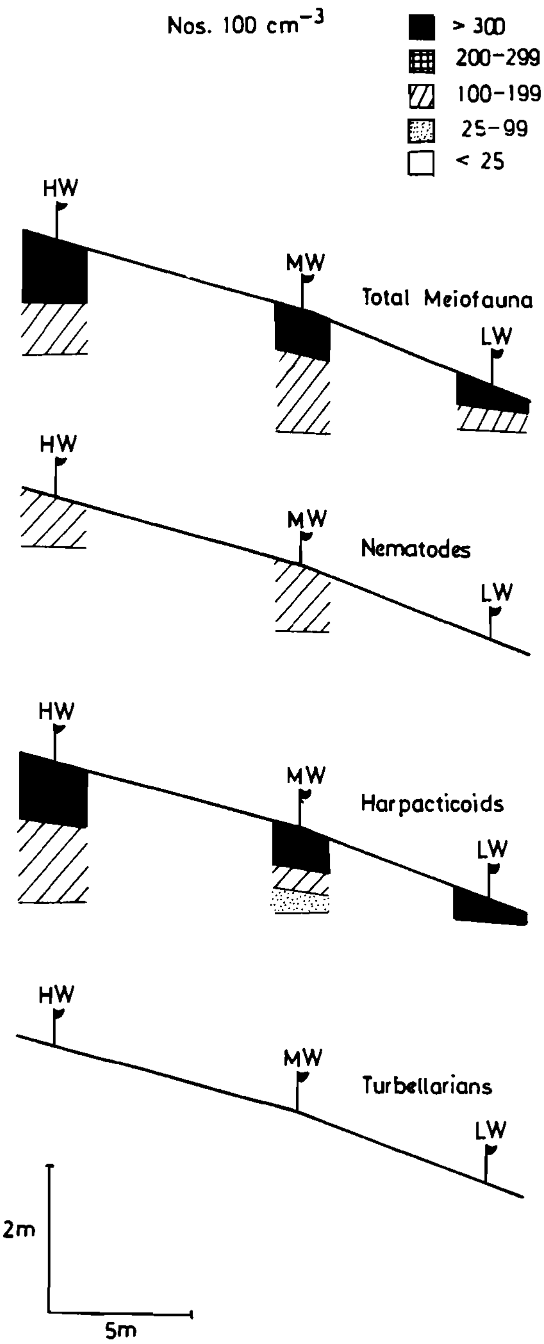

Figure 9 Density (per 100 cm^3) and intertidal distribution of meiofauna at Kelso.

Discussion

The most striking feature of Natal beaches is the increase in wave height southwards (Davies 1972) and the change in exposure to wave action with the concommitant changes in profile and sand particle size which occurs from Sodwana Bay to Kelso. The change is such that moderately sloping beaches with medium sand, characteristic of Sodwana and St Lucia, give way within a short distance to very steep, coarse-grained beaches just north of Durban. Fine, sandy beaches again appear in the vicinity of Port Edward near the Transkei border. Exceptions include Durban itself which has stabilized, moderately sloping, medium-sand beaches which are protected by groynes.

In the north the waves are moderate and the surf zone fairly wide ($\simeq$250 m) with indications of offshore bars. Also characteristic of this area are high forested dunes behind the beach. There is usually no clear drift-line although a berm may be present. In contrast the south-coast beaches experience heavy wave action characterized by plunging waves which break on the beach. At LW these beaches drop steeply into gullies which are bordered by offshore bars. The wave heights may exceed 2 m and the beaches can be described as dangerous.

An important characteristic of all these beaches is the degree of oxygenation. This follows the well-established pattern that coarse sand has a lower porosity but greater permeability than fine sand (Hulings & Gray 1971). In all cases Eh was above +280 mV indicating that, even at depths approaching 2 m, oxygen is present in solution and no trace of an RPD zone was evident (McLachlan, Dye & van der Ryst 1979) suggesting that aerobic metabolism was the dominant mode of life (Dye 1979).

The coarse south beaches must filter large volumes of sea water and rough estimates suggest a value of 60 m^3 per metre of shore per day in comparison to 10 m^3 per day for beaches near Port Elizabeth (McLachlan 1979). The low salinity at the HW water-table at Sodwana Bay indicates underground seepage of fresh water from the dunes, not uncommon on sandy beaches backed by dune systems. At Blythdale and Kelso, however, the low HW salinity may be a direct effect of the rainy conditions experienced by that section of the coast during the sampling time.

A total of 11 benthic macrofaunal species was recorded if mysids and *Charibarbitus celetus* are included and *Ocypode ceratopthalmus* and *O. madagascariensis* are ignored. This is fairly typical of the low species numbers reported from exposed sands (McIntyre 1970; Brown 1971a; Dexter 1974; Ansell, Sivadas, Narayanan, Sankaranasayanan & Trevallion 1972; McLachlan 1977b). Although intertidal zonation was blurred by the fact that most of these species (*Bullia natalensis, Emerita austroafricana, Donax madagascariensis*, mysids and isopods) undergo tidal migrations similar to those described for macrofauna in the eastern Cape (McLachlan, Wooldridge & van der Horst 1979), the basic intertidal distribution of this fauna was in agreement with Dahl's (1952) zones for warm-water regions. Cirolanid isopods were scarce and small male *Emerita austroafricana* tended to dominate the midshore zone on the northern beaches.

The abundance and distribution of macrofauna on Natal beaches indicates that extreme exposure, such as that experienced on southern beaches, precludes the establishment of macrofaunal populations in the intertidal zone. Apart from ghost crabs above HW, not a single macrofaunal organism could be found on these beaches. North and south of this zone of heavy wave action and coarse steep beaches, the macrofauna re-establishes itself (Brown & Jarman 1978). Of all the beaches, St Lucia had the greatest number of macrofauna species although abundance was low. Organisms such as *Emerita, Bullia natalensis* and *Ocypode* dominated the macrofauna in the north, *Ocypode* in the south and *Bullia rhodostoma* was the dominant organism in the extreme south (Palm Beach). An interesting find at both Sodwana Bay and St Lucia was *ca.* 10 specimens of *Charibarbitus celetus* (Smith). Only one specimen of this small fish has been found previously, at Inhaca (M.M. Smith pers. comm.).

The fact that no mysids were recorded on the southern beaches (except for Palm Beach) supports the suggestion of Brown & Talbot (1972) that particle size may be a determining factor in the colonization of some beaches by *Gastrosaccus psammodytes* and that a coarse substrate may be more limiting to juveniles than to adults. Although *G. psammodytes* was present in coarse sand on Cape Peninsula beaches, burrowing was probably facilitated by the admixture of fine sand which the coarse layer contained (Brown 1971a). The suggestion is further supported by the data from Sodwana Bay. At the headland the substrate consisted of medium to coarse sand at LW and no mysids were recorded. Particle size decreased away from the headland and both *G. bispinosa* and *G. longifissura* appeared with highest numbers in areas of relatively fine sand. The distribution of *G. bispinosa* and *G. longifissura* on the Natal coast is patchy and mysids are probably only present where a suitable substrate is to be found. Both species are recently described and their distribution has hitherto been limited to Transkei (Wooldridge 1978). Although the present study extends their range, their northern distribution limit is not known.

The meiofauna of north Natal beaches is similar in abundance and general composition to that of the east Cape beaches (McLachlan 1977b, c). Nematodes are frequently the dominant meiofaunal group, especially in finer substrates (McIntyre 1969) and this was the case at Sodwana Bay and St Lucia. On the coarse beaches to the south the organisms became larger; nematodes approximately 30% on a dry mass basis. Archiannelids dominated the meiofauna in terms of biomass. The large size of these organisms is an adaptation to large pore size (Swedmark 1964) and large interstitial harpacticoids have been shown to become more important as the sand becomes coarser (McLachlan 1978). Intertidally, archiannelids occupied the most exposed parts of the beach; the surface layers from MW to LW. Such a distribution of archiannelids has been reported previously for these beaches (Oliff *et al*, 1967). Below 30 cm their numbers dropped to insignificant levels. Harpacticoids were also present in this zone in high numbers. Thus, in contrast to macrofauna, the southern beaches have the highest meiofauna biomass, due to the presence of large archiannelids.

The Natal coast is characterized by variable beach types which are relatively poor in macrofauna, particularly just north and south of Durban where all the biomass is due to supralittoral ghost crabs. Mysid populations are patchy but may be present in high numbers in places characterized by fine to medium sands. Meiofauna is well represented on all beaches and very high biomass values may be attained on some of the seemingly most inhospitable beaches. In general, it is concluded that Natal beaches are poorer than Eastern Cape and Cape Peninsula beaches, particularly with respect to macrofauna.

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