KUNGL. FYSIOGRAFISKA SÄLLSKAPETS I LUND FÖRHANDLINGAR
Bd 25. Nr 14. 1955.

SMÄRRE UNDERSÖKNINGAR ÖVER ÖRESUND.

19.

On the littoral subsoil fauna of the Simrishamn Beach in Eastern Scania.

By

Per Brinck, Erik Dahl, and Wolfgang Wieser.

Communicated by Prof. B. Hanström, October 12, 1955.

Introduction

For many years the senior writers had been aware of the unusual type of the sandy beach N of Simrishamn on the Scanian East Coast, and one of us made an investigation of the terrestrial amphipods of the locality and analyzed one sample of sand from a granulometric point of view (Dahl 1946). It appeared likely that the coarse, reddish sand of the exposed beach would be inhabited by an interesting subsoil fauna similar to those encountered by Remane and his numerous collaborators in various parts of Europe, recently also in other continents, but not until 1954 did we get an opportunity to carry out our plans of an investigation of the locality.

Collecting

We worked on the Simrishamn Beach on two occasions, viz. June 14th–15th 1954, and October 6th 1954. The bulk of the material dealt with below was obtained during our first visit, the second one mainly aimed at the collecting of certain groups insufficiently studied during our first investigation.

The collecting methods employed were the simplest possible. Holes were dug into the beach and samples of sand were taken from various levels down to the subsoil water. To avoid mixing of sand from different layers a steel cylinder about 80 cm in height and 50 cm in diametre was sunk into the deeper holes and further digging carried out inside it.

Some sand samples from levels above the subsoil water were put into Berlese funnels and Collembola and Acarida extracted. Other similar samples as well as samples from the subsoil water were extracted according to the Baermann method. Most of the material from subsoil water was picked out by hand under a binocular.

The material was distributed among various specialists who kindly assisted us with identifications. Their names will be recorded in connection with the treatment of the various taxonomical groups on p. 10 ff. We are especially indebted to Dr. Tor G. Karling who accompanied us on our second visit and took great pains to extract and identify Turbellaria, Oligochaeta, and Polychaeta.

The investigation was financed by the Marine Biological Department of the Lund University as part of its research program.

Physiography of the Simrishamn Bache

The sand of the Simrishamn Beach was formed by erosion of the cambrian sandstone which is the typical bedrock of the area. It is somewhat reddish in colour, very coarse, and very uniform. The beach extends for about 2 kms to the NNW from Simrishamn. It is open to all winds from an easterly direction and the degree of exposure is great, for the beach slopes rather steeply and already within a few hundred metres from the shore depths of about 15 m are encountered. There are, moreover, no protecting sandbanks offshore. There are no tides.

Very little organic material is found in the sand. Algae, especially *Fucus*, are occasionally thrown ashore by heavy gales. During the summer months the beach is never allowed to remain covered by large quantities of algae for any length of time. Out of consideration for bathers they are collected and burnt. Because of the coarseness of the sand and the great degree of exposure stagnation does not occur within the sand and the formation of decomposition layers blackened by iron sulphide so typical of many Swedish beaches does not take place. The uniformity of the sand will be evident from the histograms on fig. 2. Samples were taken at three points (A 3, A 6, and A 9, all represented in fig. 3). In all three samples the two fractions with a grain diametre between 2.0 and 0.5 mm made up over 95 % of the total. This is something unique among the sandy beaches of South Sweden (cf. Dahl 1946). At the three localities mentioned above the contents of organic substance was also determined and turned out to be very low (0.21 %, 0.24 %, and 0.26 % respectively). None of the samples in question was taken within the *Fucus* layer indicated in fig. 3.

Fig. 1. The Simrishamn Beach seen from the north. G. and H. Weimarck photo.

During both our visits the temperature of sand and water as well as the salinity of the water were determined. The situation found in June is shown in fig. 3. The sea water level coincided very nearly with the mean. One complete section (A) was investigated and one complementary section (B) situated about 150 m N of A. Both lie near the centre of the beach and sampling conditions were identical.

June 14th was a bright day with strong insolation and light offshore wind and therefore the temperature of the sand surface was fairly high. In the dry sand above A 1 it amounted to 20.0° and increased inland to 23.9°. Towards the deeper layers the temperature of the sand decreased fairly rapidly, in the column A 3–A 5 from 20.0° at the surface to 13.8° just above the subsoil water level 60 cm below. The decrease was still more obvious in the column A 8–A 11, from 23.9° just below the surface to 11.8° just above the subsoil water 175 cm further down.

The temperatures found in the subsoil water itself call for some comments. About a hundred metres inland a muddy stream runs almost parallel

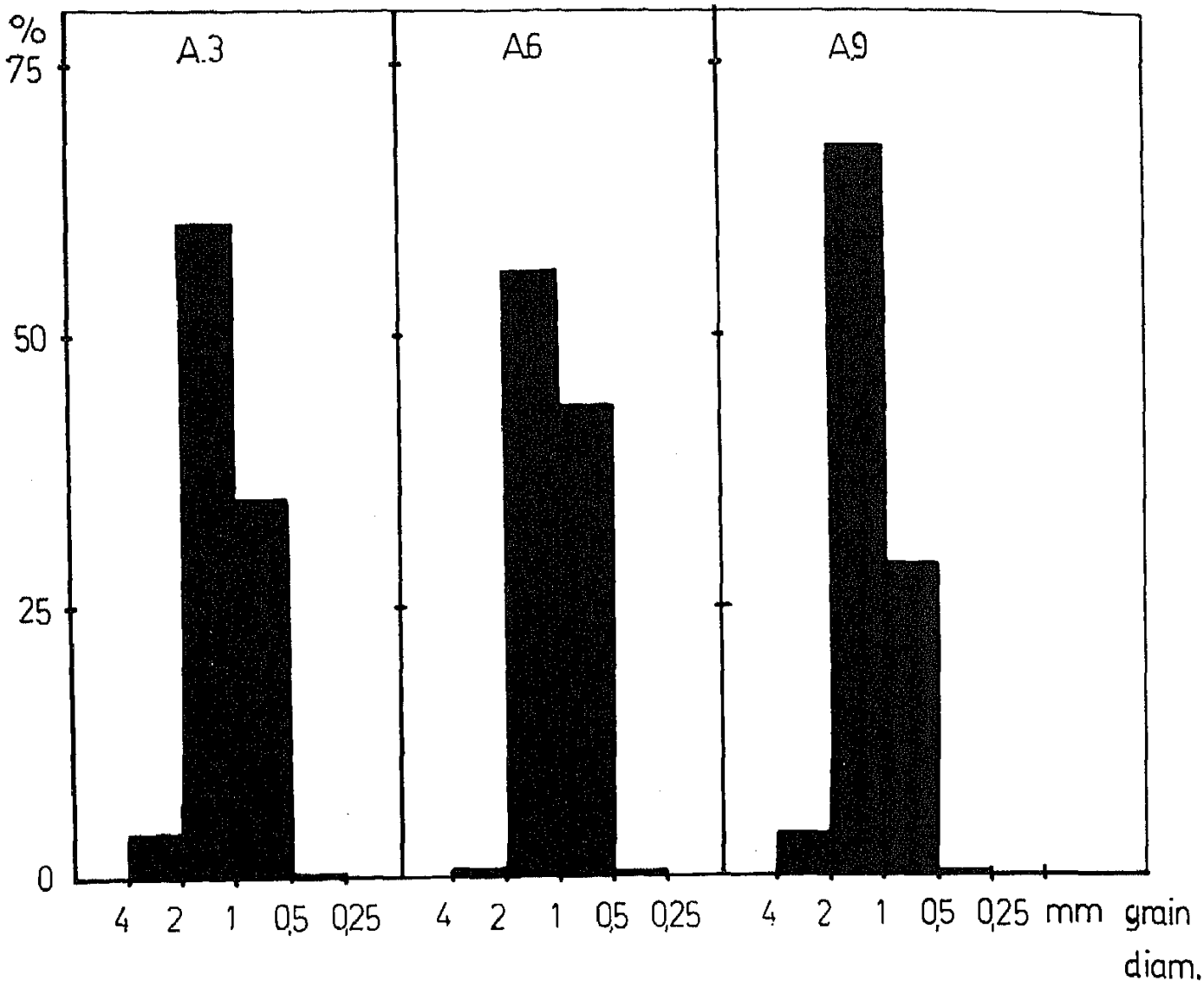

Fig. 2. Granulometric composition of three samples of sand from the Simrishamn Beach.

to the beach and flows into the sea at its southern end. Apparently a subsoil water flow from this stream penetrates the beach and accounts for the very high temperature of 17.4° found at A 11. The normal temperature of eustatic springs in the neighbourhood lies just above 7°. From A 11 the temperature decreased successively towards the sea, the surface temperature of which was 12.8°. The fresh water, as shown also by the salinity values, becomes gradually mixed with sea water.

The Baltic water in this area is a mesohaline brackish water with a comparatively stable salinity around 8 $^0/_{00}$. From the sea inland the salinity of the subsoil water at first decreased very slowly but about 3–4 m from the water's edge a very rapid decrease set in and from 6 m from the sea onwards the water was practically fresh (cf. fig. 4).

When the locality was revisited on October 6th conditions were very different. The sea water level was 75 cm higher than on the previous

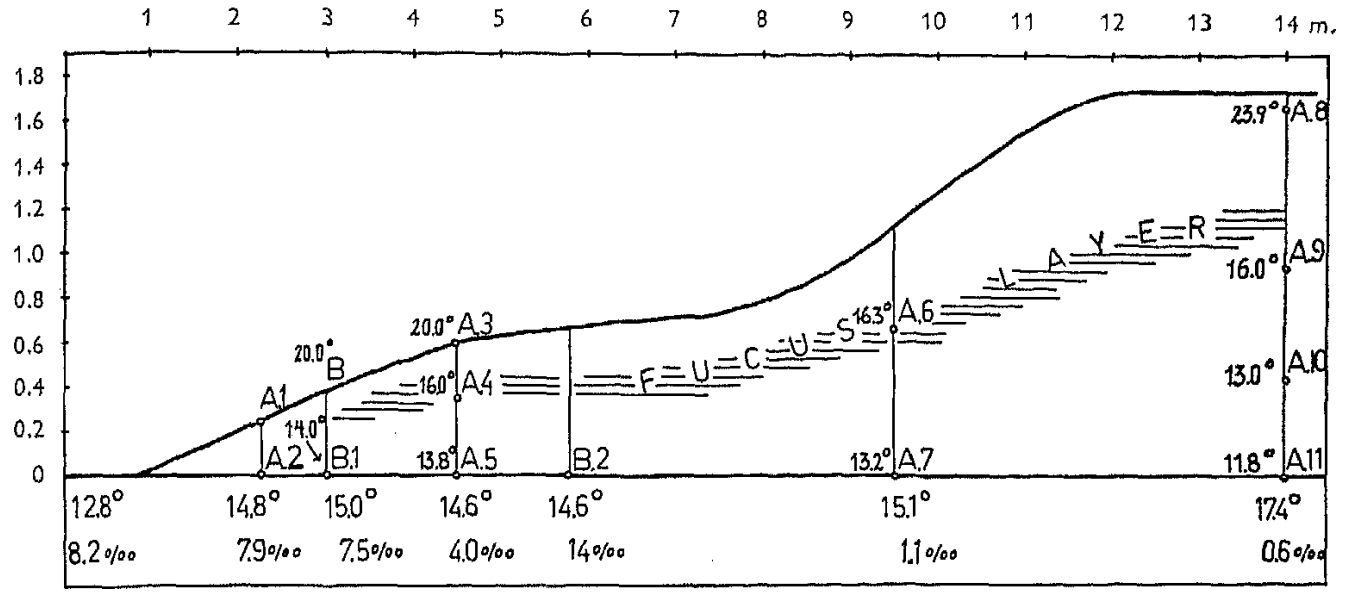

Fig. 3. Temperature and salinity in two sections through the Simrishamn Beach. The sea to the left. Temperature figures above the horizontal base line refer to the sand, those below it to the water. Further explanation in the text.

occasion and a rather heavy sea was washing the beach up to well past A 6. The surface temperature of the sea was 8.6° and the salinity 8.0 ‰. A 3 was flooded. At the column A 6–A 7 the temperature of the subsoil water was 9.3° and the salinity 6.7 ‰. At column A 8–A 11 the corresponding values were 10.4° and 0.9 ‰.

It is interesting to note that mesohaline water with a salinity of 6.7 ‰ extended to at least 9.5 m from the mean position of the water's edge, thus far into the area where, on our previous visit, fresh water was encountered in deeper layers. At the innermost locality, however, the fresh subsoil water remained practically unaffected.

Discussion of the subterranean fauna

The total number of identified species of Metazoa collected during our two visits to Simrishamn amounts to 56. The majority is made up of fairly eurytopic species, occurring in the first place in the superficial layers of the sand or at least not tied to subterranean habitats. However, a certain number of species remain which must be considered as mainly subterranean. In comparison with the Mediterranean and certain extra-European coasts these species are few indeed, and many of the typical subterranean groups such as Microparasselid Isopods, subterranean Amphipods, and Mystacocaridea are lacking entirely, the same as is the case on the well-investigated German Coast. This is only another example

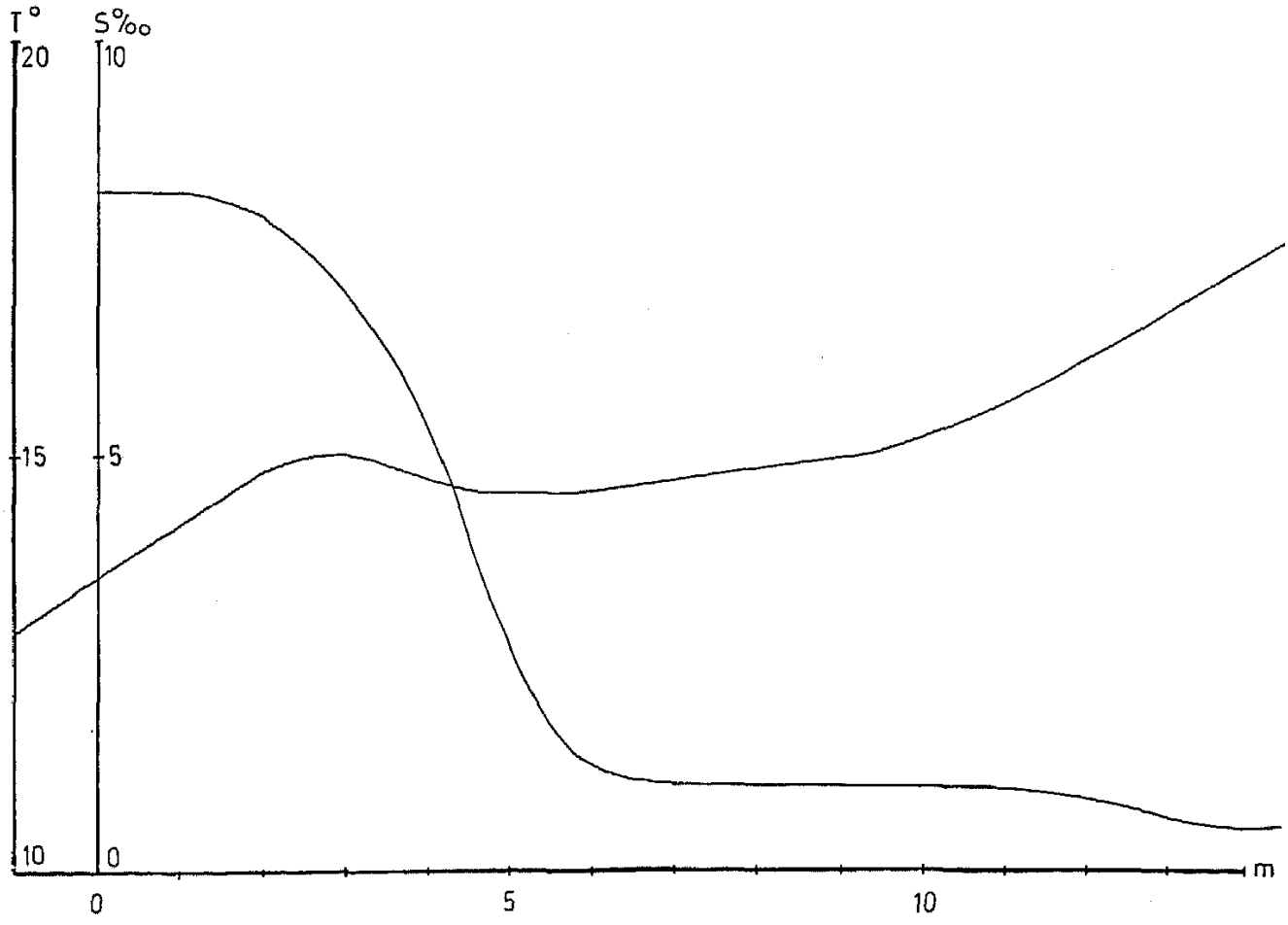

Fig. 4. Temperature and salinity curves for subsoil water at the Simrishamn Beach in relation to the distance from the sea.

of the general scarcity of ancient forms in areas affected by the latest great glaciation.

The subterranean fauna can be grouped into two categories:

1. Species inhabiting the more or less moist sand above the water level.
2. Species mainly, even if by no means exclusively, tied to subsoil water.

The first-mentioned group in the present material contains representatives of two terrestrial groups, Collembola and Acarida.

Of Collembola 9 species were obtained in the June sections. Seven of these are restricted more or less exclusively to the surface of the sand, while two, *Archisotoma besselsi* and *Anurida remyi*, are distributed evenly through practically all the samples (figs. 5 and 6). The large quantities of Collembola occurring at all levels certainly play an important part in the organic metabolism of the beach, where their main source of nourishment is probably algae of various kinds. They must also be an important source of food to subterranean predators and scavengers.

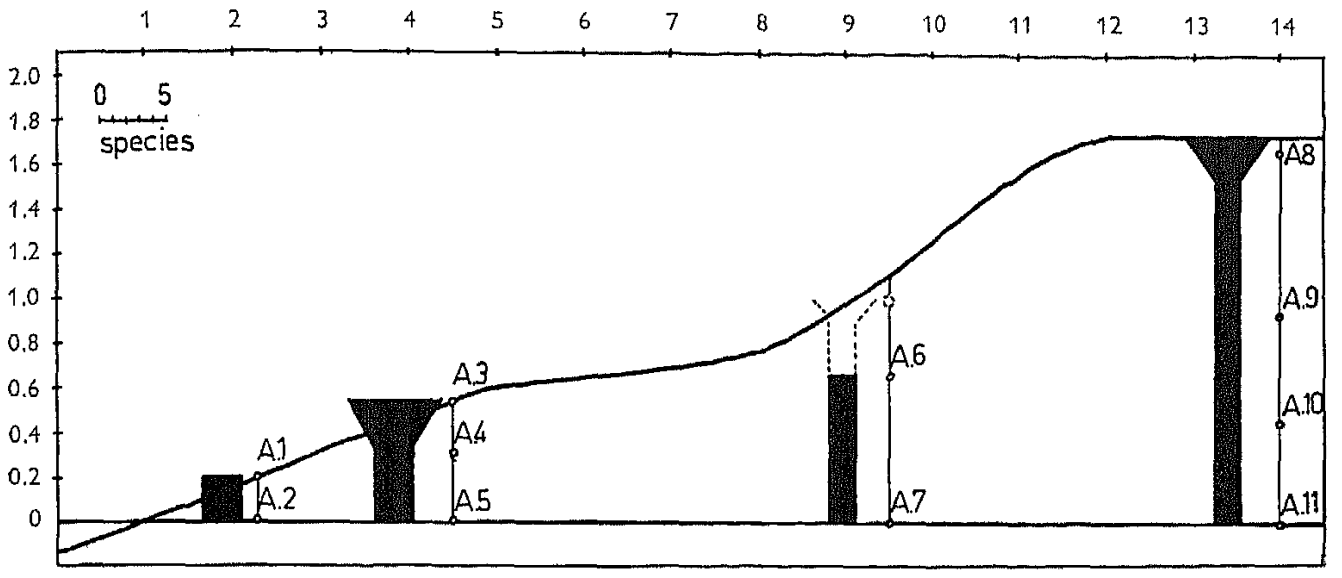

Fig. 5. Distribution of Collembola on the Simrishamn Beach. The width of the columns is proportional to the number of species as indicated by the scale in the upper lefthand corner.

In June 16 species of Acarida were obtained, 12 of which were only found at the surface, while 4 extended from the surface downwards, 2 of them penetrating as far as the subsoil water. Three species were new to science, viz. *Eugamasus halophilus*, *Halolaelaps coxalis*, and *H. suecicus*, and it is probable that these are confined to this type of habitat, as are also *Cyrthydrolaelaps hirtus* and *Lasioseius fucicola*. The remaining species are more or less eurytopic and are probably confined to algae and other vegetable debris found in surface layers.

Among the aquatic subterranean forms, which also penetrate into the moist sand above the water level, no species exclusively tied to fresh water was encountered. Those encountered in fresh water also occurred or are known to occur in brackish habitats. Of the two groups of originally non-marine ancestry the Halacarida undoubtedly invaded the subterranean habitats from the sea, while those Oligochaeta which occurred in our samples are at least also well-established brackish water species.

The distribution of some important species from subsoil waters is summarized in the diagrams figs. 7–9.

The members of the subsoil water fauna of the Baltic are euryhaline and also those which possess this euryhalinity to a less marked degree will always be able to endure shorter periods of greatly reduced salinity, at least as adults.

The range of temperature and salinity found in our June series of samples from subsoil waters can be studied in the diagram fig. 4. It will be evident that conditions closely approaching those in the Baltic water

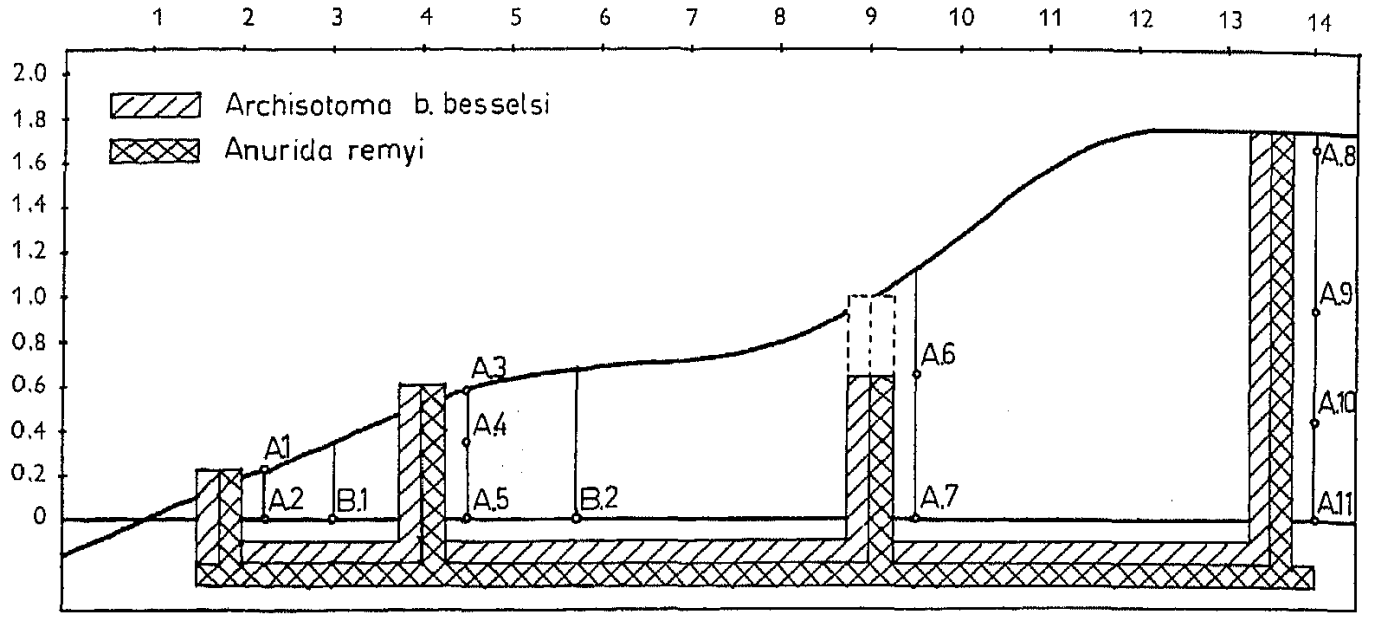

Fig. 6. Distribution of two species of Collembola on the beach.

cease to exist approximately 3–4 metres from the water's edge. Inland from that point conditions very soon assume the characteristics of non-subterranean fresh water habitats, viz. low salinity and a very high temperature. We wish once more to emphasize that the temperature in our innermost samples must be exceptionally high for a North-European subterranean locality. The combination of a decreasing salinity and a rising temperature as recently demonstrated by KINNE (1954) is very unfavourable not only to marine but also to brackish water animals. Therefore it is to be expected that in the critical area 3–5 m from the sea the comparatively stenohaline brackish water animals will disappear, leaving only the most tolerant ones to inhabit the inner part of the beach. Of the species obtained in the June series the following ones were only found on the seaward side of the critical area, viz.:

Promesostoma cochlearis
Remanea arenicola
Schizopera clandestina
Paraleptastacus spinicauda

In October, conditions had changed so that Baltic water only comparatively slightly diluted penetrated to A 6, where the following species apparently came to a halt, viz.:

Archilopsis unipunctata
Bothriomolus balticus
Proschizorhynchus gullmarensis

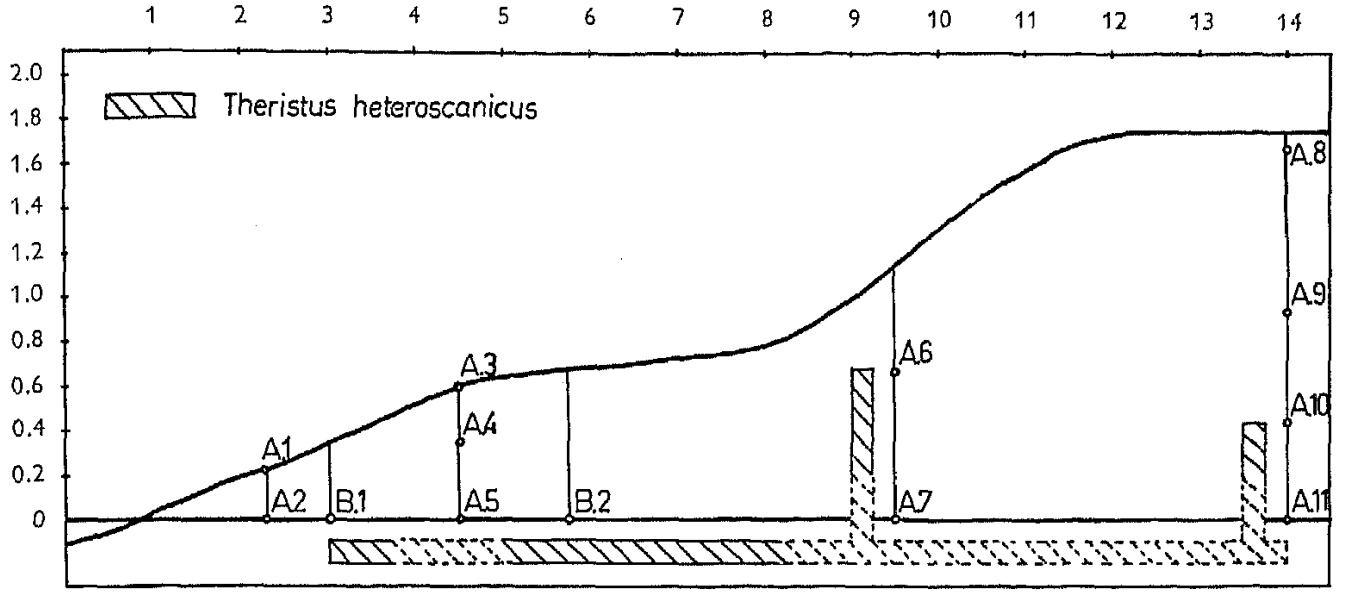

Fig. 7. Distribution of the nematode *Theristus heteroscanicus*.

Thus at least 7 species give the impression of not passing the critical areas. *Coelogynopora schultzii* in our collection (stations B 1 and B 2) seems to be tied to the mesohaline water, but Ax (1954) demonstrated its presence in nearly fresh subsoil water in the Gulf of Finland. Otherwise the general distribution of the species mentioned corroborates the opinion of their salinity preferenda expressed above.

The two characteristics of the sand of the Simrishamn Beach which could be expected to be particularly relevant from an ecological point of view are its coarseness and its poverty of organic contents.

The granulometric composition of the sand can be studied in fig. 2. It must be a factor of importance that the finer grain fractions are practically wholly lacking, so that the interstitial spaces are seldom clogged by fine grains. In this respect the Simrishamn Beach closely approaches the sample from the *Otoplana* zone in the Bay of Kiel analyzed by Ax (1951, p. 338) and also certain samples from Algeria collected by Delamare Deboutteville (1954, stations TA 51–53).

Among the species obtained the following five from their general distribution appear to be more or less tied to coarse sand, especially in subsoil water and the *Otoplana* zone, viz.:

Coelogynopora schultzii
Bothriolomis balticus
Promesostoma cochlearis
Proschizorhynchus gullmarensis
Remanea arenicola

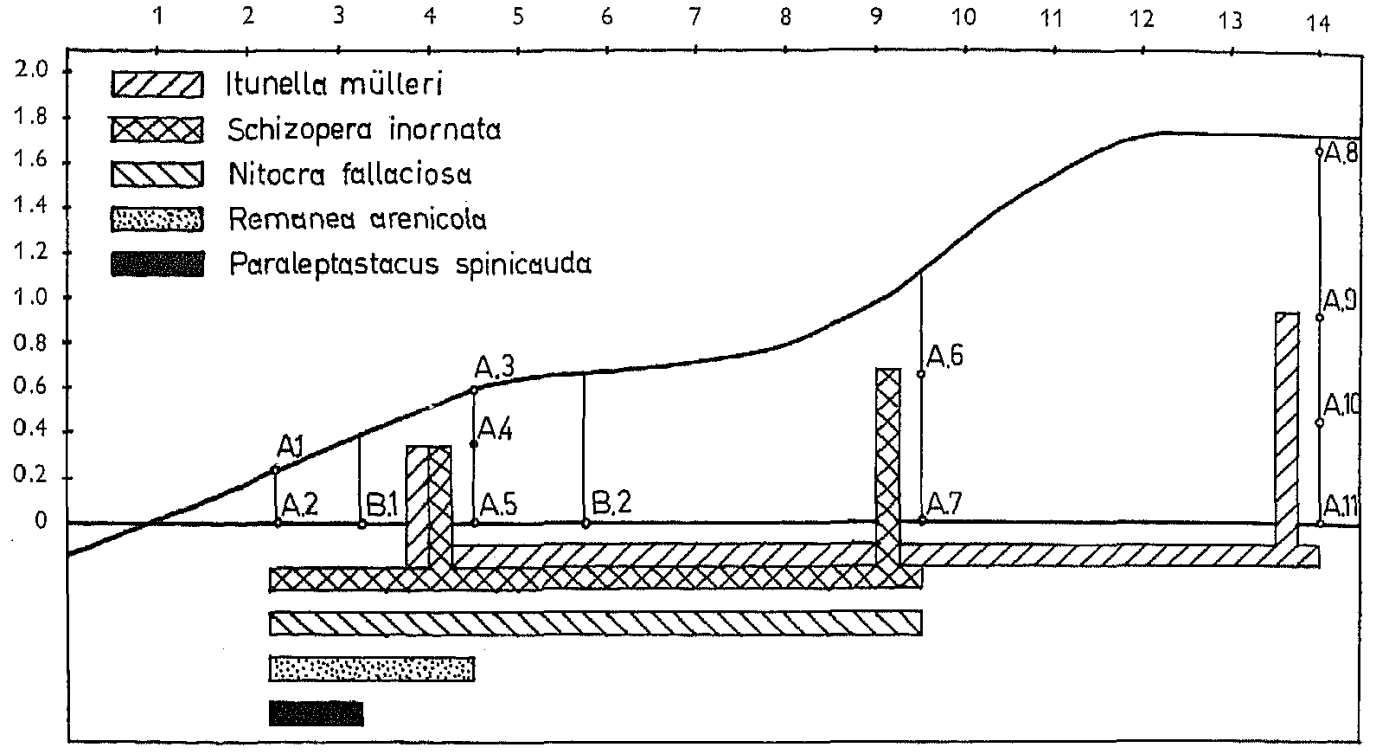

Fig. 8. Distribution of various Crustacea Harpacticoidea.

It is also very probable that the three new species

Vejdovskya simrisiensis
Monhystera dahli
Schizopera inornata

show a similar predilection for coarse sand.

The second peculiarity of the sand, its poverty in organic material, is probably due to the large and uniform size of the grains and the great exposure which combine to produce a lively vertical circulation and to prevent the long-time retention of decaying organic material in the sand. As stressed by REMANE such a free vertical circulation is one of the essential factors for the existence of a littoral subsoil water fauna.

As seen from fig. 3 we found during our June visit an accumulation of comparatively fresh algae, mostly *Fucus*, at a depth of one or two feet in the sand. The majority of the Nematoda were found at this level.

List of species obtained

Below the material of the groups hitherto worked up is listed together with some remarks on the various species. In the table at the end of the list all findings of all identified forms are recorded. The abbreviations A 1, A 2, B 1 etc. refer to the sampling localities indicated in fig. 3.

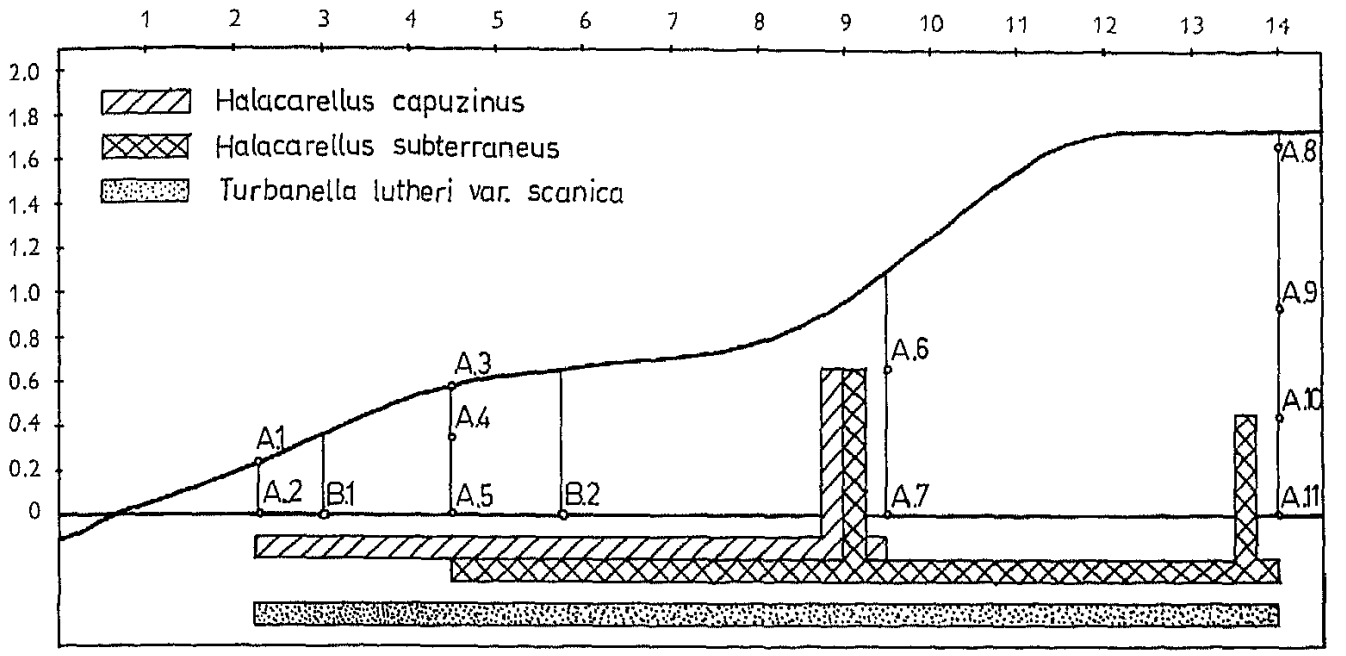

Fig. 9. Distribution of the Gastrotrichan and the two species of Halacarida obtained on the beach.

Turbellaria

The list of Turbellaria presented below is certainly incomplete. In the samples collected in June a considerable number of Turbellaria were observed, and samples were sent to Dr. P. Ax, Kiel, who had kindly undertaken to identify our species. Unfortunately practically all species sent alive died underways and could not be identified, but a few species could be recognized from material preserved in formaline.

Dr. T. KARLING from the State Museum of Natural History at Stockholm was kind enough to accompany us on our second collecting trip in October. As already mentioned (p. 4) rather unfavourable conditions were then prevailing and the catch was comparatively poor. Undoubtedly, future collecting will reveal the existence of further species.

Below are recorded only such species as could be definitely identified. One of them is new and will be described by Dr. KARLING. Here it is recorded under the provisional name given by him.

Macrostomum curvituba LUTHER

A common species especially in sandy biotopes in shallow water and brackish pools as well as in littoral subsoil water from the North Sea to the Gulf of Finland. Often in brackish, sometimes in practically fresh water (Ax 1951, 1954, KARLING in litt.). It was obtained in October at A 3 and between A 9 and A 10.

Archilopsis unipunctata (O. FABR.)

A eurytopic species distributed from the North Atlantic to the Baltic in shallow areas, only accidental in subsoil water (AX 1951, KARLING and KINNANDER 1953). Obtained in October at A 3.

Coelogynopora schultzii MEIXNER

Widely distributed in the Baltic, in the first place in coarse sand, also in subsoil water. Brackish and practically fresh water (AX 1951, 1954, KARLING and KINNANDER 1953). In June samples from B 1 and B 2.

Bothriolomus balticus MEIXNER

Like the previous species widely distributed in the Baltic and a typical inhabitant of the *Otoplana* zone. Less frequent in subsoil water (AX 1954, KARLING in litt.). A brackish water species, which, however, appears to avoid the purely oligohaline and fresh waters. Obtained in October at A 3 and A 6.

Vejdovskya simrisiensis n. sp. (KARLING in litt.)

Only found in October at A 3 and between A 9 and A 10 in salinities of 6.7 $^0/_{00}$ and 0.9 $^0/_{00}$ respectively.

Promesostoma cochlearis KARLING

A typical inhabitant of coarse sand, occurring from the Bay of Kiel to the Gulf of Finland (AX 1951 and in litt.). Apparently not occurring in purely oligohaline and fresh waters. Obtained at B 1 in June.

Proschizorhynchus gullmarensis KARLING

Generally in coarse sand from the North Sea to Kurische Nehrung and Simrishamn. Apparently not entering purely oligohaline waters (AX 1951, KARLING in litt.). Found in October at A 3.

Nematoda

Identifications by WIESER. All material from the June series. The scarcity of nematodes in the samples was very striking.

Adoncholaimus lepidus (DE MAN 1889)

This species occurred in the short-tailed form which apparently is characteristic of brackish water (GERLACH 1953). It is common in sandy habitats throughout the North Sea and Baltic, particularly in subsoil water. In the Netherlands it has been recorded from brackish earth (DE MAN). TIMM (1952) found it in many samples from Chesapeake Bay (North America). In samples from A 4 and A 6.

Eurystomina littorale ALLGÉN 1929

As in the species above the tail is plumper in the two specimens found than in the type-specimens (2, 1 as against 3–4 anal diameters). Recorded from Heligoland and Southern Sweden (Lerberget, in decaying Zostera). A 4 and A 6.

Paracyatholaimus intermedius (DE MAN 1880)

Common in sandy habitats from the North Sea to the Gulf of Finland, also inland records. 1 specimen from A 6.

Neochromadora attenuata GERLACH 1952

This species has been recorded only from the North Sea (Sylt, Amrun) where it occurred in exposed zones of the beach ("Prallhang") and in subsoil water. 1 male from B 1.

Theristus heteroscanicus WIESER nom. nov.

Syn. *Theristus scanicus* ALLGÉN 1949 nec 1942.

The only common species, obtained in various samples (cf. fig. 6). It has been recorded from Southern Sweden and from the Gulf of Finland where it also occurred in subsoil water (GERLACH 1953).

Since *Monhystera scanica* ALLGÉN 1942 (foot-note p. 72) belongs to *Theristus*, the name of ALLGÉN's second *Theristus scanicus* has to be changed.

Monhystera filiformis BASTIAN 1865

A widely distributed species, occurring in brackish water both on the coast and inland. It may also penetrate into fresh-water and soil. One female at B 1.

Monhystera dahli WIESER n. sp.

This species is closely related to *M. sabulicola* ALLGEN from which it is separated by the much more slender and longer tail and by some other minor characters. It was also found in subsoil samples on Chesapeake Beach (North America) by WIESER (unpublished). A detailed description of the species based on the Swedish and North American material will be given in a later publication. 2 males from B 1.

Rhabditis marina septentrionalis STEINER 1916

The species *Rhabditis marina* seems to be cosmopolitan. It has been found from the Barents Sea to North America in seaweeds and on sandy beaches, including subsoil water. Two females at A 4.

The material contained also two species which were unidentifiable, i. e. *Enoplus* sp. and *Rhabditis* sp.

Gastrotricha

Only one species was obtained, viz. *Turbanella lutheri* REMANE, which occurred in a form slightly aberrant from the original description and therefore was considered by WIESER (1955) to be a separate form, *T. lutheri* var. *scanicus*. It occurred in numbers in many of our June samples and throughout the whole salinity range covered by our investigation (cf. fig. 9). *T. lutheri* is distributed from the Swedish west coast to the neighbourhood of Stockholm and the Gulf of Finland (KARLING 1954). It is a typical inhabitant of littoral subsoil water and the deeper levels of the *Otoplana* zone.

Polychaeta

Stygocapitella subterranea KNÖLLNER

In samples collected at A 6 and between A 9 and A 10 in October Dr. KARLING found and identified 8 specimens of this species, previously recorded only from subsoil waters in the Bay of Kiel.

Oligochaeta

Quantitatively the Oligochaeta play a very important part in the composition of the subterranean fauna of the beach. We had no opportunity to get those present in our samples from June sorted out and identified, but from the October samples Dr. KARLING picked out and identified at least part of the specimens. In a letter, however, he points out that the list given below is only provisional and that further species are probably to be found.

The comments on the ecology and distribution of the various species was partly supplied by Dr. KARLING, partly it was extracted from his paper of 1954 and from KNÖLLNER 1935.

Pachydrilus (*Lumbricillus*) *lineatus* (MÜLLER)

A eurytopic species, widely distributed and particularly common in wrack beds. Obtained at A 3 and A 6.

Fridericia ?bulbosa (ROSA)

Also a eurytopic species recorded from many different habitats, i. a. from the *Otoplana* zone in the Bay of Kiel. Probably obtained in one sample.

Fridericia pseudoargentea KNÖLLNER

A euryhaline, littoral species often occurring in subsoil waters and tied to sandy habitats. Distributed throughout the Baltic. Occurring in all our October samples.

Enchytraeus albidus HENLE

A eurytopic, wide-spread species, particularly common in wrack beds.

Aktedrilus monospermathecus KNÖLLNER

Widely distributed in the Baltic, and like *F. pseudoargentea* a sand-loving species occurring especially in subsoil waters and in the *Otoplana* zone. In October samples from A 3 and A 9–A 10.

Crustacea

Our collection of Crustacea, almost exclusively Harpacticida, was worked up by Dr. W. NOODT, Kiel, to whom we are greatly indebted for his kind co-operation. As Dr. NOODT himself is publishing an account of the species obtained, one of which was new, here only a brief summary will be given (cf. fig. 8 and NOODT 1955).

Besides young specimens of one indeterminable *Cyclopina* species the following species, all Harpacticids, were obtained in the June samples:

Schizopera inornata n. sp.
S. clandestina (KLIE)
Nitocra fallaciosa KLIE
Remanea arenicola KLIE
Itunella muelleri (GAGERN)
Paraleptastacus spinicauda (T. and A. SCOTT)

Of these species *Remanea arenicola* is a typical coarse sand form, especially typical of the *Otoplana* zone, and it lies near to assume that the same may be true concerning *Schizopera inornata*, which, though it is previously unknown, turned out to be very common in our samples. *Paraleptastacus spinicauda* is a wide-spread and typical sand-form living in the sand or on its surface, and *Nitocra fallaciosa* is also a very wide-spread and besides very eurytopic species, which, however, in the Baltic area shows a certain predilection for subsoil water in sandy shores. *Itunella muelleri* and *Schizopera clandestina* are eurytopic brackish water species.

Collembola

The distribution and taxonomy of the Collembola of the German coasts along the Baltic and the North Sea were dealt with in two recent papers by STRENZKE (1951 and 1954). As regards the species found in the sandy beaches, the results of our investigation of the Simrishamn area agree closely with the information given by STRENZKE. Along the German coast

two species of Collembola are characteristic of the humid subterranean sand of the beaches, viz. *Archisotoma besselsi* (cf. also DÜRKOP 1935) and *Anurida germanica* GISIN. The first-mentioned is a dominating species in the Simrishamn beach, also in the subterranean habitats. It is interesting, however, that the other species typical of these habitats in Germany, *Anurida germanica*, was not found at Simrishamn (nor has it been found at any other place in Sweden). But *Anurida remyi* which is represented by scattered specimens only in the German material, was found to be a second dominating species at Simrishamn.

In a general paper on the marine collemboles of subterranean humid habitats DELAMARE DEBOUTTEVILLE (1954) groups the species into two categories: species restricted to these habitats and species more widely ecologically distributed. Although two of the species collected at Simrishamn are definitely typical of the subterranean habitats, it is apparent that no species restricted to these conditions occur there.

We are greatly indebted to Dr. K. STRENZKE, Wilhelmshaven, for the identification of the Collembola.

Hypogastrura (s. str.) *viatica* (TULLBERG)

The species was collected at the surface stations, from the wet sand of A 1 as well as the dry and warm A 8. It did not penetrate into subterranean layers.

The species is wide-spread and common along the coasts of northern Europe where it is usually associated with wrack beds. It has also been found under other littoral conditions though in low abundance except for dense crowds on the surface of temporary pools which is probably an accidental occurrence (caused by flooding of the inhabited substrate, vide STRENZKE 1954).

Hypogastrura (s. str.) *vernalis* (CARL)

Collected in dry surface samples from A 3 and A 8. It did not penetrate into subterranean layers.

The species is confined to littoral habitats. Along the Baltic coasts of Sweden and Finland it has been collected mainly in deep and slightly moist layers of wrack beds (BACKLUND 1945).

Hypogastrura (*Ceratophysella*) sp. (*armata*-group)

Species of the taxonomically difficult *armata*-group occur regularly at littoral localities. Thus *armata* s. l. has been recorded from "deep layers of wrack banks" along Swedish coasts by BACKLUND (1945). Although *armata* s. l. is regarded as ubiquitous it is probable that some of the species of the group will turn out to be thalassobiontic.

In the present material scattered specimens occurred mainly in samples from the surface.

Friesea mirabilis (TULLBERG)

Represented from a few samples from near the surface, wet as well as fairly dry ones. Not penetrating into the subsoil layer of water.

A eurytopic species, usually confined to humus. In littoral habitats mostly rare, more or less occasional. Found by BACKLUND (1945) in deep layers of wrack banks.

Anurida remyi DENIS

Present in most of the samples and apparently a characteristic species of the subsoil habitat of the Simrishamn Beach (cf. fig. 6).

The species has not previously been recorded from Sweden. It is probable, however, that some of the littoral records of *A. granaria* NIC. should be referred to *remyi*. According to STRENZKE (1954) the species prefers sandy substrata. It has been collected from subsoil water in Finland (Tvärminne) by P. AX (STRENZKE, l. c.).

Onychiurus macfadyeni GISIN

Collected in a few samples at or near surface.

The species has not been previously recorded from Sweden. It was described from Jan Mayen and later recorded from salt meadows on the shores of Sylt Island (cf. STRENZKE 1954).

Proisotoma (Isotomina) thermophila (AXELSSON)

A few specimens were collected at A 3 (surface).

The species is fairly eurytopic and not confined to littoral habitats. It has, however, been found more or less abundantly in the subterranean humid layers of sandy beaches along the German Baltic and North Sea coasts (cf. STRENZKE 1954).

Archisotoma besselsi (PACKARD) STRENZKE, forma *typica*

In most of the samples and apparently a fairly abundant species of the subsoil habitat of the investigated beach. Its distribution is illustrated in fig. 6.

A characteristic species of littoral habitats, preferring open sandy shores and regularly occurring in the subterranean humid layers along the German Baltic and North Sea coasts (cf. STRENZKE 1954 and DELAMARE DEBOUTTEVILLE 1954).

As far as we know the species was not previously recorded from Sweden.

Isotoma (s. str.) *maritima* TULLBERG

In the surface.

Wide-spread along north European coasts. BACKLUND (1945) found it abundantly in Baltic wrackbeds.

Acarida (excl. Halacarida)

Dr. M. SELLNICK kindly undertook to examine our collection of Acarida from the June series, which turned out to be of considerable interest, containing i. a. 3 species new to science. As shown by WILLMANN (1935) and STRENZKE (1951) the humid subterranean sand of the North German beaches is inhabited by a characteristic acarid fauna, and our collection proves the existence of a similar fauna also on Swedish localities of the same type.

Descriptions of two of the new species are in press (SELLNICK 1956).

Parasitus kempersi OUDEMANS

1 ♀ from A 4. The species is found mainly on marine coasts and has been recorded from various European countries including Iceland.

Parasitus fimetorum (BERLESE)

5 ♂♂ from A 3. Known to occur in manure and among rotting sea-weed.

Eugamasus halophilus WILLMANN n. sp.

A 7 1 ♂, A 8 1 L, 1 ♂, 1 ♀. Also obtained by WILLMANN in a deep subsoil sample on the shore of the Island of Juist.

Gyrthydrolaelaps hirtus BERLESE

A 8 1 ♂. A typical littoral species of marine coasts. First recorded from Spain, later also from other European countries.

Lasioseius fucicola (HALBERT)

1 ♂ from A 3. Also from the coasts of England and Ireland.

Typhlodromus tiliae OUDEMANS

1 ♂ from A 3. A European and North American species recorded from numerous localities in deciduous as well as coniferous forests.

Neoseiulus bakeri (GARMAN)

A 1, 1 ♀. Previously recorded only from the trunks of apple trees in North America.

Hypoaspis neglectus WILLMANN

A 8, 3 ♂♂, 3 ♂♂, 1 ♀. Previously recorded only from swamps in Silesia and Austria.

Arctoseius circuliformis (LEITNER)

1 ♀ from A 1. Originally found in manure heaps in Austria. Also found several times in Sweden on various cereal plants (collections of Svenska Växtskyddsanstalten) and in Bavaria below bark on tree trunks.

Arctoseius cetratus SELLNICK

1 ♀ from A 1. First found in old hay on Iceland, later on also recorded from manure heaps in Austria.

Halolaelaps (Saprogamasellus) coxalis WILLMANN n. sp.

1 ♀ from A 3, 1 L and 2 ♂♂ from A 4. The species will be described by Dr. WILLMANN in a separate paper (vide also SELLNICK 1956). It has been previously collected on beaches in northern Germany (Juist and Jadebusen).

Halolaelaps (Saprogamasellus) suecicus SELLNICK n. sp.

1 ♂ and 1 ♀ from A 3.

Halolaelaps (Saprogamasellus) holsaticus VITZTHUM

7 ♂♂ from A 7 and 1 ♂ from A 11. The species was described from material collected among wrack on the beach at Wyk, near Kiel.

Eupodes variegatus C. L. KOCH

A 3 1 specimen, A 5 1 specimen, A 8 2 specimens. Not uncommon under old hay.

Brachychthonius cricoides WEIS-FOGH

1 specimen from A 1. Previously only recorded from Denmark.

Oppia maritima WILLMANN subsp. *acuminata* STRENZKE

A 1 2 specimens. Previously only recorded from humus and peaty soil in Holstein and Pommerania.

Tectocepheus velatus (MICHAEL)

A 1, 10 specimens, 1 ad. Prefers more or less moist biotopes. Occurs throughout Europe.

Halacarida

Two Halacarida were represented in our samples from June, viz.:

Halacarellus capuzinus (LOHMANN), and
H. subterraneus SCHULZ

which are being treated in some detail by WIESER in a separate paper (cf. DAHL and WIESER 1955). *H. capuzinus* is a very eurytopic species also

entering subsoil waters, while *H. subterraneus* is a highly euryhaline species tied to subsoil habitats. It is new to the Swedish fauna. For details on the distribution of the two species cf. fig. 9.

References

AGRELL, I. 1934. Studien über die Verteilung der Collembola auf Triebsandboden. Ent. Tidskr. vol. 55: 3–4, p. 181–248, Stockholm.

ALLGÉN, C. 1949. Über einige südschwedische Brackwasser und Erdnematoden. Kungl. Fysiogr. Sällsk. i Lund Förh. vol. 19.

AX, P. 1951. Die Turbellarien des Eulittorals der Kieler Bucht. Zool. Jahrb. Syst. vol. 80 3/4, p. 277–378, Jena.

– 1954. Die Turbellarienfauna des Küstengrundwassers am finnischen Meerbusen. Acta Zool. Fenn. vol. 81, Helsingfors, 54 p.

BACKLUND, H. O. 1945. Wrack Fauna of Sweden and Finland. Ecology and Chorology. Opusc. Ent. Suppl. 5. Lund.

DAHL, E. 1946. The Amphipoda of the Sound. I. Undersökningar över Öresund 30. Lunds Univ. Årsskr. N. F. Avd. 2 vol. 42: 6. Lund.

DAHL, E. and WIESER, W. 1955. Two marine Halacaridae (Acari) new to the Swedish fauna, and remarks on the taxonomic status of a third species. Kungl. Fysiogr. Sällsk. Förh. vol. 24, Lund. In press.

DELAMARE DEBOUTTEVILLE, C. 1954 a. Collemboles marins de la zone souterraine humide des sables littoreaux. Vie et Milieu, vol. IV: 2 (1953), p. 290–319.

– 1954 b. La faune des eaux souterraines littorales en Algerie. Ibid. vol. IV: 3 (1953), p. 470–503.

DÜRKOP, H. 1935. Collembolen der unterirdischen Feuchtzone am Meeresstrande der Kielerbucht. Schr. Naturw. Ver. Schleswig-Holstein vol. 20: 2, p. 422–434.

GERLACH, S. 1953. Die Nematodenfauna der Uferzonen und des Küstengrundwassers am Finnischen Meerbusen. Acta Zool. Fenn. vol. 73.

KARLING, T. G. 1954. Über einige Kleintiere des Meeressandes des Nordsee-Ostsee-Gebietes. Ark. f. Zool. Serie 2, col. 7: 14, p. 241–249, Stockholm.

KARLING, T. G. and KINNANDER, H. 1953. Några virvelmaskar från Östersjön. Svensk Faun. Revy 1953 no. 3, p. 73–79, Linköping.

KINNE, O. 1954. Experimentelle Untersuchungen über den Einfluss des Salzgehaltes auf die Hitzeresistens von Brackwassertieren. Zool. Anz. vol. 152: 1/2, p. 10–16, Leipzig.

KNÖLLNER, F. H. 1935. Ökologische und systematische Untersuchungen über litorale und marine Oligochaeten der Kieler Bucht. Zool. Jahrb. Syst. vol. 66, p. 425–512, Jena.

NOODT, W. 1955. Sandstrand-Copepoden von der schwedischen Ostküste. Kungl. Fysiogr. Sällsk. Förh. vol. 24, Lund. In press.

SCHNEIDER, W. 1939. Freilebende und pflanzenparasitische Nematoden. Tierw. Deutschl. Part 36: 2, 1. 260 p. Jena.

SELLNICK, M. 1956. Zwei neue Milbenarten aus Küstengrundwasser von Simrishamn an der südlichen Ostküste der Provinz Skåne in Schweden. Kungl. Fysiogr. Sällsk. Förh. vol. 25, Lund. In press.

Table 1.

The distribution of the species obtained on the Simrishamn Beach.

Species name	Sample number															
	A 1	A 2	B 1	A 3 June	A 3 Oct.	A 4	A 5	B 2	A 6 June	A 6 Oct.	A 7	A 8	A 9	A 9–10 Oct.	A 10	A 11
Turbellaria																
Macrostomum curvituba	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.
Archilopsis unipunctata	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Coelogynopora schultzei	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.
Bothriomolus balticus	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.
Vejdovskya simrisiensis	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.
Promesostoma cochlearis	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Proschizorhynchus gullmarensis	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Nematoda																
Adoncholaimus lepidus	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.
Eurystomina litorale	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.
Paracyatholaimus intermedius	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Neochromadora attenuata	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Theristus heteroscanicus	.	.	+	.	.	.	.	+	+	.	.	.	.	.	+	.
Monhystera filiformis	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Monhystera dahli	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhabditis marina septentrionalis	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Gastrotricha																
Turbanella lutheri	.	+	+	.	.	.	+	+	.	.	+	.	.	.	.	+
Polychaeta																
Stygocapitella subterranea	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.
Oligochaeta																
Enchytraeus albidus	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Pachydrilus lineatus	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.
Fridericia pseudoargentea	.	.	.	.	+	.	.	.	.	+	.	.	.	+	.	.
F. ? bulbosa	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Aktedrilus *monospermathecus*	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.
Crustacea																
Itunella mülleri	.	.	.	.	.	+	.	+	.	.	+	.	+	.	+	.
Nitocra fallaciosa	.	+	+	.	.	.	+	+	.	.	+	.	.	.	.	.
Remanea arenicola	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.
Schizopera clandestina	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
S. inornata	.	+	+	.	.	+	+	+	+	.	+	.	.	.	.	.
Paraleptastacus spinicauda	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Acarida																
Parasitus kempersi	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
P. fimetorum	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Eugamasus halophilus	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
Cyrthydrolaelaps hirtus	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Lasioseius fucicola	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Typhlodromus tiliae	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Neoseiulus bakeri	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypoaspis neglectus	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Arctoseius circuliformis	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A. cetratus	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Halolaelaps coxalis	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.
H. suecicus	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
H. holsaticus	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+
Euppdes variegatus	.	.	.	+	.	.	+	.	.	.	.	+	.	.	.	.
Brachychthonius cricoides	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oppia maritima ssp. acuminata	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tectocepheus velatus	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Halacarida																
Halacarellus capuzinus	.	+	+	.	.	.	+	+	+	.	+	.	.	.	.	.
H. subterraneus	.	.	.	.	.	.	+	+	+	.	+	.	.	.	+	+
Collembola																
Hypogastrura viatica	+	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.
H. vernalis	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.
H. armata-group	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.
Friesea mirabilis	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.
Anurida remyi	+	+	+	+	.	.	+	+	.	.	+	+	.	.	+	+
Onychiurus macfadyeni	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.
Proisotoma thermophila	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Archisotoma besselsi	+	+	+	+	.	.	+	+	+	.	+	+	.	.	+	+
Isotoma maritima	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.

STRENZKE, K. 1951. Notizen über die Milben und Collembolen der unterirdischen Feuchtzone des Nord- und Ostseestrandes. Kieler Meeresforsch. vol. 8: 1. Kiel. P. 82–85.

– 1954. Verbreitung und Systematik der Collembolen der deutschen Nord- und Ostseeküste. Veröff. Inst. Meeresforsch. Bremerhaven. Vol. 3. Bremen 1954, p. 46–65.

TIMM, R. W. 1952. A survey of the marine nematodes of Chesapeake Bay, Maryland. Chesapeake Biological Lab., Solomons Isl., Maryland. Publ. 95.

WIESER, W. 1955. Turbanella lutheri Remane var. scanica nov. var., ein neues Gastrotrich aus dem Grundwasser der schwedische Ostseeküste. Kungl. Fysiogr. Sällsk. Förh. vol. 24: 16. Lund. 5 p.

WILLMANN, C. 1935. Über eine eigenartige Milbenfauna im Küstengrundwasser der Kieler Bucht. Schr. Naturw. Ver. Schleswig-Holstein vol. 20: 2, p. 422–434.

Tryckt den 3 jan. 1956.