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An Interstitial Fauna Transect of a Solomon Islands Sandy Beach

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An interstitial fauna transect of a Solomon Islands sandy beach

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[Plates 75 and 76]

Surface sand samples were collected from a number of stations arranged down a transect of the beach at Komimbo Bay, west Guadalcanal. The included interstitial sand animals have been identified to generic level and their distribution and relative numbers are described. The transect was surveyed and the sand samples have been subjected to a particle size analysis.

Introduction

Very little of either a systematic or an ecological nature has been published on the sand beach interstitial fauna of the South Pacific. Nothing at all has been published on that of the Solomon Islands area. The primary purpose of this study has been the collection of the interstitial animals to ascertain whether or not they are similar in form and habit to those described from the more widely explored beaches of the Northern hemisphere, Southern Africa and Brazil. The emphasis, in a preliminary study of this kind, had clearly to be systematic, but the sampling was carried out in such a way that it would be possible to collect some information of an ecological nature that might prove useful to subsequent workers. It cannot be claimed that this information is quantitative in the strict sense for several reasons. First, only a single sample was taken at each station: secondly, the extraction technique was not sufficiently sophisticated to ensure that every animal was isolated from the sand samples. However, the samples were of the same volume, were collected in the same way in each instance and each was subjected to an identical extraction routine which, by subsequent experimentation, was demonstrated to consistently extract a very large proportion, if not all, of the included fauna.

Komimbo Bay was chosen as the area for study partly because of the interesting animals found in the first exploratory samples, partly because of the complexity of beach types to be found within the one bay and partly because of the availability of accommodation at and transport to the beach itself. Two brief visits to Komimbo Bay were made by the Marine Party as a whole and I was later able to return to the area for a further 3-week period while the Marine Party were making their second visit to the Marovo Lagoon.

Komimbo Bay is situated several miles to the west of Cape Esperance and close to the northern tip of Guadalcanal (figure 170*A*). At its eastern and western extremities the bay is well sheltered by Tongenoti and Kesau Points respectively. The bay opens to the north-west but although the fetch from this quarter is considerable the beach itself is protected for the greater part of its length by an offshore fringing coral reef (figure 170*B*). The reef is separated from the beach proper by a spring-tidal reef flat of varying width. The beach is quite narrow, seldom exceeding 50 ft. in width. Its texture varies considerably along the

2-mile length of the bay ranging from fine grey iron-sand in the one area unprotected by the fringing reef to a coarse clean shell-sand in the area of the described transect and a mixture of shell-sand, mud and coral rubble along the eastern arm. The beach slope is also significantly different in the different areas. Whereas that of the iron-sand beach (figure 177, plate 75) is even and steep that of the transect in figure 178, plate 75, is quite gentle and terminates where the beach joins the spring tidal flat in an abrupt and well-marked step. On the landward side the beach is fringed with several miles of flattish frequently swampy land utilized in some part as coconut plantation. Three small streams discharge into the bay.

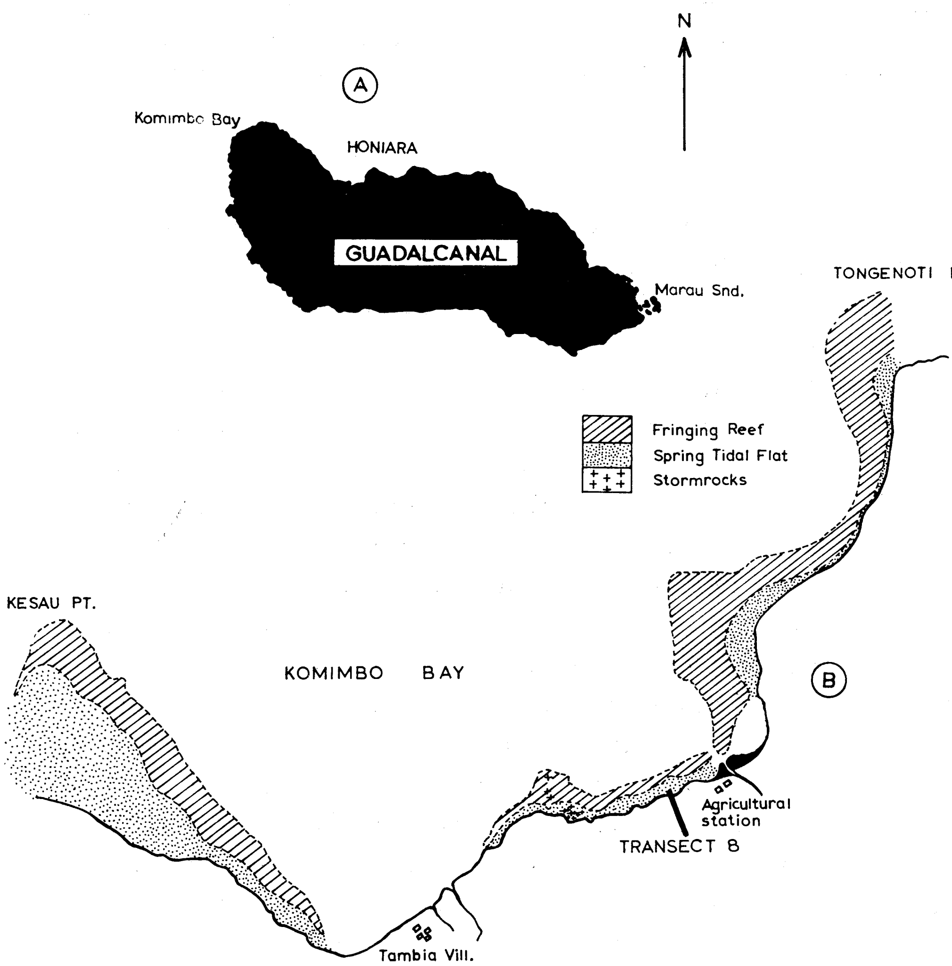

Figure 170. *A*. Location map of Guadalcanal. *B*. Sketch map of Komimbo Bay showing location of Transect 8.

Techniques

The described transect (figure 171 *A*) was number 8 of a series of 14 established along the length of the bay. The transects were set up at right angles to the shore line and traversed the beach between mean low-water springs and high-water springs. The positions of the various transects were chosen for a variety of reasons. In some cases an obvious change in the sediment type occurred, in others the presence of a minor point in the shore line of a particularly exaggerated example of the terminal steps dictated the choice. A series of samples, 200 cm^3 in volume, were taken at 3 ft. intervals up each transect beginning at the terminal step. These were designated as Station X at the step then X–3, X–6 and so on. This technique was followed because of the step itself and the constancy with which it occurred around the bay notwithstanding the varying width of the beach. The uppermost station was determined by the height of high water during the period of the study.

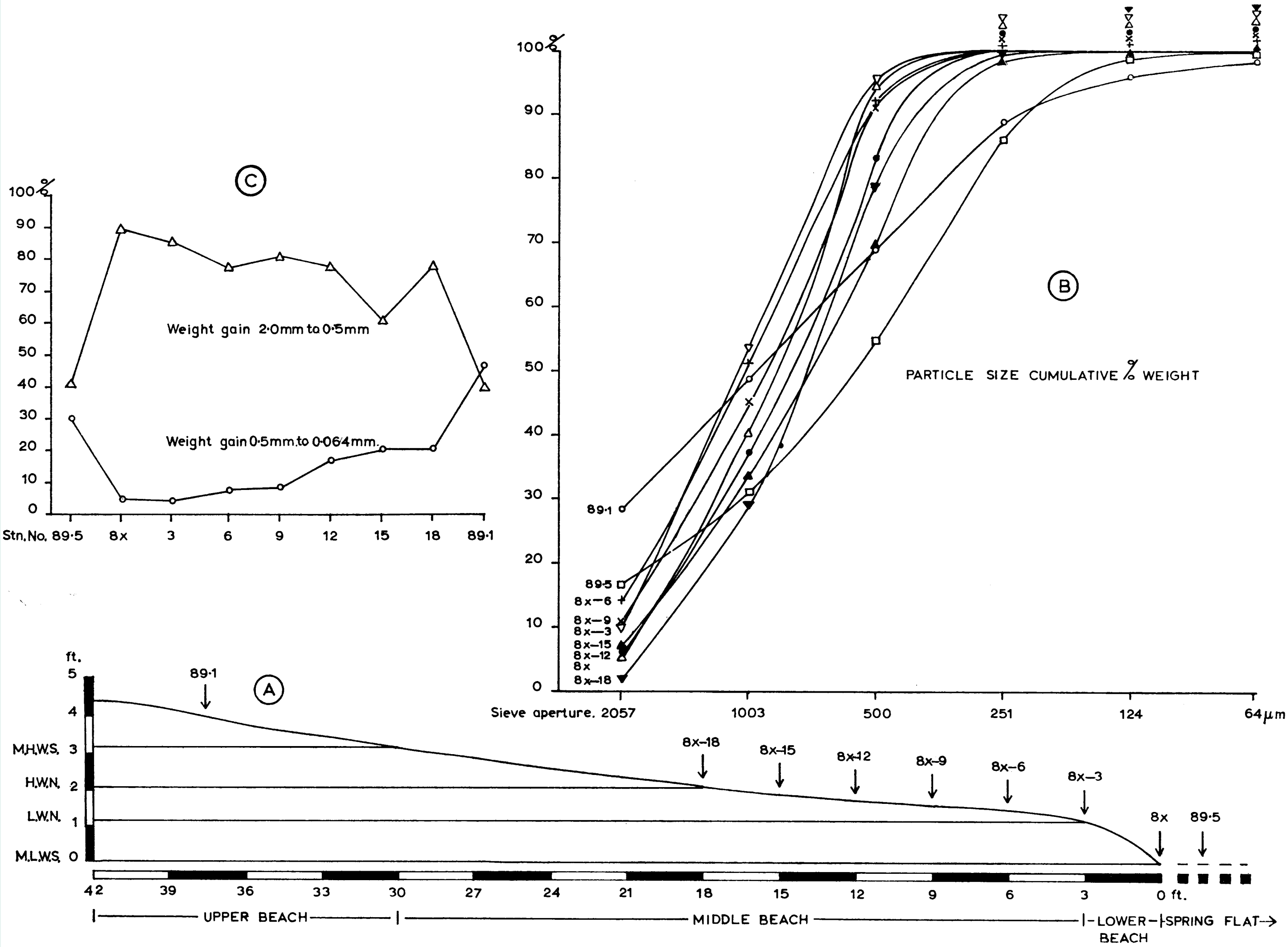

FIGURE 171. *A*. Profile of Transect 8 showing stations. *B*. Particle size cumulative curves. *C*. Weight gain 2·0 to 0·5 mm, and 0·5 to 0·064 mm.

The sample was collected from the top 2 in. of sand at each station. The animals were extracted in the following manner. The sand was placed in a bowl and covered by an inch or so of seawater. The whole was stirred vigorously until a vortex appeared and the supernatant water was then rapidly decanted off through a 100 μm nylon gauze. The procedure was repeated three times and the gauze then inverted in a Petri dish of sea water. The contents of the dish were examined under the microscope, the particularly interesting or delicate animals removed for separate narcotization and preservation where possible and the remainder preserved in bulk in 70% alcohol. The sand was retained for sediment analysis. In several instances the sand was subjected to a more extensive series of extraction routines for the purpose of checking the thoroughness of the method, but very few animals were obtained after the initial series.

The beach

The beach at transect 8 (figure 171 *A*) extends for some 42 ft. above the lower step. The rise apart from that of the step itself is gradual, steepening slightly above high-water neaps. The total rise is 4 ft. 6 in. The particle size cumulative curves (figure 171 *B*) illustrate the relative percentage by weight of the particles. It will be seen that in all the station samples the bulk of the particles are between 1 and 0·25 mm in diameter. The beach proper is clearly composed of coarse to very coarse sand. On the other hand, the spring-tidal flat and the upper beach have a rather smaller median particle size with a much larger fraction of the weight due to particles smaller than 0·25 mm in diameter. This is perhaps more readily demonstrated by the further graph (figure 171 *C*) in which the station samples generally show a gradual trend to increase or decrease respectively and the spring-tidal flat and upper beach samples a much more exaggerated trend.

Despite the coarseness of the lower beach and middle beach sediment the general topography of the beach appears to be relatively stable. I visited the area in several stormy periods during which the profile of the unprotected iron sand beach was considerably altered by heavy seas but in the area of the transect little if any change in the topography occurred. It is probable that the fallen trunks of coconut trees which in some areas traverse the beach at close intervals (figure 179, plate 76), contribute significantly to its stability. Judging by the quantity of marine fouling organisms growing on them, these tree trunks are a relatively permanent feature of the beach and by acting as a series of low groynes they help to restrict lateral movement of the sand. Where these coconut trunks are absent and where the distance between the beach proper and the fringing reef is wider, as near the mouth of the eastern stream, some lateral sand movement does occur and the sediment is in some instances sorted into a remarkably distinct series of beach cusps (figure 180, plate 76).

The composition of the sand is of some interest. It is commonplace to refer to white sand tropical beaches as coral sand beaches. Microscopic examination of the samples showed that in this case such a generalization was quite unjustifiable. The beach below high-water neaps owes very little in particle composition to the adjacent coral reef. The sand is composed instead of a large amount of fine broken shell mixed with fine rock fragments and a very large number of micro-foraminifera. Coral fragments do occur but they are mostly above 2 mm in size and it will be seen from figure 171 *B* that such fragments form only a small proportion of the total. The empty tests of the large reef-dwelling macro-foraminifera (Homotremidae) are also common in the coarsest fraction. Only on the upper beach and the spring-tidal flat are largish quantities of coral debris present and these mostly occur in the fine end of the particle spectrum. It appears likely that, while the wave action on this beach is very gentle, it is sufficiently strong in normal circumstances to be able to carry particles of a size of less than 2 mm up the beach and deposit them. A proportion of

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FIGURE 177. Transect 1, Komimbo Bay showing the width and slope of the open iron-sand type beach.

FIGURE 178. Transect 8, Komimbo Bay showing the width and slope of the beach at about mean sea level.

(*Facing p.* 520)

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FIGURE 179. A view to the east from Transect 8 towards Transect 9 at low water showing the groyne-like disposition of the fallen coconut trunks along the shore.

FIGURE 180. The beach near the mouth of the eastern stream showing the sediments sorted into distinct beach cusps.

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the finer sediment would be carried out by the backwash which is accelerated by the presence of the wave step while the bulk of the remainder are probably leached out beneath the surface of the sand by the considerable seaward movement of water through the coarser particles. The finer particles are deposited on the spring tidal flat when the water velocity diminishes. The organic debris content of the sand, i.e. in the form of plant fragments, is generally very low and the sand, even to a depth of a foot or more, is highly oxygenated with no sign of an H_2S layer.

In summary then, the beach is short, of an even slope terminating in an abrupt step, of stable topographic form and composed of coarse, clean, highly oxygenated sand made up of shell and rock fragments together with a large number of living micro-foraminifera.

The fauna

Protozoa

No attempt was made to collect protozoa other than foraminifera of which the following genera were present in large numbers (many of the animals were clearly alive): *Quinqueloculina*, *Bolivina*, *Reussella*, *Discorbis*, *Calcarina*, *Criboelphidium*, *Amphistegina*, *Cymballoporella*.

Nematoda

In contrast to described European sands very few nematodes were encountered during the survey. Occasional individuals did occur. Only the very distinctive genus *Desmoscolex*, of which a single specimen occurred at Station 8*X*, has so far been identified.

Turbellaria

Because of the limited time available, and the primitive working conditions, it was not possible to preserve these animals by the special methods that are necessary for subsequent identification. All that can be said is that, while turbellarians were present in small numbers, they were in no sense a dominant part of the fauna.

Annelida

Five annelids were present along the transect (figure 172). Of these, four were polychaetes and the fifth a minute oligochaete. Only two, the archaennelid *Nerilla* sp. and the syllid *Sphaerosyllis* sp. occurred in substantial numbers. The oligochaete was confined to the upper part of the transect.

Crustacea

Copepoda

Three harpacticoids and a single cyclopoid copepod occurred along the transect (figure 173). Only the harpacticoid *Phyllopodopsyllus* sp. was present in large numbers and it will be seen that its distribution was restricted to the lower part of the beach. The cyclopoid *Cyclopina* sp., though always numerically small was, on the other hand distributed fairly evenly up the beach.

Isopoda and Tanaidacea

Three isopods were present (figure 175), a *Microcerberas*, an *Angeliera* and a minute *Cirolana* together with a *Tanais*. The distribution pattern is of interest demonstrating the marked difference in habitat of the *Cirolana* from the other species.

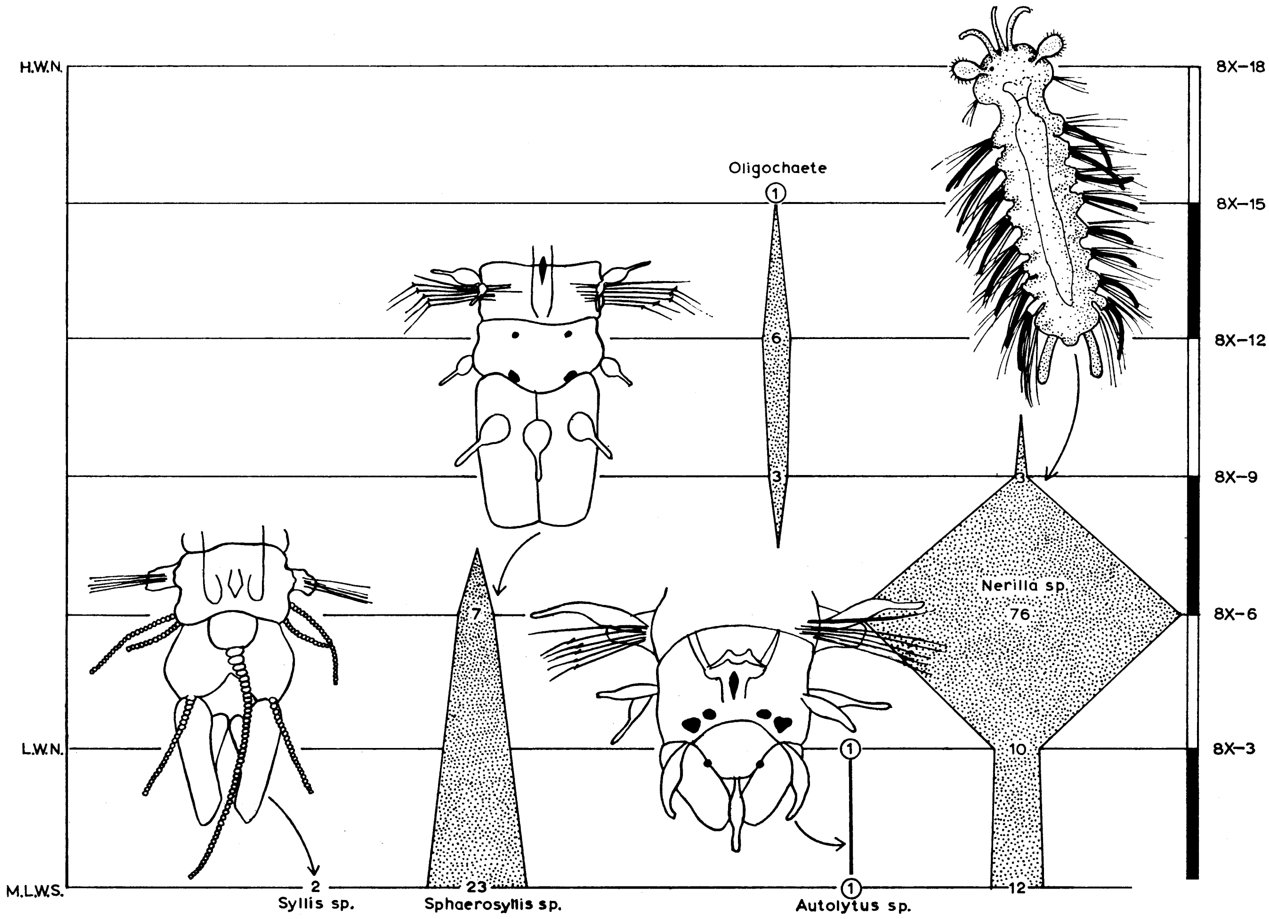

FIGURE 172. The Annelida of Transect 8 together with their distribution.

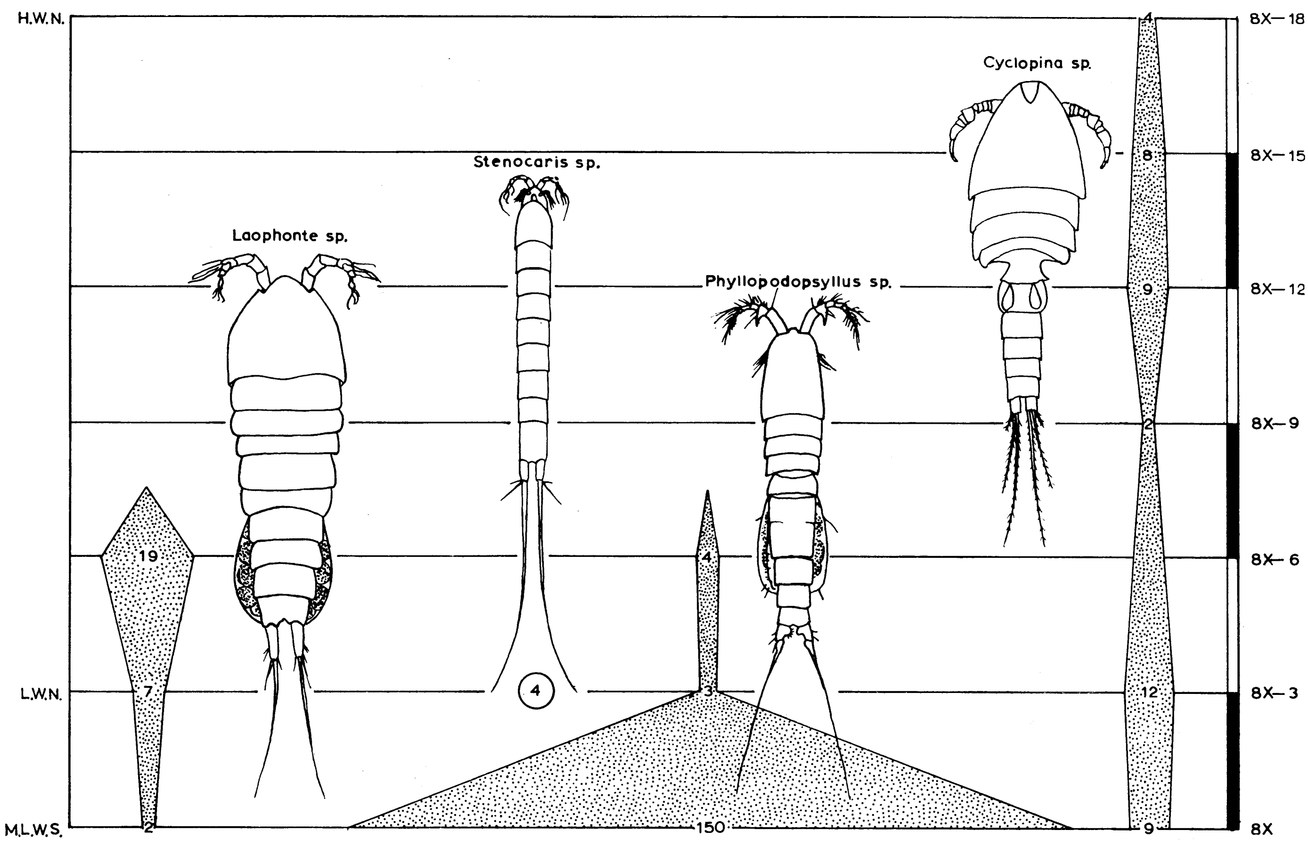

FIGURE 173. The Copepoda of Transect 8 together with their distribution.

Amphipoda

A single amphipod genus *Bogidiella* was present in large numbers and appears to have its population centre some distance up the beach. The absence of *Bogidiella* at Station 8*X*–6 appears to be anomalous and may be a result of the failure to collect more than one sample.

Ostracoda. Three ostracods were present (figure 174), two cytherids and a species of *Polycope*. The cytherids occurred in very large numbers each with a population centre roughly complementary to the other. Polycope was confined to the lower part of the beach.

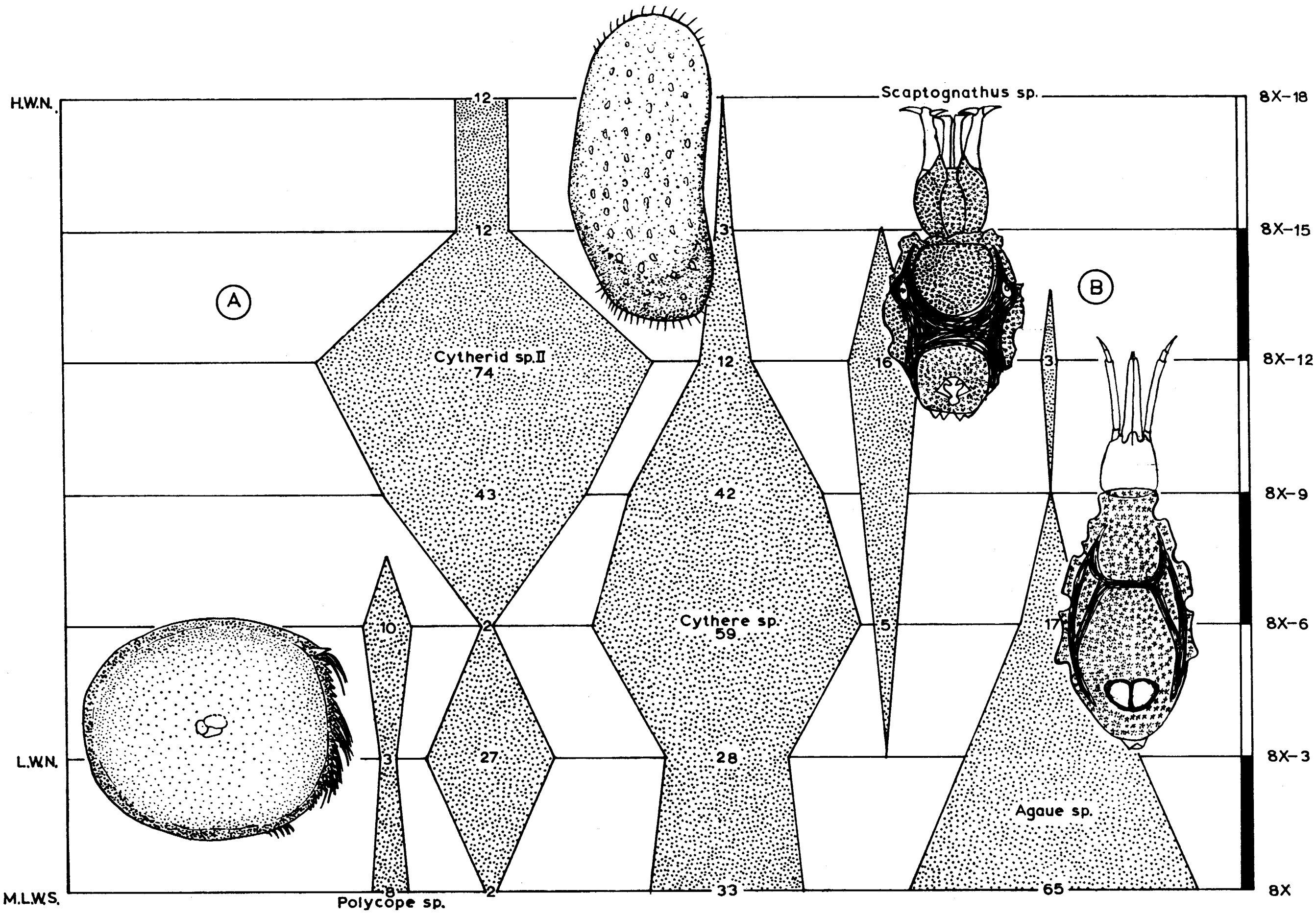

FIGURE 174. *A*. The Ostracoda of Transect 8 together with their distribution. *B*. The Acari of Transect 8 together with their distribution.

Acari

Two well-known genera of halacarid mites were present along the transect. *Agaue* is clearly dominant in the lower regions of the beach and is to some extent replaced by the genus *Scaptognathus* in the upper region.

Mollusca

Prosobranchia

The genus *Caecum* was present in some numbers at two stations.

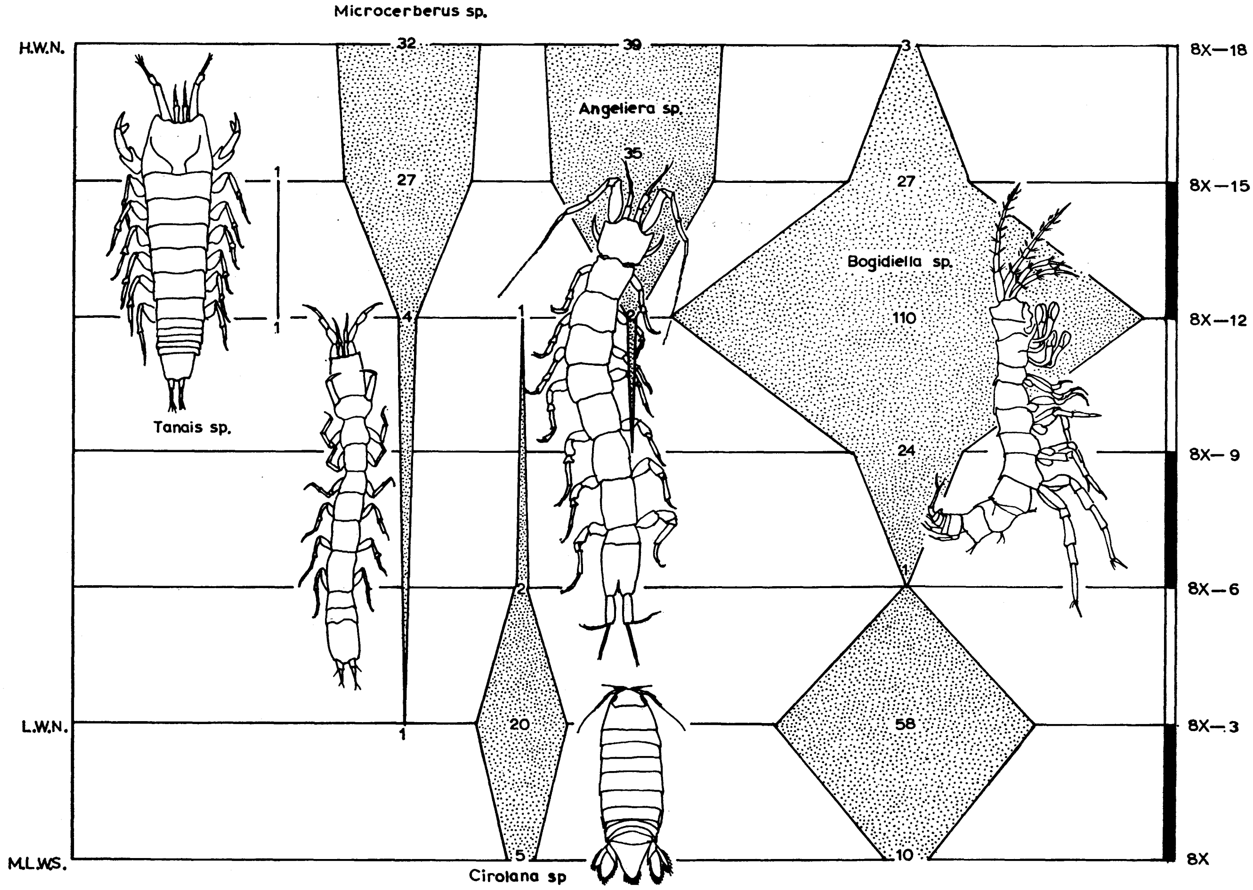

FIGURE 175. The Peracarida of Transect 8 together with their distribution.

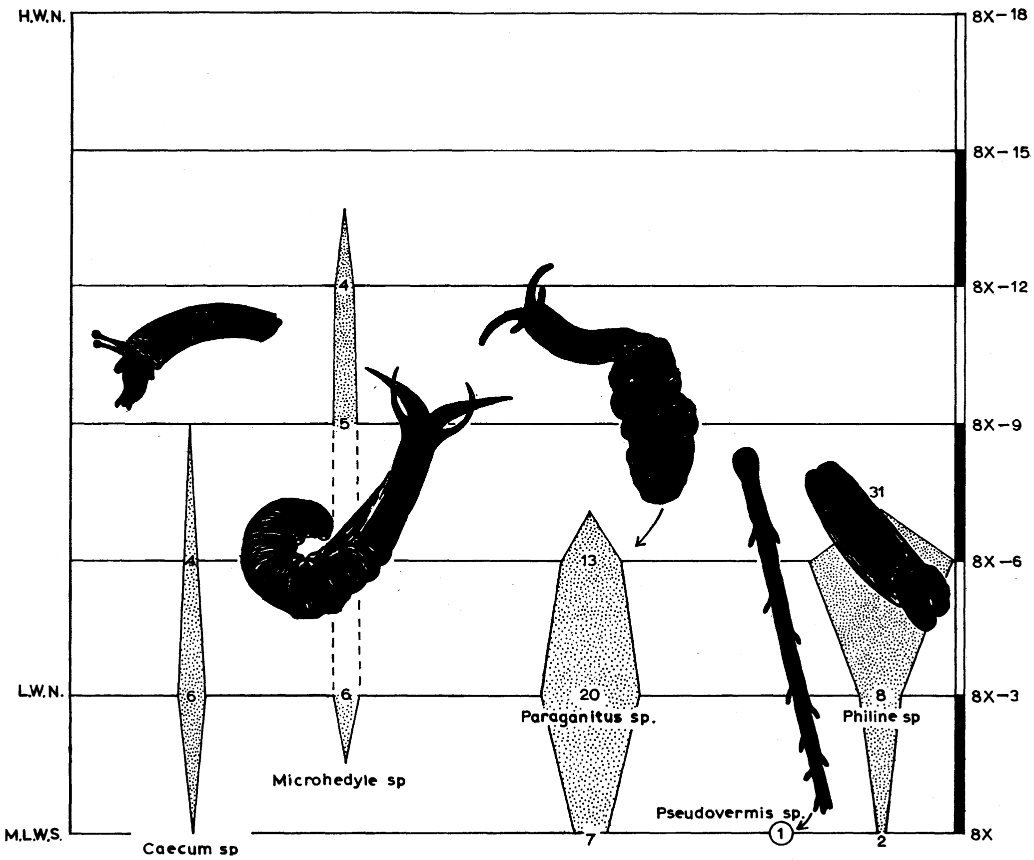

FIGURE 176. The Mollusca of Transect 8 together with their distribution.

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Opisthobranchia

Four interstitial opisthobranchs representing three families were present. All were common with the exception of the minute modified aeolid *Pseudovermis*. The small microhedyle *Paraganitus* was especially common.

Discussion

Although it would clearly be foolhardy to draw conclusions of a wide nature from the data obtained from a single beach transect, some general remarks can reasonably be made. It is clear that the interstitial fauna of the Solomon Islands beaches of this type is not greatly different from that of similar beaches described in other parts of the world. No remarkable new discoveries above the generic level have so far been made though some of the genera and many of the species are clearly new to science. A large number of genera have been recorded from the South Pacific for the first time and some of these, especially the micro-isopods, may be of biogeographical interest. Other genera previously considered to be relatively uncommon are plentiful in this rich environment. Some groups, notably the Nematoda, the Turbellaria and the Copepoda seem to be less common, at least in numbers of species, than elsewhere.

Despite the low latitude of the Solomon Islands and the consequent high average air temperature the interstitial animals are demonstrably present in large numbers quite high on the beach. It appears that the small tidal range and the complex tidal régime, together with the cleanliness and great porosity of the sand, assures the animal population of a tolerable temperature maximum even fairly high on the shore. In fact sand temperatures below high-water neaps seldom exceed 20 °C, a temperature not greatly in excess of that attained by the sands of warm temperate beaches.

I am most grateful to the Royal Society of London for their invitation to participate in the B.S.I.P. expedition, the South Pacific Research Programme Committee of the University of Auckland for granting me funds which enabled me to do so, and the University of Auckland for granting me leave to participate. I am deeply indebted to Professor J. E. Morton of the University of Auckland, the leader of the Marine Party, for his constant encouragement and advice during and after the expedition, and particularly for his generosity in permitting me to remain at Komimbo Bay during the second visit to the Maravo Lagoon when my attendance would have perhaps made his own work easier. Dr M. C. Miller generously gave encouragement and advice at difficult periods both on the expedition and later. Dr R. K. Dell, Director of the Dominion Museum, Wellington, encouraged me greatly during the Marau Sound and Yandina periods and has since offered useful advice on publication.

I am grateful to Mr O. Torling and Mr J. Schenck for making their respective beach cottages in the B.S.I.P. available to me during the Komimbo period and to Mr Ian Gower who took me into his home at Marau Sound. Mr J. Grover, O.B.E., then Director of the B.S.I.P. Geological Survey, made the Komimbo Bay section of the work possible by generously providing me with a vehicle from his Department. I would like to thank

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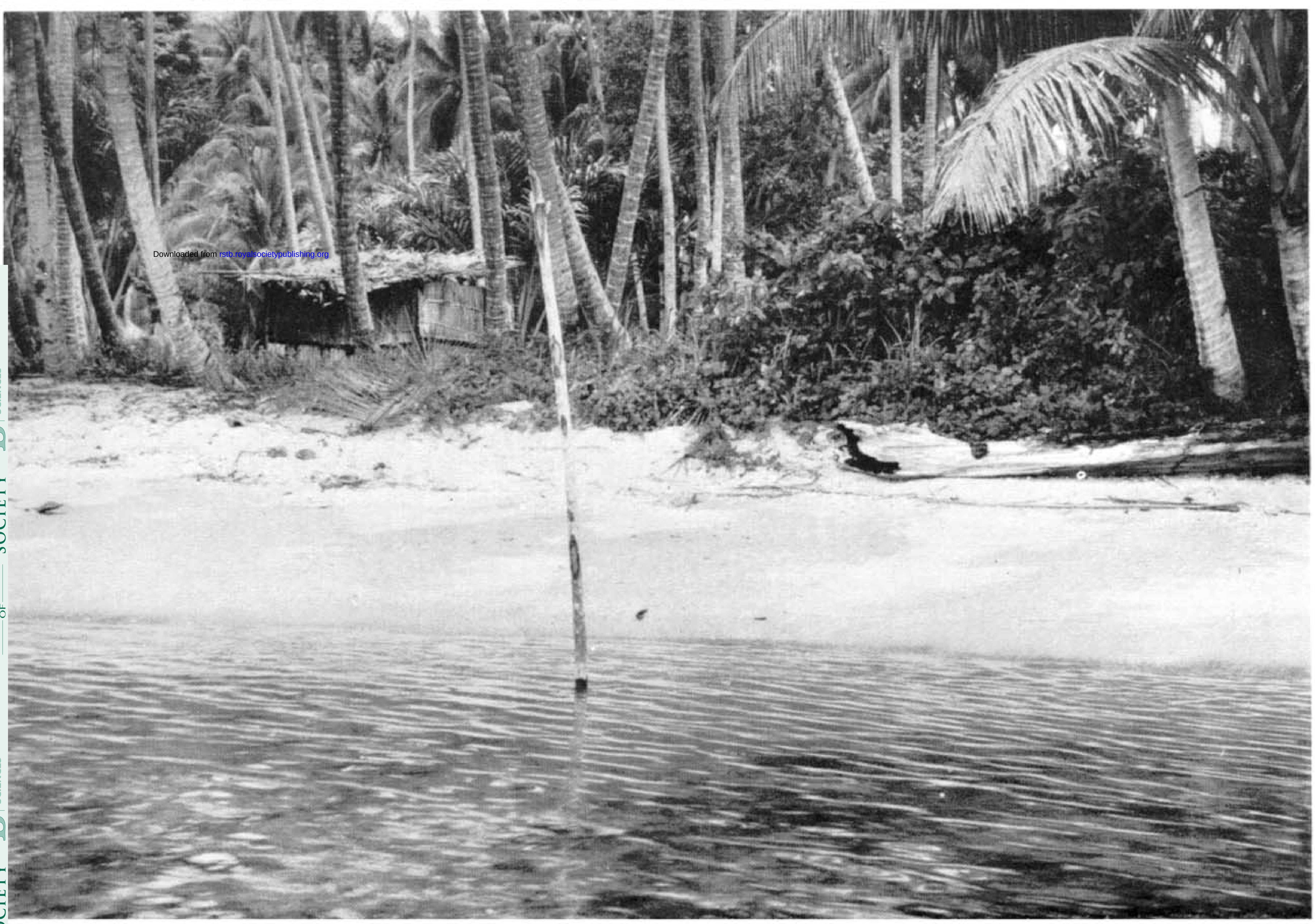

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