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# An Ecological Account of the Marine Interstitial Opisthobranchs of the British Solomon Islands Protectorate

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# An ecological account of the marine interstitial Opisthobranchs of the British Solomon Islands Protectorate

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[Plate 77]

An account of the marine interstitial opisthobranchs collected during the Royal Society of London Expedition to the British Solomon Islands Protectorate (1965) is given. Information on the numbers and distribution of the animals on the beaches is included together with observations on the animals and their habitat.

## Introduction

While the sand beach interstitial fauna survey, described in part in Challis (1969) was designed to collect as many specimens and as much general ecological information as possible one particular group of animals, the minute sand-dwelling opisthobranch mollusca were especially eagerly sought.

Until recently, Challis (1968), there have been no published records of the occurrence of these animals in the marine sands of the South Pacific Ocean. However, interestingly enough, the type genus *Acochlidium* Strubell, 1892, of one of the most frequently encountered orders of this group, the Acochlidiacea Odhner, 1937, was initially erected to accommodate two species of freshwater opisthobranch collected by Strubell from a stream on the island of Amboina in the Banda Sea region of the Indonesian Archipelago a region reasonably close geographically to the B.S.I.P. Although there are subsequent records of the collection of these freshwater animals from a number of localities: Bergh (1895), Flores; Benthem Jutting (1955), Sumba; Bayer & Fehlmann (1960); Palau Islands; there are no earlier records of the occurrence of members of this order or of those families of other orders whose members normally inhabit the interstitial spaces of marine sands. This lack of records of Pacific marine species is surprising for quite intensive work on the systematics of some groups of interstitial animals has been carried out in recent years in North America, New Caledonia and Australia. These animals are sufficiently distinctive to ensure rapid recognition should they be seen and sufficiently interesting to ensure equally rapid publication of such a sighting. It must be assumed that they have not been found before in the Pacific region.

Since 1892 a number of species of three groups of interstitial opisthobranchs the Acochlidiacea, the Philinoglossacea (Hoffmann 1933) and the Pseudovermidae (Pelseneer 1906) have been recorded and described from European and Brazilian waters. I hope to demonstrate in this and subsequent papers that these exceptionally interesting animals do occur in the intertidal sands of the B.S.I.P. and other Pacific island shores, at least some of them in quite substantial numbers, and that they are closely related to those described previously from elsewhere.

The opportunity for an intensive study of the sand beach interstitial fauna presented

itself during the main visit of the Marine Party to Komimbo (Guadalcanal) in mid-August. The fauna of a number of exploratory sand samples collected at intervals along the beach proved to be both rich and interesting and it was decided to erect a series of surveyed transects along the length of the bay and sample as many different types of sediment as possible in the time available.

During these 9 days the fauna was isolated and preserved in bulk from some forty 200 $cm^3$ sand samples. A number of very interesting animals were found, notably the 'micro-isopods' *Microcerberus* and *Angeliera* which occurred in large numbers and the small and specialized amphipod *Bogidiella* which was even more common. Most importantly three species of interstitial sand opisthobranchs were present and reasonably common at stations on several transects towards the middle of the survey area. Of these, two species were members of the family Microhedylidae of the order Acochlidiacea while the third was a minute—though sexually mature—member of the Philinidae of the order Cephalaspidea. Where individuals or numbers of these animals were collected in the general samples as many extra samples as time permitted were taken at the same station.

This discovery of the opisthobranchs, while of the greatest interest, affected the tempo of the work to a considerable degree. Where before it had been acceptable to isolate the fauna from the sand and simply preserve it in bulk for later sorting it now became essential to remove the opisthobranchs for special narcotization and fixation techniques. The description of these very small and taxonomically rather difficult animals involves the details of their internal anatomy and it was important that they be preserved in a condition suitable for histological examination. Consequently when the time allotted to the Komimbo survey came to an end the sampling of the general interstitial fauna transects was incomplete and in addition the need was felt for larger numbers of specimens of two of the opisthobranchs.

It was decided that the results of the work were of sufficient interest to warrant my remaining at Komimbo for the duration of the Marine Party's second visit to the Marovo Lagoon. During the extension to the time at Komimbo substantial numbers of the three original species of opisthobranchs were collected and the general sampling programme was completed. However, despite an accelerated sampling procedure only three specimens of the *Pseudovermis* were taken. This aeolid is an exceptionally active, elongate and labile animal and although great care was taken only one of the specimens was finally preserved in a condition suitable for subsequent sectioning. Consequently it was with some reluctance that the work at Komimbo Bay was terminated as the party prepared to move to a new and quite unexplored study area, Marau Sound, at the eastern and opposite extremity of Guadalcanal.

Within a short time of our arrival it became clear that Marau Sound with its many offshore islands, its living coral reef and its large number of sand beaches and flats was potentially the most interesting area yet visited. Several of the beaches appeared to have the approximate characteristics of the richer part of Komimbo Bay and conveniently enough the narrow beach fringing the inner shore of Maraunibina, the small island immediately opposite the camp site, seemed very similar to the one from which *Pseudovermis* had been collected at Komimbo.

Because of the need to collect as many specimens as possible of this animal it was

decided to concentrate on this aspect of the interstitial fauna study. This decision meant the virtual abandonment of the more formal ecological work of the sort carried out at Komimbo, but it permitted a much larger number of samples to be processed in the time available.

After a day or two's collection and examination of sand, specimens of the two Komimbo Microhedylidae were being recovered from the beach on the sheltered side of Maraunibina Island. Shortly afterwards a *Pseudovermis*, that was undoubtedly the same as the Komimbo species, was recovered from the Maraunibina sand and by the end of the period enough specimens had been collected to ensure a reasonably adequate supply of histological material. During this work two other sand opisthobranchs were found. The first was a very small *Microhedyle* of a distinctly new type. The animal was not particularly common and was restricted to the Maraunibina shore, but a reasonable number were collected and preserved. The second was a further specimen of the *Philinoglossa* sp. (Hertling 1932), of which a single animal had been collected but not identified at Komimbo Bay. No specimens of the Komimbo *Philine* were collected during the Marau Sound period.

Towards the end of the expedition, the main Marine Party spent some time at Banika Island in the Russell Group. The prime concern of the party, during this period, was the exposure/shelter index study (Morton & Challis 1969) and only limited time was available for interstitial work. However, some samples were taken from Banika beach and several of the previously collected opisthobranchs were found in small numbers. Fortunately, a third specimen of the *Philinoglossa* was taken and preserved in excellent condition. These collections were of considerable use for not only did they add a further locality to the list but because electric power was available at Yandina it was possible to use the electronic flash unit to photograph the animals alive through the stereo microscope.

At Port Vila on the island of Efate in the New Hebrides we interrupted our home journey for 2 days in order to make a rapid comparison between those shores we had seen in the B.S.I.P. and the shores close to Vila. Although we were primarily concerned with the structure and biology of the spectacular algal ridge near Pango, a few random sand samples were collected from the more sheltered area of Pango beach. From these four samples two specimens of the B.S.I.P. *Pseudovermis* were recovered together with two specimens of the *Philine* and a large number of specimens of the most common Komimbo *Microhedyle*.

## Techniques

The way in which the Komimbo Bay transects were established together with an explanation of the terminology used is given in Challis (1969). Station 'X' is positioned on the terminal step of the beach proper and the remainder of the station X–3, X–6, etc., are arranged at 3 ft. intervals up the transect towards high water.

The method used to extract the fauna from the sand has also been described in this paper. Where opisthobranchs were present they were separated from the remainder of the fauna, sorted into species and sketches were made of the living animals. They were narcotized in small groups in a solution of propylene phenoxetol in sea water. This substance was introduced to the watch-glass in very small quantities on the tip of a fine needle.


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Phenoxetol though miscible with water tends to remain in suspension in very small oily droplets. It proved to be most important that the animals should not come into direct contact with these droplets. Where this did occur they invariably displayed a violent shock reaction and at the same time sloughed off large pieces of epidermis. If contact with the chemical was prolonged for more than a few seconds the animals disintegrated completely. While narcotization progressed the animals were kept under constant observation and when they were moribund the water was pipetted away and the watch-glass quickly flooded with very hot Bouin's fluid. They were kept in Bouin for about 12 h, then washed several times and finally stored in 70 % alcohol.

These specimens have subsequently been used in several ways. Radula and hard part preparations were prepared by carefully dissolving the animals in hot 10 % KOH in a watch glass and mounting the hard parts in polyvinyl-lactophenol (P.V.L.P.) (Salmon 1949) to which a small quantity of Chlorozol Black E had been added. Further specimens have been sectioned and stained in a variety of ways for histological examination and reconstruction. Some specimens were mounted whole in P.V.L.P. and although little internal detail can be seen some superficial inclusions such as integumentary spicules and the nematocysts present in the cerata of the *Pseudovermis* can be very clearly seen under phase contrast.

Where circumstances permitted the living animals were photographed with a 35 mm single lens reflex camera coupled to one eyepiece of the stereomicroscope. An electronic flash unit permitted photographs at quite high magnifications to be taken even though the animals glided rapidly across the field of view. Although few of these photographs are suitable for publication they are, nevertheless, most useful in assisting in the production of drawings that show accurately the shape and proportions of the living animals.

## The beaches

A description of the Komimbo sandy shore in general and of the beach at transect 8 in particular is given by Challis (1969). The remainder of the Komimbo particle size analysis has yet to be completed and it is hoped to make this information available, together with a more comprehensive account of the interstitial fauna later.

Little precise information can be offered on the beaches examined during the later part of the expedition when the search for further specimens of sand opisthobranchs dominated the work. However, some general observations may be of use to those engaged in subsequent studies of this nature.

That part of the beach on Maraunibina Island which became the focal point of the interstitial work at Marau was a short strip on the western side which extended northwards for about 150 yards from the southern tip of the island. As will be seen from figure 183 the area is on the sheltered landward side of the island and is at the same time well protected by a parallel fringing reef. The beach is seldom more than 20 ft. in width and like that at Komimbo ends in an abrupt 'step'.

Some samples were taken from the beach on the mainland opposite the island and a small number of opisthobranchs were recovered from this locality. At this point the shore is different from that on Maraunibina. There is no beach 'step' and the slope is gentle and

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FIGURE 184. A general view of the foreshore near Paruru showing the narrow beach and the extensive low tidal rubble flat.

FIGURE 185. A view of the shore near Station 5 showing the narrow beach and rubble flat together with a litter of groyne-like coconut trunks.

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even. At its lower limit the beach merges with a rubble strewn low tidal flat. The sand was moderately coarse but silty and contained a large amount of terrestrial organic debris. From the photographs, figures 184, 185, plate 77, it will be seen that this beach is again very sheltered, and, in common with most of the B.S.I.P. shores visited, the sand is restricted to a relatively narrow area between the upper shore and the lower flat.

Banika beach in the Russell group was similar to Komimbo and the few opisthobranchs collected were taken from that end of the beach that was sheltered by dead offshore coral boulders.

Pango beach near Port Vila in the New Hebrides was much wider than any of the sandy shores examined in the Solomon Islands though in the area from which the samples were taken it is similarly sheltered. The sand was very clean and coarse but of a different composition to that of Komimbo or Marau. There were very few rock fragments and many fewer foraminiferan tests. The main components were broken shell and hard coral fragments together with some remnants of encrusting coralline algae from the nearby coral ridge.

It appears that several factors characterize the sandy beaches on which the interstitial opisthobranchs may be collected. They are usually sheltered to a high degree by low tidal offshore fringing reefs or rubble flats. The sand is always coarse in texture and usually includes a large proportion of fine broken shell fragments. The beach topography appears to be very stable in normal circumstances.

## The interstitial opisthobranchs

The systematic account of the interstitial opisthobranchs is nearing completion and several papers have been submitted. The description of only one species *Paraganitus ellynnae* (Challis 1968) has so far been published. It will therefore be necessary to use only generic names in this account. However, comparable species have been described in most of the genera and these names will be used to differentiate the animals where several of the B.S.I.P. species are members of the same genus.

### *Philine* sp.

The first interstitial opisthobranch to be collected on the expedition was the minute *Philine* (figure 181*C*) discovered at Komimbo Bay. The animal ranged in length from approximately 2 to 2·5 mm. The larger animals were sexually mature.

The external appearance of this slug is reasonably typical of the genus, though the ratio of length of the head shield to that of the visceral hump is more exaggerated than it is in the larger members of the genus. The animal has lost the wide wedge-shaped profile of its larger relatives and has become markedly elongate. This is an interesting example of the general adaptive tendency to vermiformity exhibited by many interstitial members of otherwise less elongate families of animals (Swedmark 1964). Internally the radula and gizzard plates are of the *Philine* type though the organization of the mantle cavity appears to be rather different from that of the described species. Sub-epidermal eyes and a reduced internal shell are present.

An attempt was made to investigate the feeding behaviour of this animal. It seems

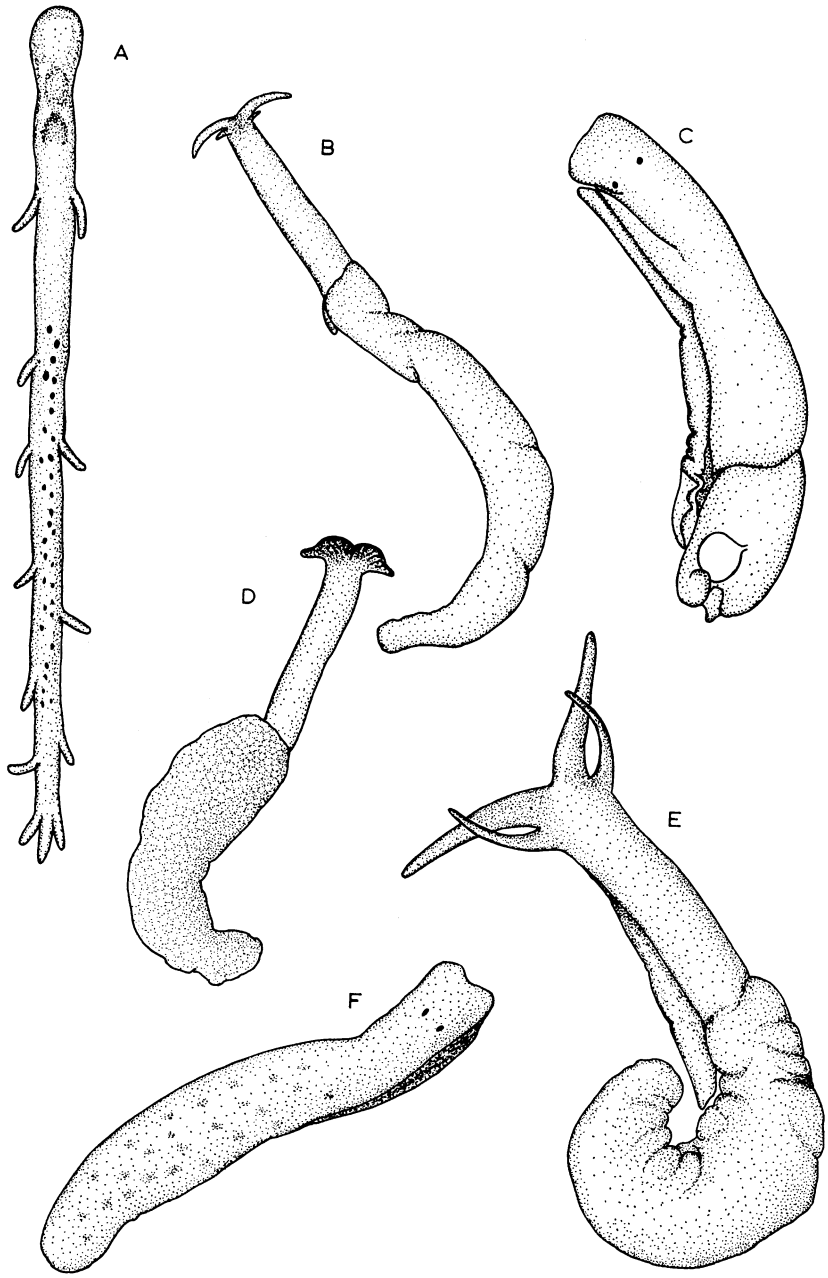


FIGURE 181. The interstitial opisthobranchs collected during the expedition. *A*, *Pseudovermis* sp.; *B*, *Paraganitus ellynnae*; *C*, *Philine* sp.; *D*, *Microhedyle* sp. 2; *E*, *Microhedyle* sp. 1; *F*, *Philinoglossa* sp. The drawings are taken from photographs of the living animals.

reasonable to infer from the well-developed gizzard that the food crushing habit of the larger members of the family has been retained. It is known that some of the smaller *Philine* species feed upon micro-foraminifera (W. B. Rudman, pers. comm.) and the presence of large numbers of these protozoans in the sand suggests that this animal might do the same. The *Philine* were placed in sand to which known numbers of a variety of foraminifera species had been added. They were left undisturbed and the foraminifera were counted at intervals. However, even after a week none of the presumed prey animals had been taken. Although the result of the experiment was negative some species of *Philine*


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are notoriously difficult to feed in artificial conditions and a similar experiment in a more controlled environment could produce a different result.

The distribution diagram (figure 182*C*) shows the animal to have been present in small numbers at several stations on five transects. The actual numbers collected in each sample are shown in table 36 while the numbers on the distribution diagrams for this and the other species are simple averages. *Philine* was the only opisthobranch collected on Transect 3, an area subject to contamination by fresh water from the nearby stream. Several minute but typically *Philine* type spawn masses were collected on Transects 3 and 4. This animal

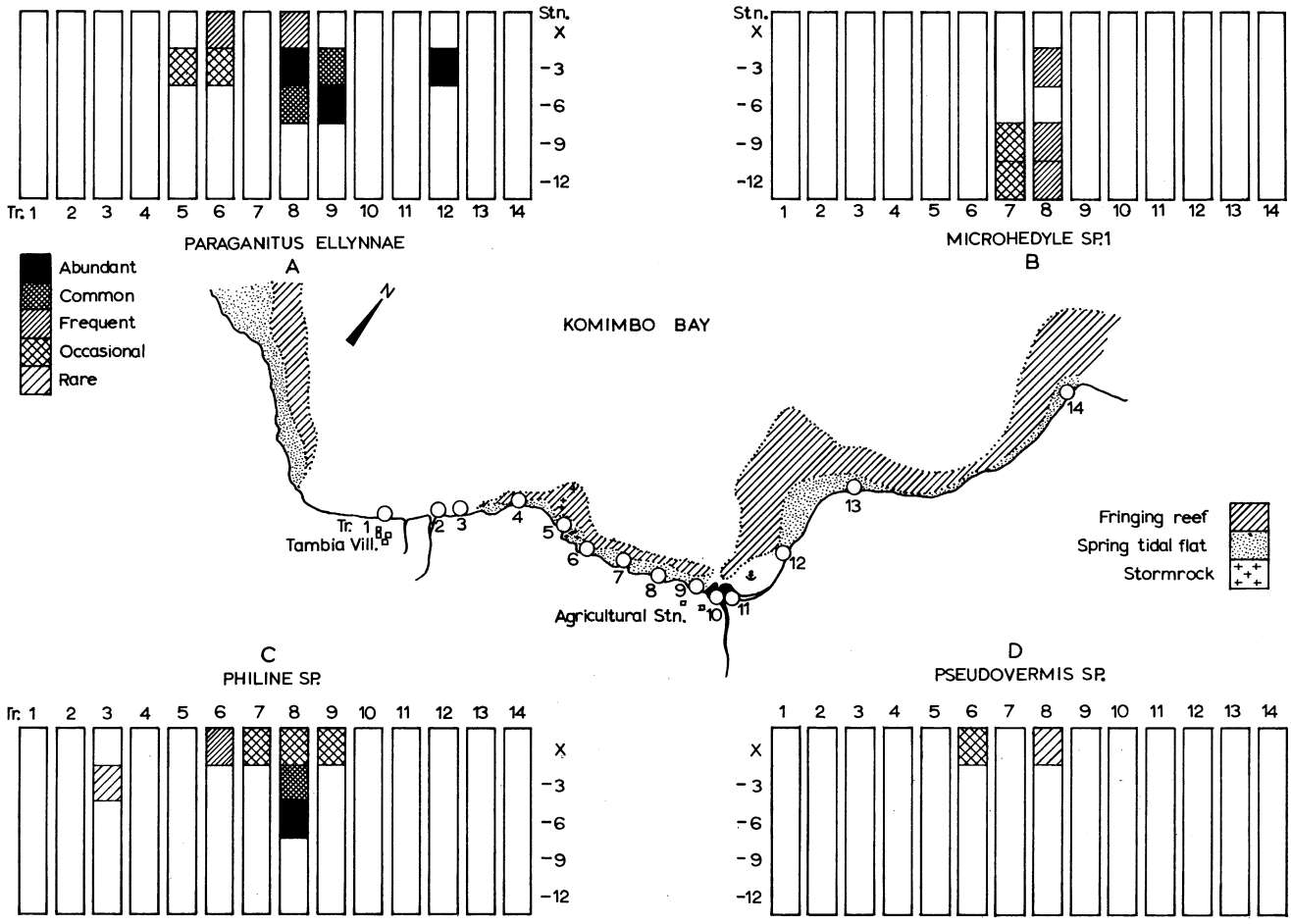


FIGURE 182. The distribution and abundance of the opisthobranchs collected at Komimbo Bay together with a sketch map of the area showing the locality of the transects. Abundance criteria: The classification is based on a simple average of the number of specimens taken at any one station. Rare, 1; occasional, 2; frequent, 4; common, 8; abundant, 16 or more.

was subsequently collected from Pango beach in the New Hebrides but from no other locality.

The discovery of this *Philine* is of some interest, for while several very small members of the genus have been described it has never been suggested that they are interstitial opisthobranchs in the same sense as are the Acochlidiacea. It seems likely that this species is, in fact, a truly interstitial member of the genus.

TABLE 36. THE NUMBER OF INTERSTITIAL OPISTHOBRANCHS RECOVERED FROM THOSE INDIVIDUAL SAMPLES IN WHICH THEY OCCURRED TOGETHER WITH LOCALITIES AND STATION NUMBERS

*Philine* sp.

| locality | stn. | no. |
|---|---|---|
| Komimbo | 3X | S |
| | −3 | 1 |
| | 6X | 4 |
| | 7X | 3S |
| | 8X | 2 |
| | | 2 |
| | −3 | 6 |
| | −6 | 10 |
| | | 31 |
| | 9X | 2 |
| | −3 | S |
| Pango | | 2 |
| total | | 64 |

*P. ellynnae*

| locality | stn. | no. |
|---|---|---|
| Komimbo | 5X−3 | 2 |
| | 6X | 1 |
| | | 8 |
| | −3 | 2 |
| | 8X | 17 |
| | | 2 |
| | | 3 |
| | −3 | 17 |
| | | 9 |
| | | 5 |
| | | 21 |
| | | 49 |
| | −6 | 12 |
| | | 15 |
| | 9X−3 | 11 |
| | −6 | 70 |
| | 12X−3 | 33 |
| Marau Snd. | 2X | 10 |
| | 3X | 4 |
| | | 6 |
| | | 23 |
| | | 19 |
| | | 24 |
| | | 37 |
| | | 7 |
| | 4X | 4 |
| | | 1 |
| | | 2 |
| | | 1 |
| | 5X | 1 |
| Banika Bch. | | 25 |
| total | | 441 |

*Microhedyle* sp. 1

| locality | stn. | no. |
|---|---|---|
| Komimbo | 8X−3 | 6 |
| | −9 | 8 |
| | | 6 |
| | −12 | 2 |
| | | 5 |
| | | 3 |
| | 7X−9 | 2 |
| | −12 | 2 |
| Marau Snd. | 1X | 1 |
| | | 3 |
| | 2X | 2 |
| | 3X | 2 |
| | | 3 |
| | | 2 |
| | | 12 |
| | | 2 |
| | | 12 |
| | | 7 |
| | | 1 |
| | 5X | 4 |
| Banika Bch. | | 3 |
| total | | 86 |

*Microhedyle* sp. 2

| locality | stn. | no. |
|---|---|---|
| Marau Snd. | 1X | 2 |
| | | 3 |
| | 2X | 3 |
| | 3X | 1 |
| | | 2 |
| | | 7 |
| | | 2 |
| | | 1 |
| | | 1 |
| | | 4 |
| | 4X | 2 |
| | 5X | 3 |
| Banika Bch. | | 3 |
| | | 2 |
| | | 4 |
| | | 2 |
| | | 3 |
| | | 1 |
| total | | 46 |

*Pseudovermis* sp.

| locality | stn. | no. |
|---|---|---|
| Komimbo | 6X | 2 |
| | 8X | 1 |
| Marau Snd. | 3X | 3 |
| | | 3 |
| | | 1 |
| | | 4 |
| | | 1 |
| | | 1 |
| | | 2 |
| | | 3 |
| Banika Bch. | | 2 |
| Pango Bch. | | 2 |
| total | | 25 |

*Philinoglossa* sp.

| locality | stn. | no. |
|---|---|---|
| Komimbo | 8X | 1 |
| Marau Snd. | 3X | 1 |
| Banika Bch. | | 1 |
| total | | 3 |

'S' = spawn.


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*Paraganitus ellynnae*

Shortly after the discovery of the *Philine* a small member of the Microhedylidae, since described under the name *Paraganitus ellynnae*, was collected in large numbers from several Komimbo transects. This animal subsequently proved to be the most common of the sand-dwelling opisthobranchs encountered during the expedition.

*P. ellynnae* (figure 181*B*) is approximately 1·8 mm in length when sexually mature. Its general external appearance is reasonably similar to that of other members of the family. The foot is very short and terminates immediately behind the anterior end of the visceral sac. This is dragged behind and appears to be slightly buoyant so that it floats a little above the substratum.

Internally several features of the anatomy differentiate the animal from the species of the genus *Microhedyle*. In 1953 Ernest Marcus erected the new genus and species *Ganitus evelinae* to accommodate a small member of the Microhedylidae he collected in large numbers from the littoral sands of the island of São Sebastião near São Paulo in Brazil. This animal lacked rhinophores and possessed a most unusual uniseriate saccoglossan-like radula. The radula of *P. ellynnae* is identical to that described by Marcus (1953) but the animal has small but quite distinct rhinophores. While recognizing that the new animal is systematically very close to *G. evelinae* I reluctantly decided on the grounds of this and some internal differences to erect a further genus. A comprehensive study of the two animals may make the amalgamation of the two genera advisable.

The distribution diagram (figure 182*A*) shows the animal to have been present in some numbers at five transects in the Komimbo Bay study area. *P. ellynnae* was again common at Marau Sound except at transect 1 (figure 183). It was subsequently collected at Banika Beach in the Russell Islands. The microdistribution was very uneven, and where several samples were collected at the same station, they yielded widely different numbers of this animal (table 36).

*Microhedyle* sp. 1

In the samples on transect 8 and especially in those taken from stations a little higher up the shore a number of specimens of a further member of the Microhedylidae occurred. This animal (figure 181*E*) has yet to be described. Externally it is very similar to *Microhedyle tyrtowii* (Kowalevsky 1901). The animal is approximately 2·5 mm long and is readily distinguishable from *P. ellynnae*. As in the latter species the foot is short and attached only to the anterior trunk. The visceral sac is dragged behind and is often curved anteriorly so that the animal roughly resembles a question mark. The oral tentacles are long, very thick at the base and taper regularly to the distal tip. These tentacles are typically held at right angles to the mid-line. The rhinophores are also long and are typically carried pointing forward above the oral tentacles very like a pair of curved horns. Internally, the radula is very like that described for several members of the genus.

The distribution diagram (figure 182*B*) shows the animal to have been collected at Komimbo only on transects 8 and 9 and the population centre appears to be a little higher on the beach than that of *P. ellynnae*. The number of specimens collected was much smaller. This *Microhedyle* was also collected from several localities at Marau Sound (figure 183) and from Banika beach. The number of specimens taken in individual samples is shown in table 36.

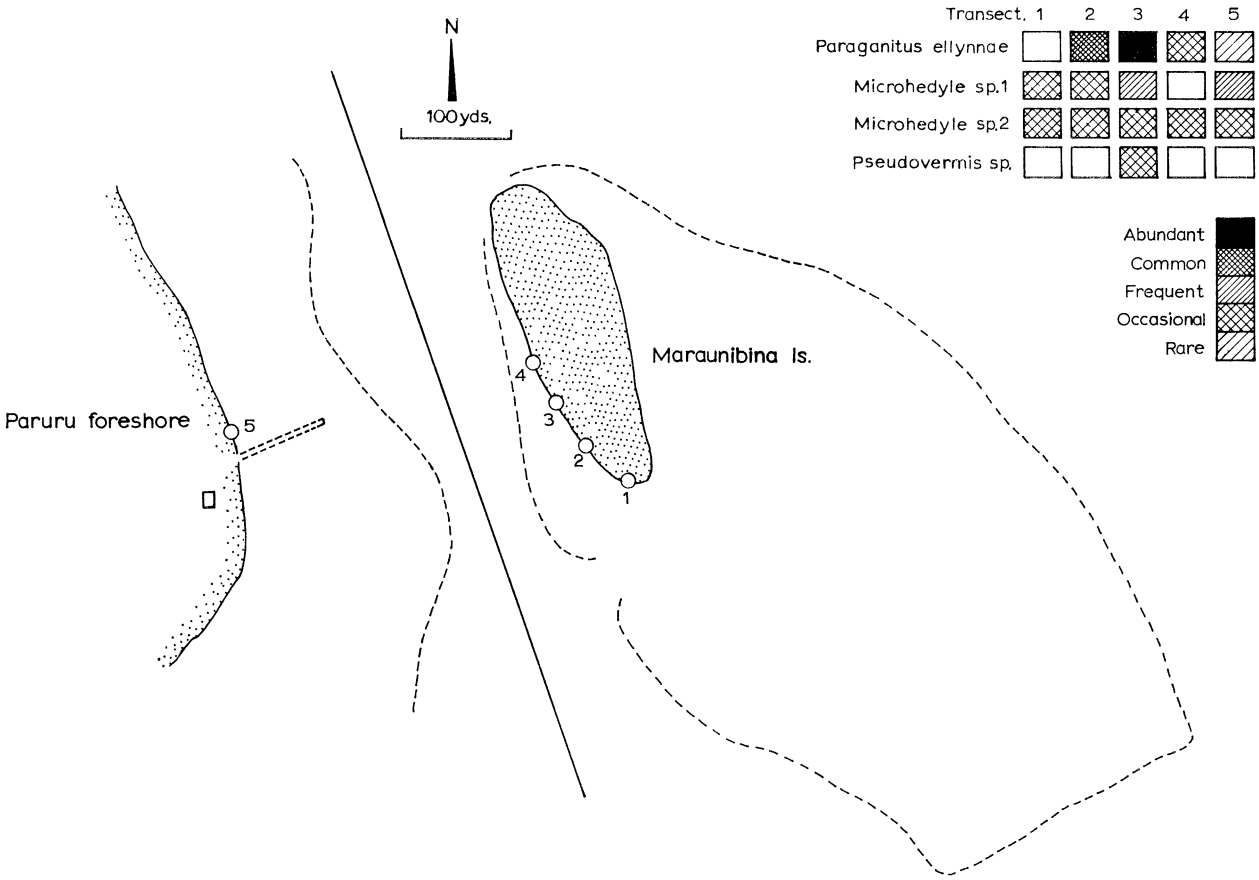


FIGURE 183. The distribution and abundance of the opisthobranchs collected at Marau Sound together with a sketch map of Maraunibina Island and the adjacent foreshore. Abundance criteria: as for Komimbo. (100 yds = 91 m).

## *Pseudovermis* sp.

During the extension to the Komimbo Bay period three specimens of the highly modified interstitial Aeolid *Pseudovermis* were collected. The animal (figure 181*A*) is immediately recognizable as a member of the family and has a marked external similarity to *P. salamandrops* Marcus, E. du B.-R. 1953. There are, however, some clear differences. The living animal is much more attenuated than that figured by Marcus. The ratio of length to breadth of the B.S.I.P. species is about 17:1 whereas that of the Brazilian species is given as 12:1. The maximum diameter of *P. salamandrops* seems to occur in the mid-region of the body while in the new species the head has the distinctly greater diameter. Neither species possesses eyes and in both the number and arrangement of the cerata is similar. Internally the animals differ in the details of the radula and quite markedly in the arrangement of the reproductive system.

The distribution diagram (figure 182*D*) shows that the animal was found at Komimbo only at the lowest station on transects 6 and 8. The sand in this part of the beach is exposed only at low-water springs and even in this circumstance it remains saturated. Further specimens were recovered in very small numbers (table 36) from a number of samples taken at a similar tidal level near the northern extremity of the area studied on

Maraunibina Island (figure 183). Two specimens were collected from Banika Beach and two more were taken from Pango Beach in the New Hebrides.

The discovery of *Pseudovermis* led to an intensive search for the very small free-living sand hydrozoans belonging to the genera *Halammohydra* and *Psammohydra* that have been suggested as its probable food in other areas. Marcus, E. du B.-R. (1953) Boaden (1961). However, despite careful examination of a very large number of living sand samples no hydrozoans were found. Fize (1961) discussed the feeding of *Pseudovermis* briefly and recorded that although he was able to collect quite large numbers of the aeolid he was unable to find the suggested hydrozoan prey species. He pointed out that the very young animals lack nematocysts in their cerata and suggested that *Pseudovermis* might better be thought of as a facultative rather than as an obligate hydroid feeder. As early as 1901 Kowalevsky put forward the hypothesis that *Pseudovermis* fed on *Microhedyle* and Fize observed precisely this behaviour in *P. setensis*. The B.S.I.P. species behaved similarly. When placed in a Petri dish with *Paraganitus ellynnae* it consistently attacked the smaller opisthobranch, tearing off and ingesting pieces of its visceral sac. Fize's account was unknown to me at the time and although this behaviour was observed on several occasions the confinement of the two species in a much smaller environment than they would normally occupy led me to minimize its significance. However in view of Fize's similar observation it seems probable that the small Microhedylidae do constitute at least a part of the food of *Pseudovermis*.

More recently a further member of the genus *Pseudovermis* has been found subtidally in New Zealand. A large number of individuals of the solitary Pennarian hydroid *Heterostephanus* sp. were collected nearby and a comparison of the nematocysts present in the two species makes it virtually certain that this species feeds at least partly on this hydrozoan. No Microhedylidae have yet been found at this locality.

### *Microhedyle* sp. 2

During the search for *Pseudovermis* at Marau Sound small numbers of a further Microhedyle were discovered. The animal (figure 181 *D*) was quite distinctly different from the two Acochlidiacea collected first at Komimbo Bay and was clearly very similar externally to *M. milaschewitchii* (Kowalevsky 1901 *a*). The specimens were approximately 1·5 mm long and were the smallest opisthobranchs encountered during the expedition. Kowalevsky mentions no actual size for his animal but says, surprisingly, that it is a little longer than *M. tyrtowii*. Unfortunately he failed to describe the detail of the radula of his species and it was informally suggested by Marcus when he erected the genus *Ganitus* that *M. milaschewitchii*, because it lacked rhinophores, possibly belonged in this new genus. However, in a later paper (Marcus, Ev. & Marcus, E. 1954), specimens of an apparently identical animal from both European and Brazilian waters were very closely examined and Kowalevsky's original description was greatly amplified. The radula proved to be of the *Microhedyle* rather than of the *Ganitus* type and the species was returned to its former genus. The length of 1·5 mm given by Marcus agrees closely with that of the B.S.I.P. species as does the distinctive green colour of the digestive gland. The anatomical work necessary to describe the species is incomplete at the date of writing but should shortly be finished.

The Marau sound distribution diagram (figure 183) shows that the animal was recovered




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in small numbers (table 36) both from the area worked at Maraunibina Island and from the foreshore of the mainland opposite. This microhedyle also occurred at Banika Beach in the Russell Group and at this locality, though still uncommon, it was the most widely distributed of the interstitial opisthobranchs.

### *Philinoglossa* sp.

During the Komimbo Bay study a single specimen of a very small and very elongate bullomorph that was noticeably externally different from the *Philine* was collected. The animal (figure 181*F*) was about 2 mm in length and very narrow. The ratio of length to breadth was about 7:1, whereas that of the *Philine* was nearer to 4:1. No division of the animal's body into head shield and visceral hump was apparent. Anteriorly, a lateral groove divides the notum and the foot but behind the mid-body region this becomes very indistinct. Subepidermal eyes are clearly visible but there is no trace of a shell. The radula agrees with that described for the family Philinoglossidae Hertling 1932. There are no jaws or gizzard plates. Only two further specimens were collected, one from Maraunibina Island and the other from Banika Beach (table 36). It is hoped to describe this animal in detail in a later paper.

## Discussion

Representatives of each of the known families of marine interstitial opisthobranchs, with the exception of the Rhodopidae, were collected during the expedition. The numbers both of species and individuals indicates that they are a relatively important part of the meiofauna of those beaches on which they occur.

Some general observations on their habitat preferences can be made from the distribution pattern of the animals on the beaches examined. They appear to prefer a sheltered topographically stable shore composed of coarse clean sand. Provided that the sand remains clean and unclogged with organic debris or silt the number of animals seems to increase with increasing shelter. The largest numbers are to be found on the lower part of the shore at a level that, in this area of very small tidal range, is very near the level of the water table during the period of low tide. Even after many hours of emergence this part of the beach is invariably saturated. The animals are prevented from spreading to seaward by the very fine particle size composition of the spring tidal sand and rubble flats. Beyond the reefs and rubble flats the shore profile steepens rapidly and the bottom sediments are largely composed of mud and of a grade of sand too fine to accommodate the opisthobranchs.

It is interesting to note that while several of the opisthobranchs were present in each of the areas examined the *Philine* and the *Microhedyle* sp. 2. were less widely distributed. These species, where they did occur, were in each instance collected together with animals of the more widely distributed species, and the reason for their absence at certain localities is problematic.

The presence of several of the Solomons species in the very few sand samples collected at Pango beach in the New Hebrides some 800 miles to the south-east is of considerable interest. There is every reason to expect that the same or very similar species of interstitial opisthobranchs will eventually be discovered in other regions of the Pacific Ocean.


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FIGURE 184. A general view of the foreshore near Paruru showing the narrow beach and the extensive low tidal rubble flat.

FIGURE 185. A view of the shore near Station 5 showing the narrow beach and rubble flat together with a litter of groyne-like coconut trunks.