

## NOTES ON THE FAUNA OF PULAU BERHALA

by

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(Medan).

### Introduction.

In November 1925 the author and his friend Dr. L. FULMER paid a short visit to Pulau Berhala. As a result of this trip it was decided to make a more extended faunistic survey of the island as soon as circumstances would permit. So in 1926 I went again to Pulau Berhala and stayed there for a week (21-28 August). In working out the various collections made during this second visit, it was deemed necessary to complete them and to fill up some gaps in the observations on the biology of the green turtle, *Chelonia mydas*. Consequently, in 1927 I once again went to the isle of Berhala and remained there from 7-17 August. In the same year a short visit was also paid at Christmas time with the chief purpose of obtaining data on bird migration, but in this respect the results of this fourth trip were rather disappointing.

Except for a few stray notes relating to the collections which MjöBERG, F. C. VAN HEURN and CORPORAAL brought back from their visit to Pulau Berhala in 1919, I am not aware that there has been published anything else on the fauna of the island, though from a letter of Mr. BODEN KLOSS, Director of Museums S.S. and F.M.S., I gather that in 1920 members of the F.M.S. Museums did also some collecting on Pulau Berhala. Therefore the following notes are chiefly based on the collections and observations made by myself; but of course, references are duly made to the recent work of DAMMERMAN concerning the fauna of the isles of the Krakatau group and of Pulau Durian and the Rhio Lingga archipelago and to the various publications of British naturalists on the fauna of the Aroa and other islands situated in the Straits of Malacca. The results of my second and third collecting trip have already partly been published (cf. Bibliography).

The faunistic exploration of Pulau Berhala was rendered feasible by the financial support of the Indisch Comité voor Wetenschappelijke Onderzoekingen (Netherland Indies Committee for Scientific Research) to whom my acknowledgements are due. Furthermore, I have to tender my sincere thanks to Prof. DOCTERS VAN LEEUWEN, Director of 's Lands Plantentuin, Dr. DAMMERMAN, Director of the Zoological Museum and Dr. BEUMÉE, Director of the Herbarium, for their cordial co-operation and assistance and to all of those specialists who have kindly assisted me in identifying the collections.

### Topographical and historical notes.

Pulau Berhala is the name given to a group of two little islands (fig. 1) situated in the Straits of Malacca some 50 miles due east of Belawan (Port of Medan). Its shortest distance to the mainland of the East Coast of Sumatra is about 21 miles (see accompanying map, fig. 2). From Tandjong Bringin or Bandar Chalipah in the district Padang and Bedagei it can be viewed with the naked eye if weather is fine. Both islands are composed of granite (cf. Bibl. 10, p. 99-100)<sup>1)</sup>.

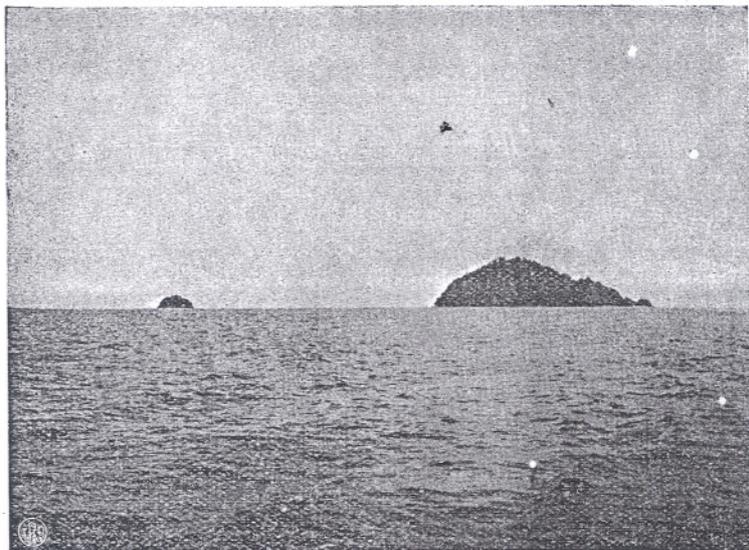


Fig. 1. Pulau Berhala (from SW).

<sup>1)</sup> I am indebted to Dr. DRUIF, geologist at the Deli Tobacco Experiment Station, Medan, who visited Pulau Berhala in December last year, for the following comments on the geology of that island.

„The islet consists chiefly of granite. Only between the main part and the „Staat” there are some layers of gneiss with one dyke of pegmatite (size about 1½ m). The granite is medium coarse, a few specimens however have been collected which show porphyric structure. The mineral composition varies little; by microscopical determination Orthoclase, Microcline, some Albite, Quartz and Biotite were found. Zircon is abundant while some Apatite and Garnet were also observed. Interesting is the occurrence of several minerals of pneumatolitic origin: Tourmaline, Dumortierite and Monazite. A few crystals of Casiterite could be isolated. Another most interesting fact lies in the occurrence of older rocks as inclusions in the granitic body. Quartzite and Zoisite-quartzite could be identified. By weathering the granite gives birth to a light red coloured loamy-sandy soil with very little organic matter. On some spots lateritic decomposition was observed, yielding a yellowish-red, heavy, loamy soil. The dense jungle does not allow an extensive search for diachases or other tectonical features, but the coast shows at least in one case the result of folding movements. Measurements taken on the gneiss did result in: Fall 42 degrees, strike N 30 E. The granite of the „Staat” has developed cleavage as illustrated by the wellknown „plate” form. There can be little doubt that Pulau Berhala forms part of the same batholithic intrusion that everywhere in this part of Malaysia brought the Tin-ores of highly economic importance.

Collecting has only been done on the largest of the two islets. This islet — Pulau Berhala proper — rises abruptly from the sea to an altitude of 135 m as indicated by my aneroid whereas on the Dutch Admiralty chart its altitude is given as 178 m. It is more or less pentagonally shaped and covers an area of approximately 36 ha (90 acres). One of the sides of the pentagon is formed by the sandy beach on the S-side of the island, extending in a direction approximately W.-E. By a rocky promontory this beach is divided into two parts, of which the eastern and longest part is favoured by *Chelonia mydas* to perform its egg-laying operations. Isolated from the main island by a narrow strip of sand, which is submerged at high tide but otherwise dry, and opposite to its SE-point lies a wooded mass of rocks (fig. 3) which, for convenience' sake, may be called the "Staart" in this article and which attains a height of some 20 m. At a distance of approximately half a mile NW of Pulau Berhala proper lies the second islet of the group, a mere rock crowned with some vegetation and utterly devoid of a beach. The S-side of the main island is fringed by a coral reef (fig. 4), making landing directly on this side of the island somewhat difficult and quite impossible of course at low water. The "Staart" and the main island form a little bay, open to the NE, which at high tide affords a good landing place for vessels like the native sampan or chinese tongkang. The island offers no other suitable landing place, for its E, N and W-sides, surrounded by huge

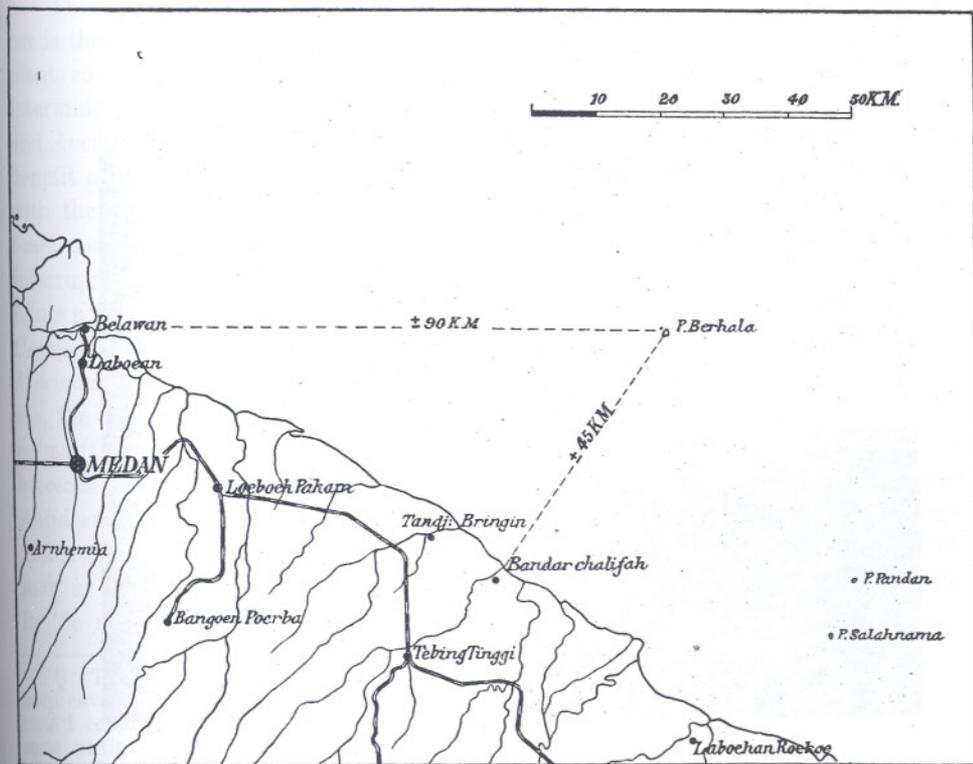


Fig. 2. Map of Sumatra's East Coast.

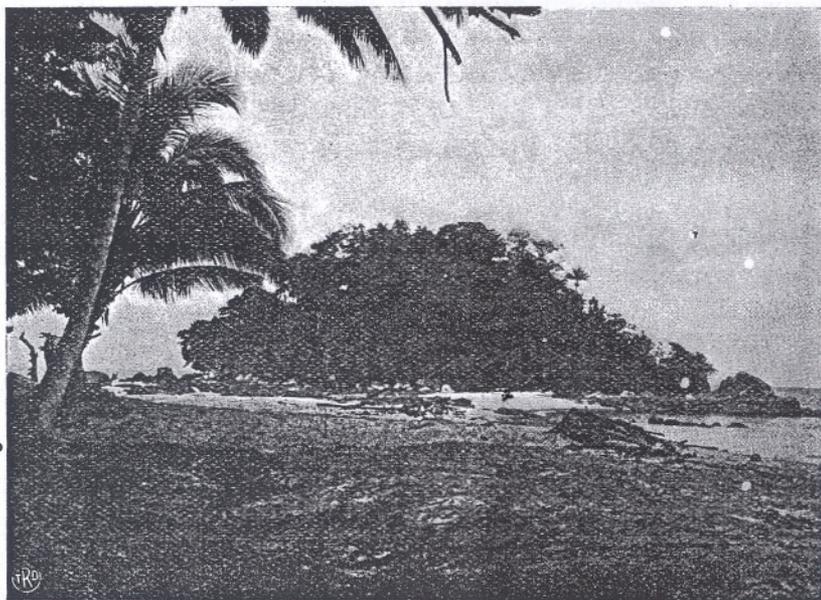


Fig. 3. The "Staart".



Fig. 4. Part of the shore at low water with coral reef (from E).

granite boulders whereon the swell is always pounding, slope steeply into the sea. The depth of the sea between Pulau Berhala and the Sumatra Coast does not fully reach 30 fathoms.

The main island is only temporarily inhabited by Malays, who visit the island chiefly on account of the eggs of the green turtle which are dug up, preserved and sold\* at the nearest mainland markets. Chinese fishermen sometimes call at Pulau Berhala if weather is too bad for fishing, or if their fresh-water supply needs replenishing. Some tumble-down huts stand just within the shelter of the promontory dividing the beach into two parts. Following the path which runs over this rocky projection, we arrive after a 5 minutes walk at the place where one of the rivulets, by which the island is watered, comes out on the beach and where the Malays have built a primitive bathing place (panchoran) by diverting the stream over an aquaduct made of split-up bamboos. Here water seems always obtainable, even in very dry years as in 1926. Another path — fainter and running first through a stony rivulet beyond the native encampment, afterwards following mostly a ridge — leads directly inwards and to the highest point of the island. Halfway one can make a halt near a huge boulder from where a splendid view of the sea may be had. From this point a side path, first steep downwards then steep upwards, leads to a narrow cave, a breeding place of swifts <sup>1</sup>).

The main island is densely clothed with virgin forest; but mangrove fails <sup>2</sup>), nor is there a Casuarina belt. From the beach the jungle is separated by a small plant community of subsponaneous origin. Here we find tall coconut palms intermingled with bananas and trees like jambu (*Eugenia*), mango (*Mangifera*) and *Averrhoa* and some papaws; here too Manihot, chilly etc. are grown for the benefit of those native fishermen who happen to visit the island. As contrasted with the Pescaprae community which is only poorly developed, the Barringtonia community — though limited to a narrow girdle close to the shore and interrupted by the subsponaneous community just mentioned above — exhibits a fair development. It comprises the common elements, such as *Terminalia Catappa*, *Barringtonia speciosa*, *Calophyllum Inophyllum*, *Hibiscus tiliaceus*, *Morinda citrifolia*, *Erythrina* etc. At several places, in close proximity to the sea, the rocks are covered with groups of *Pandanus tectorius* and tufts of tall palms (*Oncosperma filamentosa*). The mixed forest largely consists of Euphorbiaceous elements such as *Galearia filiformis*, *Trigonostemon longifolius* and *Antidesma montanum* intermingled with big specimens of *Ficus*, *Myristica* and *Artocarpus*. The undergrowth is chiefly composed of Rubiaceae elements, such as *Psychotria sarmentosa*, *Pavetta Indica* and *Lasianthus cyanocarpus*. In the ravines an Aroid, *Schismatoglottis calyptrata*, abounds.

<sup>1</sup>) The little island N of Pulau Berhala proper possesses a fine and rather deep cave, running inwards from a mouth situated at sea level. Owing to lack of time I could only make a very superficial inspection of this cave; I collected there some unfinished Collocalia-nests.

<sup>2</sup>) Some mangrove elements, however, occur on the island viz. *Excoecaria agallocha*, *Heritiera littoralis* and *Caropa obovata*.

Historical data concerning Pulau Berhala are of course very scarce. Some were kindly furnished to me by Mr. L. C. HEYTING, a Government Civil Officer. The island appears on an old Chinese map of the year 1430. In times of Portuguese mastery it was known as Illha Polvoreiro (Varela). In the Karo-Batak dictionary of JOUSTRA, Pulau Berhala is said to be the place where Datuk Roembija Gande, a well known magician, has his abode. According to the narrative of a Malay fishermen I met on Pulau Berhala, this island once was the residence of a very devout Datuk who, after the death of his wife, departed and settled on another island (Pulau Datuk = Pulau Jarak?). The grave of his wife on the "Staart" afterwards became a place of pilgrimage ("kramat").

What, however, is still more important in connection with the fauna of Pulau Berhala is the fact that in 1899 the Deli Tobacco-Growers Association erected there a quarantine station for Chinese immigrants, but this occupation lasted for a short time only, the barracks afterwards being completely abandoned (cf. Bibl. 22, p. 92-93). It seems quite plausible that the coconut trees and plantains, which at present border the beach, were planted during the time the island was occupied for quarantine purposes.

### The Fauna.

Before reporting in detail upon the different faunistical groups, it seems advisable to put forward a few remarks on some of the factors which have a distinct bearing on the composition of the fauna of Pulau Berhala, though some interesting phenomena remain utterly unexplained by them, and also on the circumstances under which the faunistical exploration of the island has been carried out.

Perhaps the most important ecological factor is the smallness of the island (Pulau Berhala proper not exceeding 90 acres) thus excluding all those forms which, in a wild state, require much vaster areas.

An other factor of ecological importance is the type of vegetation with which the island is covered. Now Pulau Berhala is forested from its base up to its very highest point mainly by dense but monotonous virgin jungle as has already been pointed out in the foregoing chapter. This monotony of the flora explains why fauna-elements, which are exclusively confined to such biotopes like grassy plains or mangrove swamps, are entirely wanting, though occasionally one may have the luck to meet on the island such an element, probably on errand.

A third factor is the lack of stagnant fresh-water pools of any extensive proportions, fresh-water life therefore being confined to the few rivulets trickling down the damp, rocky ravines and forming minute cascades and shallow water-holes in the rainy season, but almost dry in rainless periods.

Though there is a more or less constant intercourse between Pulau Berhala and the opposite mainland and though the island has served for a time as a

quarantine station, the influence of both factors, with some exceptions which will be discussed later on, is, I think, on the whole rather insignificant.

As already mentioned before, two visits of longer duration were paid to the island (in 1926 and 1927 resp.) but both times in the same month viz. August. Therefore a fair impression of seasonal changes in the fauna of the island could not be obtained. In this connection I will refer to the rather puzzling seasonal difference in the occurrence of (non migratory) birds and butterflies as noticed by DAMMERMAN during his subsequent visits to Pulau Durian. Besides, in 1926, the East Coast of Sumatra suffered from abnormal drought during the period February-July which also may have influenced in many respects the fauna of Pulau Berhala, especially its invertebrate fauna.

On both visits the method of trapping by lamp light was employed but it did not yield the results expected by me. This, to a certain degree, must be ascribed to the fact that there was a full moon on both occasions that I stayed at the island, but beyond doubt the prevailing fairly strong wind also had a marked influence on the lamp catches.

It was not possible for me to practice systematically the method of soil-sifting. Only two samples (one gathered at 50 m above sea-level, the other near the beach) were sifted but seemed rather poor.

It goes without saying that if in the following there is any question of either the absence or presence on Pulau Berhala of an element of a special faunistic group, one has to bear in mind that for small and inconspicuous forms there is always the possibility that they have been overlooked and they may be discovered on a later occasion. But if such forms like squirrels and frogs or even forms like the Rhinoceros beetle and the red ant *Oecophylla smaragdina*, the presence of both of which is readily to be noticed (of the one by the characteristic damage to its foodplant and of the other by its large-sized leafy-nests), have repeatedly not been observed, one may safely assume that indeed they do not belong to the present fauna of the island.

### Mammals.

Only 4 species were caught, 2 of which may have been introduced, viz. *Tragulus kanchil*, the largest terrestrial mammal of the island, and *Pachyura murina*. The latter is the common musk shrew of human buildings, but on Pulau Berhala it is far from numerous. In fact we did not trap a single specimen in 1926 and only 4 or 5 specimens in the following year.

If we may believe the Malay fishermen the mouse deer is only a recent introduction. Some 20 or 30 years ago a Rajah of Padang and Bedagei went on pilgrimage to Pulau Berhala and on that occasion took with him a score of live mouse deer; at his arrival these creatures were released as a kind of ritual performance which the Malays call "bajar nijat". In this respect the presence of the "kramat" on the "Staart" already mentioned before supports in some degree the credibility of the story.

Rats (*Rattus r. neglectus*)<sup>1)</sup> are very numerous, at least in the vicinity of the Malay encampment and cause a great deal of damage to the coconut trees by boring holes in the unripe nuts. In the forested inner part of the island I could scarcely discover any trace of these rodents. I think it quite possible that our common Malay house rat (*Rattus r. diardi* JENT.) was introduced to the isle of Berhala when this served as a quarantine station, but that for some reason or other it could not survive the struggle for life (cf. Bibl. 6, p. 291-292). It certainly would be a very interesting experiment to introduce the house rat once more to Pulau Berhala with a view to giving it a fair chance to establish itself once more on the island and to keep an eye from time to time on how this species will manage there in the future. It seems worth mentioning that Pulau Jarak, which lies only some 40 miles E of Pulau Berhala, between this island and the Dindings (Malacca coast), has a species of rat, viz. *R. r. jarak* (cf. Bibl. 1 and 36) which differs slightly from *R. r. neglectus*. It is by no means easy to understand by what special factor this subspecific difference has originated since area, climate and vegetation of both islands are almost identical.

As far as I could ascertain no other bats than *Pteropus hypomelanus fretensis* live on the island. In December 1927 when I paid a short visit to Pulau Berhala a big dadap tree on the beach opposite the "Staart" was in flaming bloom and each night the "kluangs" gathered there to feast on its buds and young pods. I never saw the flying foxes undertake nightly migrations. One might expect to find also insectivorous bats on Pulau Berhala; but I think I am right when I say there are none.

A puzzling feature with regard to the mammalian fauna of Pulau Berhala, which struck me every time I visited the island, is the total absence of monkeys and squirrels. If monkeys and squirrels inhabited the island in olden times — and why should this not have been so? — the question arises immediately for what reason have they disappeared. At all events the lack of these notorious nest robbers is all-important to bird life on Pulau Berhala.

### Birds.

In the course of my subsequent visits altogether 15 species of birds have been collected while 7 more species were only seen but not shot. To these 22 species I must add two more, viz. *Ninox scutulata*, of which a specimen was caught by F. C. VAN HEURN in November 1919 (cf. Bibl. 45, p. 97) and a *Pitta* observed by him at the same time (letter of 19th July, 1928), making up the sum total of 24 species as against 29 species recorded by ROBINSON and BODEN KLOSS for the neighbouring island of Jarak (cf. Bibl. 39).

A fact which struck me when I visited Pulau Berhala in December 1927, touches upon the paucity of migratory species observed at that time in comparison with the abundance of migrants met with by ROBINSON and BODEN KLOSS

<sup>1)</sup> *R. r. neglectus* (JENT.) = *Mus r. jalorensis* BONH., the Malay fieldrat (cf. DAMMERMAN in Treubia, X, 2-3, 1928, p. 307-308.).

on the other islands in the Straits of Malacca (Pulau Jarak, Aroa Islands and the One Fathom Bank Lighthouse) when they collected there in the month of November 1918 and 1919. Mr. BODEN KLOSS, on questioning him about this point, kindly informed me that he thinks it possible "that most of the migrants travel down the Malacca side of the Straits or are attracted by the larger and less forested Aroa Group" (letter of 20th January, 1928).

A remarkable feature of the avifauna of Pulau Berhala is the total absence of woodpeckers, and some other groups (Timeliidae, Dicaeidae<sup>1)</sup>) which one is reasonably inclined to expect there.

*Haliaeetus leucogaster* breeds on Pulau Berhala; an enormous nest of this white-bellied sea eagle was sighted in the bare top of a lofty forest tree. In August 1926 I shot at a *Haliaeetus* sitting on a branch but missed or only wounded the bird. As it flew away it let drop from its claws a snake, undoubtedly a sea snake (cf. Bibl. 27).

MJÖBERG (cf. Bibl. 21), who visited the island on two different occasions, found bird life exceedingly rich, kingfishers and pigeons being dominant. Now by pigeons in all probability is meant *Myristicivora bicolor* which, like *Caloenas nicobarica*, is a characteristic denizen of our smaller islands. Large flocks of the pied imperial pigeon daily visited the same fruit trees to which they returned time after time with regular intervals. I never saw them in the crowns of the coconut palms as did BODEN KLOSS on Pulau Babi, Great Nicobar (B. KLOSS, In the Andamans and Nicobars, p. 157). As I observed the Nicobar pigeon during August as well as in December, it is most likely resident. Of the pink-headed fruit dove, *Ptilopus jambu*, a single immature example was shot at dusk in August 1927. I think the bird had just arrived as it behaved rather drowsily. Kingfishers, in contradiction to MJÖBERG'S statement, I found to be far from numerous. The ruddy kingfisher, *Halcyon coromandus*, was only once seen, viz. in November 1925.

The commonest bird on Pulau Berhala, at least during my stay in August 1926, was the Koel, *Eudynamis malayana*. In August 1927, however, it seemed to me that these birds were not nearly so abundant.

*Collocalia* (perhaps *innominata*) was found breeding in the caves at both islands (cf. p. 281), though at the time I visited these caves only a few nests (without eggs) of this swift were obtained.

Both sunbirds, *Cinnyris hasselti* and *Anthreptes malaccensis*, are common islanders. They were always seen fluttering in the crowns of the cocon palms around the spikes and alternately visiting the flowering jambu trees. Especially as *A. malaccensis* is dependant on the presence of coconut palms, we cannot wonder that it was not found on Pulau Jarak since this entirely uninhabited island is devoid of coconut trees as Mr. BODEN KLOSS wrote to me.

*Motacilla melanope* was observed both times I visited the island in the summer months, but in 1927, at Christmas time, there were none to be seen.

<sup>1)</sup> In consequence no Loranthids, the dissemination of which is performed by Dicaeids eating the viscid fruits, were noticed.

*Hirundo gutturalis* was always present. *Calornis chalybea* was only once noticed (August 1927). A small flock alighted on a fig tree near the shore for a short time and then disappeared; afterwards no other examples were seen or heard.

According to the Malay fishermen the frigate birds (probably *F. ariel*) roost on the small islet north of the main island. The same informants told me that the Rajah of Padang and Bedagei, who is said to have introduced the kanchils (cf. p. 283), also brought with him some specimens of *Streptopelia tigrina*, the Malay spotted dove. It is no wonder, however, that these doves could not establish themselves there as this species affects open country.

### Reptiles and Amphibians.

The naturalist who visits Pulau Berhala is very likely to be impressed by the abundance of lizards met with everywhere. Both *Aphaniotis acutirostris* and *fusca* are very numerous in the jungle proper, whereas *Mabuia rudis* and *Lygosoma olivaceum* may be seen fairly often amongst the shrubbery along the beach. According to the observations of HOPE SWORDER on Pulau Senang and Johore Bahru (cf. Bibl. 42), which agree very well with those of KOPSTEIN on Amboina, Saparua etc. (cf. Bibl. 16), *Lygosoma atrocostatium* is in its habitat confined to the seashore "between high and low water mark", seeking refuge in "old tree stumps on the beach, the drift wood along high water mark and in crevices in the rocks" when the tide comes in. I regret that I have not spent more time in observing the habits of this interesting species which, like *Lygosoma bowringi*, is still not yet known from Sumatra though both species have also been found by DAMMERMAN on the isles of the Krakatau group. The same naturalist also mentions *L. atrocostatium* from Pulau Durian, Rhio Lingga archipelago.

In 1926 we made a diligent search in the few tumble-down huts near our camp but in spite of our efforts and money offered to the Malays for "chichaks", not a single specimen of the commoner species of house geckos was discovered; a strange fact indeed for which I cannot give a reasonable explanation since, in 1927, we not only caught several specimens of *Lepidodactylus lugubris* and *Gecko monarchus* there, but also some specimens of a *Hemidactylus*, which proved to be new to science (*H. vandermeer-mohri*). Of *Gecko monarchus* a specimen was also captured in the jungle, far away from the native dwellings; when hunting in the jungle we often heard the characteristic call of the "tokeh" (cf. also KOPSTEIN on the habits of *Gecko verticillatus*. Bibl. 16, p. 79).

*Varanus salvator*, the monitor lizard, may be seen at low water crawling over the sun-scorched bare rocks along the seashore as well as in the damp, cool forest ravines. Si Alang, an intelligent Malay fisherman I met at Pulau Berhala in 1927, informed me that on several occasions he had come across the "menjawak" swimming out to sea as did JACOBSON in May 1908 (cf. Bibl. 11, p. 197).

The sole snake found on Pulau Berhala was a fine specimen of *Dipsadomorphus dendrophilus*, the ular tiung, which was captured at night by one of the native's huts<sup>1)</sup>. It appeared to be parasitized by *Amblyomma helvolum*. If my Malay informants are right in their statement no other species of snakes occur on the island.

As has already been mentioned, *Chelonia mydas* is a regular visitor of the sandy beach of Pulau Berhala. The two sea snakes inserted in the list of reptiles and amphibians on p. 293 were both captured alive, *Hydrophis* in the densest part of the forest, *Enhydris hardwickei* in the shrubbery along the shore. In my opinion in both cases we have to consider the snakes as a lost prey of *Haliaeetus leucogaster* (cf. Bibl. 27).

The Amphibians are — strange to say — simply and solely represented by *Ichthyophis glutinosa* of which the eel-like larvae live concealed in the mud of the two rivulets referred to in the chapter dealing with the topography of the island. Neither frogs (*Rana*) and tree-frogs (*Rhacophorus*), nor toads were ever seen or even heard by us.

## Insects.

### HYMENOPTERA.

More than 15 species of ants have been collected on Pulau Berhala (see list p. 294). A surprising feature of the antfauna of the island is the absence of *Oecophylla smaragdina*, the big red ant which builds up its leafy nests with the aid of its larvae. As the ferocious species is very common in the coastal districts of the East Coast of Sumatra, it is rather difficult to understand why it is not present on Pulau Berhala whereas two other species viz. *Dolichoderus bituberculatus* and *Plagiolepis longipes*, both of which are also very common in the coastal plains, are well represented on the island. I should here point out that JACOBSON (cf. Bibl. 11, p. 200) has found *O. smaragdina* on Krakatau together with several species of *Polyrhachis*, the latter genus also being represented on Pulau Berhala by at least 2 species.

Of other Hymenoptera I will mention the occurrence of *Xylocopa latipes*, a species of *Megachile* and a Scoliid wasp, which latter, however, I failed to catch. The presence of the leafcutter bee was demonstrated by the characteristic marginal cuttings in the leaves of several shrubs.

### COLEOPTERA.

Of the more conspicuous forms caught by the lamp I mention *Batocera albofasciata*, *Monohammus fistulator*, *Macronota malabariensis*, *Mimela debilis*<sup>2)</sup> and a fine green, gold-sprinkled Buprestid. Especially the two first-named species came very readily to the lamp. *Orjctes rhinoceros*, the common pest of

<sup>1)</sup> Another example of *D. dendrophilus* was captured by some members of a party who visited the island in December 1929.

<sup>2)</sup> I have to thank Dr. LEEFMANS for the identification of these 4 species; the remaining material is still wanting examination.

coconut trees, is entirely absent on Pulau Berhala and the chance that from the opposite mainland a rhinoceros beetle will ever arrive on the island by the wing is, I think, very slight, but it is not quite so improbable that some *Oryctes*-larvae may accidentally arrive with drifting cocos trunks. I have no doubt that the other notorious cocos pest, the red palm weevil (*Rhynchophorus ferrugineus*) is also absent. The plantains along the shore are heavily infested by a species of *Cosmopolites*, probably *sordidus*. This weevil has almost certainly been introduced by means of corms which people imported from the mainland, though it is not at all improbable that it has arrived on the island by means of floating plantain stems as this weevil species can resist immersion in water (at least fresh water) for several days (cf. WALTERS, Viability of the weevil *Cosmopolites sordidus* etc. in Rept. Agr. Dep. St. Lucia, 1925 (Trinidad, 1926), p. 8).

#### LEPIDOPTERA.

Butterflies seem to be very scarce, a few Lycaenids and some Pierids (*Terias hecabe* and a species of *Catopsilia*) being the only representatives of the rich rhopalocerous fauna of Sumatra's East Coast which we could collect at Pulau Berhala. Moths must be far better represented though our lamp-catches yielded rather poor results in this respect owing to the circumstances referred to above (p. 283). I noted a fine example of *Nyctipao* in the forest and a *Cephonodes* hovering by the flowers of *Scaevola frutescens*.

It is perhaps worthy of note that the plantains along the beach show no sign whatever of attack by the common leaf-roller, *Erionota thrax*.

#### DIPTERA.

Though near by our camp on the beach there were some puddles of fresh water and the numerous flower sheathes of the coconut palms which had dropped down furnished many suitable breeding places for mosquitos, these were not troublesome owing to the everlasting cool breeze. In the jungle, however, there were plenty. A nuisance, especially to my native taxidermist, were the small greyish flies, enlivening the shore. A big Asilid was also collected.

On *Wedelia biflora* the common bud galls caused by a Trypetid were found. The presence of gall midges was noted by their galls <sup>1)</sup> on *Heritiera littoralis*, *Terminalia Catappa*, *Leea indica*, *Melothria* sp. and *Ficus* sp. div.

#### HEMIPTERA.

Concerning this order one gets the impression that it is very poorly represented. A Gerrid skims the rivulets. At the lamp were caught a species of *Polytoxus* (probably *P. fusco-vittatus*), a Cydnid (*Scoparipes* ? *longirostris*) and a Mononychid. *Cantao ocellatus*, was found on a shrub along the shore.

<sup>1)</sup> Some of the galls mentioned in this paper have already previously been recorded by DOCTERS VAN LEEUWEN-REYNVAAN and DOCTERS VAN LEEUWEN (The Zootecidia of the Netherlands East Indies) from material collected on Pulau Berhala at an earlier date.

Of Fulgorids 3 species have been identified viz. *Pochazia fuscata*, *Nogodina plena* and *Pseudorhiza carinata*. The shrill song of a singing cicada was sometimes heard in the forest but I failed to get a live specimen.

Of Aphids I can only mention a species producing galls on *Wedelia biflora* and another one (perhaps not identical with the foregoing) on *Justicia Gendarussa*. A Coccid was found on a species of *Vitex* (?). The leaves of the jambu tree (*Eugenia* sp.) near the eastern panchoran were strewn with the galls of a Psyllid.

#### ORTHOPTERA.

The richness of Pulau Berhala in Orthoptera, at least with regard to individuals, is very striking. The same holds good with regard to spiders and since both groups constitute, I presume, the main food of lizards one cannot wonder at the abundance of the latter (cf. p. 286).

Altogether 22 species have been identified by KARNY. In 1926 a few specimens closely resembling *Valanga nigricornis* were noticed feeding on cocos leaves but we failed to catch them; in 1927 however I did not see any again. Strangely to say neither Mantoids nor Phasmids were found. Perhaps the most interesting find is *Xiphidion cognatum*, a species which hitherto had only been recorded from Borneo and Amboina.

We never discovered specimens of the common cockroaches (*Periplaneta americana* and *australasiae*) in the native dwellings though both species certainly must have had over and over again a good opportunity for invading the island, but it seems that these true house-hold pests cannot stand their ground there, though the reasons why are still not very clear to me since at least *P. australasiae* was found by DAMMERMAN on the isle of Krakatau. According to MALCOLM BURR (Fauna and Geography of the Maldive and Laccadive Peninsulas, I, p. 234) *P. americana* is "common throughout the Maldives, infesting the larger boats, but seldom found ashore". In August 1927 an introduction "en masse" happened when directly after landing in the morning I unpacked a case filled with rice and swarming with cockroaches, viz. *P. americana*, owing to the fact that my boy had left it open on board the night before. I think it worth while for any naturalist who in future may visit Pulau Berhala, to take special pains in trying to discover if the cockroaches have really succeeded in establishing themselves.

#### ODONATA.

Dragon flies are — or at least were during all my visits — exceedingly scanty. In fact we only sighted some 3 or 4 specimens at a time. In March 1929 when I paid a 10 minutes visit to Salanama, an island of much the same size as Pulau Berhala and lying halfway between that island and the Aroa group (off Tandjong Balei), dragon flies were quite plentiful whereas on Pulau Berhala, where we landed an hour later, the almost total absence of Odonata was

very evident. Perhaps the fact that the isle of Salanama is only partly forested and has more open ground than Pulau Berhala may account for this difference in the occurrence of Odonata on both islands. According to Mr. LIEFTINCK, of the Buitenzorg Museum, who kindly identified the material, the 2 species found on Pulau Berhala are *Ischnura senegalensis* and *Rhyothemis phyllis*, both common species. Of the former species a male and female were caught in copula.

#### ISOPTERA.

In the Berhala fauna termites obviously do not form such a striking feature as is the case on Pulau Durian according to DAMMERMAN (l.c. p. 287). This, perhaps, must be ascribed to the fact that the soil is rather poor in organic matter as, owing to the steepness of the island, considerable masses of vegetable mould are always carried away during the rainy seasons (cf. also note on p. 278).

Only very scanty material of the remaining insect orders being available I must refrain from dealing here with those orders.

#### Arachnids and Myriopods.

REIMOSER has described 13 species of spiders from Pulau Berhala (cf. Bibl. 33), but since this number is only based on the collection made in August 1926 we may safely assume that the number of species is indeed higher. In 1927, for example, I caught some *Gastracanthas* which I looked for in vain in 1926. The most remarkable find is *Laches sundaica* since all the other species of this genus are restricted in their distribution to the Mediterranean.

As is the case with other faunistical groups, the spider fauna of Pulau Berhala too is characterised by the absence of some of the most common and widespread elements viz. the large *Heteropoda venatoria* and *Uloborus geniculatus* which both are frequenters of human habitations. Concerning the latter species it is, however, possible that it is contained in the collection made in 1927 which has not yet been worked by REIMOSER<sup>1)</sup>.

With regard to the Scorpions and Myriopods I regret that I cannot report upon them here in detail as the material brought from Pulau Berhala is still wanting examination.

As for Acari one should consult the list on p. 296. Of gall-producing species at least 4 were observed viz. on *Terminalia Catappa*, *Wedelia biflora*, *Pavetta* sp. and *Nephrolepis hirsutula*.

#### Crustacea.

Since the terrestrial Isopods collected on Pulau Berhala have not yet been studied I can only deal here with some of the larger forms of land crustaceans inhabiting the island. In this respect the occurrence of *Sesarma ocyropa* is most

<sup>1)</sup> Since this was written the paper of REIMOSER dealing with the whole collection of spiders from Pulau Berhala has been published (cf. Bibl. 34). It appears from his paper that indeed *U. geniculatus* does not occur on the island. In total 27 species were identified.

interesting. This little crab was found in both rivulets where it hides in holes and underneath stones or among roots and rotten leaves. Here too may be mentioned the find of a young male of *Metasesarma rousseauxi*; it was collected above high watermark on a tree trunk that had broken down. The biggest representative of the crustaceous fauna of the island is *Gecarcoidea lalandii* which has its refuge amongst the roots of some large forest tree or in rock crevices. It seemed to me that in August 1926 this species was far more numerous than in August 1927. It surely is an astonishing fact that with regard to the Dutch East Indian archipelago this species was — up to its discovery on Pulau Berhala — only recorded from one other locality, viz. the Bay of Gorontalo (Celebes) (cf. Bibl. 18).

The shore is alive with numbers of *Ocypoda ceratophthalma* and in the jungle, up to the highest point of the island, hermit crabs (*Coenobita*) find their way. The rôle these notorious scavengers play in the economy of as small an island as Pulau Berhala must certainly not be underrated (cf. BORRADAILE in Fauna and Geography of the Maldive and Laccadive Peninsulas, I).

### Mollusca.

Apart from those forms like *Melampus* and *Pythia* which are more or less semi-marine in that their habitat is restricted to the shore, 7 species of land- and only one species of fresh-water molluscs were collected on Pulau Berhala. The fresh-water species, *Melania tuberculata truncatula*, was found in the brook near the western panchoran.

In my note on the molluscs of the island (cf. Bibl. 23) it was stated that *M. t. truncatula* had not been recorded up till then from the opposite mainland but this, evidently, is erroneous since PRASHAD (cf. Bibl. 32) already mentioned this species from Sumatra where DEN DOOP has found it at several places. Moreover, a renewed examination of my *Opeas*-material makes the presence of *O. javanicum* on Pulau Berhala very doubtful since the specimens formerly identified as *O. javanicum* belong in fact to *O. gracile*; thus the idea of *O. javanicum* being introduced from Java to Pulau Berhala by bird's agency must be dropped (cf. also Bibl. 12, p. 141).

*Diplommatina calcarata* was collected by sifting the humus of a large epiphytic *Asplenium*-fern; in this substratum specimens of *Opeas gracile* were also found. *Omphalotropis dohertyi* and *Alycaeus frühstorferi* were picked from between the rotten leafsheathes of decaying plantains as was also the case with the specimens of *Lagochilus*. Here too *O. gracilis* and *Prosopias achatinaceum* occur.

From the list of DEGNER (cf. Bibl. 9) it appears that *A. frühstorferi* and *D. calcarata* are not yet known from Sumatra but a more detailed malacological investigation of the East Coast will no doubt reveal their presence there. Both species are recorded from West Java. In 1927 I also collected a slug (*Sem-perula*?) but owing to some mishap I lost the tube with its contents.

## Vermes.

Two species of earth-worms are mentioned by MICHAELSEN, viz. *Perionyx violaceus* and *Pontoscolex corethrurus* (cf. Bibl. 19). Both are peregrine forms, the latter species moreover circummundane. *P. corethrurus* was also found by DAMMERMAN on Pulau Durian, Rhio Lingga-archipelago (cf. Bibl. 20). It is quite probable, however, that in my own collection some more species are represented but this collection has not yet been examined <sup>1)</sup>.

Leeches do not occur on Pulau Berhala. A single specimen of a land planarian was found crawling among rotten plantain leaves, but owing to bad preservation it got lost. It measured approximately 15 cm; its colour was pale brown with a longitudinal black dorsal line.

## List of Mammals from Pulau Berhala.

(identified by Messrs. N. CHASEN and C. BODEN KLOSS)

- Tragulus kanchil* subsp.  
*Rattus rattus neglectus* (JENT.) \*  
*Pachyura murina* (LINN.)  
*Pteropus hypomelanus fretensis* KLOSS.

## List of Birds from Pulau Berhala.

(species not marked have been identified by Mr. H. C. SIEBERS; those marked \* were only seen but not collected by the author).

- |   |   |
|---|---|
| <i>Haliaetus leucogaster</i> GM.                  | XI-1925, VIII-1926, VIII-1927,<br>XII-1927. |
| <i>Ninox scutulata</i> (RAFFL.) <sup>2)</sup>     | XI-1919 (?).                                |
| <i>Halcyon chloris</i> BODD.                      | VIII-1926, VIII-1927.                       |
| * „ <i>coromandus</i> (LATH.)                     | XI-1925.                                    |
| <i>Alcedo bengalensis</i> GM.                     | VIII-1926.                                  |
| <i>Hierococcyx fugax</i> (HORSF.)                 | VIII-1926.                                  |
| <i>Eudynamis malayana</i> CAB. & HEINE            | XI-1925, VIII-1926, VIII-1927,<br>XII-1927. |
| <i>Surniculus lugubris brachyurus</i><br>STRESEM. | VIII-1927.                                  |
| * <i>Collocalia</i> sp.                           | VIII-1926, VIII-1927.                       |
| <i>Alseonax latirostris</i> (RAFFL.)              | VIII-1926, VIII-1927.                       |
| <i>Cinnyris hasselti</i> (TEMM.)                  | VIII-1926, VIII-1927, XII-1927.             |
| <i>Anthreptes malaccensis</i> (SCOP.)             | VIII-1926, VIII-1927, XII-1927.             |
| <i>Hirundo gutturalis</i> SCOP.                   | XI-1925, VIII-1926, VIII-1927,<br>XII-1927. |

<sup>1)</sup> Since the manuscript was finished a note on the oligochaete fauna of P. Berhala was published by STEPHENSON (cf. Bibl. 41).

<sup>2)</sup> Cf. p. 284.

<i>Motacilla melanope</i> PALL.	VIII-1926, VIII-1927.
<i>Limonidromus indicus</i> (GM.)	VIII-1926.
* <i>Calornis chalybea</i> HORSF.	VIII-1927.
<i>Pitta</i> sp. <sup>1)</sup>	XI-1919 (?).
<i>Ptilopus jambu</i> (GM.)	VIII-1927.
<i>Myristicivora bicolor</i> (SCOP.)	XI-1925, VIII-1926, VIII-1927, XII-1927.
<i>Caloenas nicobarica</i> (L.)	VIII-1926, VIII-1927, XII-1927.
* <i>Tringoides hypoleucus</i> (L.)	VIII-1926, VIII-1927, XII-1927.
* <i>Ardea sumatrana</i> (RAFFL.)	XII-1927.
* <i>Demiegretta sacra</i> GM.	VIII-1927, XII-1927.
* <i>Fregata</i> sp.	VIII-1926, VIII-1927, XII-1927.

### List of Reptiles and Amphibians from Pulau Berhala.

(the Reptiles have been identified partly by Dr. J. K. DE JONG and partly by L. BRONGERSMA, the Amphibians by Dr. L. F. DE BEAUFORT).

#### Reptilia.

- Gymnodactylus* sp.  
*Hemidactylus vandermeer-mohri* BRONGERSMA  
*Lepidodactylus lugubris* (D.B.)  
*Gecko monarchus* (D.B.)  
*Aphaniotis acutirostris* MODIGL.  
 „ *fusca* (PTRS.)  
*Calotes cristatellus* (KUHL)  
*Varanus salvator* (LAUR.)  
*Mabuia rudis* BLGR.  
*Lygosoma olivaceum* (GRAY)  
 „ *atrocostatum* (LESS.)  
 „ *bowringi* (GTHR.)  
*Chelonia mydas* (L.)  
*Dipsadomorphus dendrophilus* (BOIE)  
*Hydrophis* sp.  
*Enhydris hardwickei* (GRAY)

#### Amphibia.

- Ichthyophis glutinosa* (L.)

The following species which have been found on Pulau Jarak (Cf. Bibl. 42) are mentioned here for comparison: *Gecko verticillatus* LAUR., *Mabuia multifasciata* (KUHL) and *Lygosoma olivaceum* (GRAY).

<sup>1)</sup> Cf. p. 284.

**List of Ants from Pulau Berhala.**(identified by Dr. A. STÄRCKE) <sup>1)</sup>

- Bothroponera rufipes* JERDON.  
*Ectomomyrmex annamitus* ER. ANDRÉ v. *arcuata* FOREL.  
*Euponera (Brachyponera) jerdoni* FOREL.  
*Odontomachus haematoda* LINNÉ.  
*Sima pilosa* F. SMITH.  
*Crematogaster (Orthocrema) biroi* MAYR v. *andelis* SANTSCHI.  
 " " *millardi* FOREL.  
 " " *treubi* EMERY.  
*Monomorium floricola* JERDON.  
*Dolichoderus (Hypoclinea) bituberculatus* MAYR.  
 " " " v. *bornensis* FOREL.  
*Technomyrmex* sp.  
*Atopodon meermohri* STÄRCKE.  
*Anoplolepis longipes* JERDON.  
*Paratrechina (Nylanderia) taylori* FOREL.  
*Camponotus (Tanaemyrmex) irritans* F. SMITH subsp.  
 " (*Myrmablys*) *reticulatus* ROGER v. *bedoti* EMERY.  
 " (*Colobopsis*) *vitreus* F. SMITH v. *oebalis* FOREL.  
*Polyrchachis (Myrma) mayri* ROGER.  
 " (*Myrmhopla*) *phyllophila* F. SMITH.

**List of Hemiptera from Pulau Berhala.**

(identified partly by Mrs. R. KARNY and partly by Dr. D. MAC GILLAVRY)

- Cantao ocellatus* THNB.  
*Scoparipes ?longirostris* SIGN.  
*Gerris* sp.  
*Polytoxus* sp.  
*Mononyx* sp. (larva).  
*Pochazia fuscata* FABR.  
*Nogodina plena* WALK.  
*Pseudoryxa carinulata* SCHMIDT (?).

**List of Orthoptera from Pulau Berhala.**

(identified by Dr. H. H. KARNY)

- Gryllacris signifera* (STOLL) subsp. *obscura* BRUNNER v. W.  
*Rhaphidophora spec. juv.*  
*Euscyrtes concinnus* (DE HAAN)

<sup>1)</sup> The species which Mr. CORPORAAL collected on Pulau Berhala in November 1919 and which have been identified by Mr. SANTSCHI (cf. Bibliography, 44) are also enumerated in this list.

- Cardiodactylus philippinus* BOLIVAR?  
*Ornebius* spec.  
*Nemobius* spec.  
*Psyra melanonota* STÅL  
*Isopsera chaseni* KARNY  
*Phyllomimus ampullaceus* (DE HAAN)  
*Xiphidion cognatum* REDTENBACHER  
*Oxya sinensis* (WALKER)?  
*Atractomorpha crenulata* (FABRICIUS)  
*Erucius apicalis* (WESTWOOD)  
*Panesthia angustipennis* (ILLIGER)  
*Pycnoscelus surinamensis* (LINNAEUS) (Cosmopolitan).  
*Periplaneta americana* (LINNAEUS) (only in luggage of the author).  
*Pseudophoraspis nebulosa* (BURMEISTER)  
*Rhicnoda rugosa* BRUNNER v. W.  
*Eoblatta notulata* (STÅL)  
*Blattella* (s.l.) 3 spp. indet.

### List of Spiders from Pulau Berhala.

(identified by Dr. E. REIMOSER)

- Macrothele maculata* (THOR.)  
*Ariadna snellemanii* (HASS.)  
*Scytodes marmorata* L. KOCH.  
*Zelotes javanus* (KULCZ.)  
*Chiracanthium rupicola* (THOR.)  
*Olios acolastus* (THOR.)  
 „ *lutescens* (THOR.)  
*Heteropoda sumatrana* THOR.  
*Thecticopis orichalcea* (SIM.)  
*Parhedrus fasciatus* REIMOSER  
*Cryptothele sundaica* THOR.  
*Laches sundaica* REIMOSER  
*Lycosa rabulana* THOR.  
*Ctenus robustus* THOR.  
*Bavia sexpunctata* (DOL.)  
*Cosmophasis thalassina* (C. L. KOCH)  
*Plexippus paykulli* (AUD.)  
*Laufeia eucola* (THOR.)  
*Rhomphaea irrorata* THOR.  
*Miagrammopes albomaculatus* THOR.  
 „ *cambridgei* THOR.  
*Leucauge ventralis* (THOR.)  
*Orsinome vethi* (HASS.)

*Cyrtophora moluccensis* (DOL.)  
*Cyclosa bifida* (DOL.)  
*Aranea lugubris* WALCK.  
*Gasteracantha mammosa* C. L. KOCH

#### List of Acari from Pulau Berhala.

(identified by Dr. A. C. OUDEMANS)

*Meritaspis calcaratus* HIRST 1923, on *Pteropus hypomelanus fretensis* KLOSS.  
*Amblyomma helvolum* C. L. KOCH 1844, on *Dipsadomorphus dendrophilus* (BOIE).  
*Haemaphysalis traguli* OUDMS. 1928, on *Tragulus kanchil* subsp.  
*Tritia corporaali* OUDMS. 1926.  
*Allothrombium vandermeermohri* OUDMS. 1928.

#### List of non-marine Molluscs from Pulau Berhala.

(identified partly by Miss T. VAN BENTHEM JUTTING and partly by Dr. F. HAAS)

*Trichochloritis crassula* (PHIL.)  
*Prosopeas achatinaceum* (PFR.)  
*Opeas gracile* (HUTTON)  
*Lagochilus* or *Adelomorpha* sp.  
*Alycaeus frühstorferi* MÖLLDFF.  
*Diplommatina calcarata* MÖLLDFF.  
*Omphalotropis dohertyi* ALD.  
*Pythia* spp.  
*Melampus fasciatus* DESH.  
*Melania tuberculata* var. *truncatula* (LAM.)

#### List of Oligochaeta from Pulau Berhala.

(identified by Lieut.-Col. J. STEPHENSON)

*Pheretima indica* (HORST) f. *typica*  
 „ *berhalana* STEPHENSON  
*Perionyx violaceus* HORST  
*Pontoscolex corethrurus* (FR. MÜLL.)  
*Glyphidrilus horsti* STEPHENSON

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