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# ZOOLOGISCHE VERHANDELINGEN

UITGEGEVEN DOOR HET RIJKSMUSEUM VAN  
NATUURLIJKE HISTORIE TE LEIDEN

(MINISTERIE VAN CULTUUR, RECREATIE EN MAATSCHAPPELIJK WERK)

No. 137

NOTES ON THE LOCALITIES, HABITATS, BIOLOGY,  
COLOUR AND VERNACULAR NAMES OF NEW GUINEA  
FRESHWATER CRABS  
(CRUSTACEA DECAPODA, SUNDATHELPUSIDAE)

by

L. B. HOLTHUIS

Rijksmuseum van Natuurlijke Historie, Leiden

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**NOTES ON THE LOCALITIES, HABITATS, BIOLOGY,  
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**L. B. HOLTHUIS**

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With 10 text-figures and 4 plates

From October 1954 to May 1955 three staff members of the Rijksmuseum van Natuurlijke Historie (Dr. L. D. Brongersma, Dr. M. Boeseman and myself) visited Netherlands New Guinea (at present officially named West Irian, and part of Indonesia) with the object to make zoological collections there and to study the fauna of this most interesting area. Dr. Boeseman as an ichthyologist, and myself as a carcinologist, devoted a large part of our available time to the freshwater fauna. Although most of Dr. Boeseman's attention was given to fishes, and my main interest was with macrurous Decapoda, we brought together fair collections of fresh water crabs, and both of us made field notes on these collections.

The late Dr. Richard Bott<sup>1)</sup> of the Senckenberg Museum, Frankfurt am Main, was so kind as to undertake the systematic study of this material and of other New Guinea fresh water crabs held by the Rijksmuseum van Natuurlijke Historie. A report on them by Dr. Bott is published simultaneously with the present note. Dr. Bott preferred not to include in his paper the field notes on our material in the rather elaborate way in which I had prepared these for him, and after ample discussion we decided that I should publish these notes separately in the present paper.

These field notes contain mainly descriptions of localities and habitats where the crabs were collected by us; in several instances also descriptions of the colour and colour patterns of the living animals were made, as well as observations on their biology; finally, of a number of species the names given to them by the natives were noted. Not only Dr. Boeseman's and my own field notes are given here, but, if available, also those made by the collectors of the other New Guinea fresh water crabs of the Leiden Museum

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<sup>1)</sup> Shortly before this note went to the press, we received the shocking news of Dr. Bott's death.

(e.g., those by Dr. H. Boschma, the zoologist of the 1939 New Guinea Expedition, and those by Dr. W. Vervoort, zoologist of the 1959 Sterrengebergte Expedition). In the present paper these notes are given in a somewhat more extensive form than I had first presented them to Dr. Bott. Furthermore I have also included here the published information on habitat, colour, etc., of the New Guinea fresh water crabs reported in the papers dealing with the species in question.

In previous reports on New Guinea fresh water crabs the localities are often very summarily given. Indications like "Kloofbivak" or "Bivak IV" without any other data, except perhaps the date of collecting, are not rare. In many instances the exact positions of such localities could only be found by consulting the narratives of the expeditions during which the material was collected. The greater part of these narratives is not easily accessible to zoologists, and many are written in Dutch. Therefore I thought it worth while to try and locate for all the localities in New Guinea from which

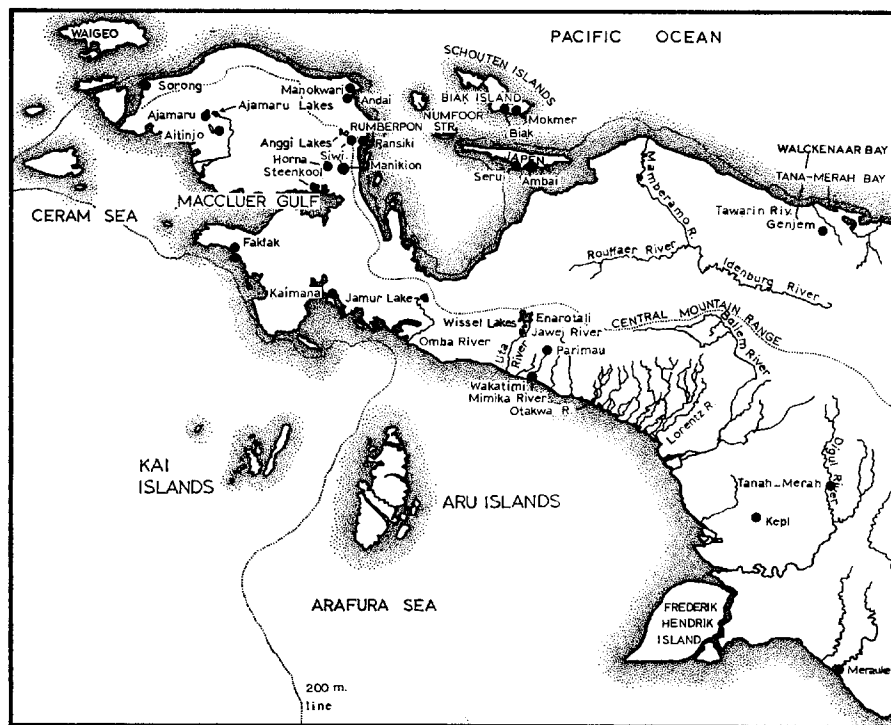


Fig. 1. West Irian (former Netherlands New Guinea).

fresh water crabs have been mentioned, the exact <sup>2)</sup> geographic position and the altitude above sea level. This information was gracefully accepted by Dr. Bott and included in his paper.

In studying the various narratives, I often encountered most interesting descriptions of the stations at which the crabs were taken, which, in my opinion, will be of great interest for a better understanding of the environment in which these species live. For this reason, apart from discussing the habitats, biology, colour and vernacular names of the species dealt with by Dr. Bott, I have included in the present paper an enumeration of all the localities whence these crabs have been reported. If possible, a description of these localities is given, either from personal observation, or from the literature. Under each species the localities are numbered consecutively: they are arranged geographically, first those within West Irian (former Netherlands New Guinea) are treated, followed by those of the Territory of New Guinea and the Territory of Papua, respectively. The localities within West Irian are grouped into two categories, viz., those north of the east-west watershed formed by the Central Mountain Range of New Guinea, and those south of it; this division is roughly comparable to that between the territories of New Guinea and Papua in the eastern half of the island. The meanings of the indications (t), (d), and (s) after the locality numbers are: (t) is "type locality", i.e., localities at which type material of the species or one of its synonyms has been collected, (d) is "doubtful", i.e., localities from which material is collected of which the identity is not fully certain, being those localities that Bott (1974) ranged under "Frühere unbestätigte Meldungen", and (s) indicates those localities of which I obtained direct information from the collectors, or that I visited myself. The doubtful localities are included here under the species to which the material was either originally or later referred. One has to keep in mind, however, that, as Dr. Bott clearly indicated, the identity of the material from these localities can only be decided after reexamination. In the cases where this original material is either lost or insufficient for identification (e.g., by being damaged, incomplete, or immature), renewed collecting at these localities might produce material in sufficiently good condition to make the identity of the original material reasonably clear. Also for this reason inclusion of these localities seems most important.

As far as possible, the exact spelling, in which the name of the locality

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2) The adjective "exact" should be taken cum grano salis, as in several instances determination of positions during the expeditions could not be fully accurate, and different maps often will indicate different positions for the same locality. I have tried here to come as close to the truth as possible.

is given in the carcinological papers, is cited first, followed by the modern spelling, and additional details, like the exact<sup>2)</sup> position. Such details are especially important as the spelling of the geographic names in New Guinea has not been consistent, while sometimes names have changed entirely or were used only as temporary indications (like those of bivouacs of expeditions). Most of the names and positions adopted here are in accordance with the spelling and indications used in the 1944 "Gazetteer (No. 2) New Guinea and Nearby Islands", (ed. 2) issued by the Hydrographic Office of the U.S. Navy Department (cited in the present paper as Anon., 1944).

The order in which the species are arranged in Dr. Bott's (1974) paper is adopted throughout the present note.

I am much indebted to Dr. Richard Bott for identifying our crabs, for reading the manuscript of the present note and for his patience with me. It is my hope that this note may prove a useful addition to Dr. Bott's fundamental paper. Furthermore I want to thank here Professor Dr. H. Boschma and my colleagues Dr. M. Boeseman and Prof. Dr. W. Vervoort for placing at my disposal the field notes on the material collected by them and for oral informations.

### **Rouxana ingrami** (Calman, 1909)

Bott, 1974: 10, text-fig. 1, pl. 1 figs. 1-6.

Localities. — West Irian (north of the Central Mountain Range):

1 (d). "Sawia, N. G. septentr., Août 1911 (coll. Gjellerup et P. N. van Kampen)" (Roux, 1927: 327, under *Paratelphusa* (*Liotelphusa*) *wichmanni* Roux). This is Sawija, "gelegen op  $\pm$  11 K.M. ten Zuiden van de plaats Arso, op een  $\pm$  200 M. hoogen heuvel aan den rechter-oever der Arso-rivier, tusschen deze en de Obiakoer" (situated at about 11 km S. of the village of Arso [at 2°44'S 140°48'E], on a hill at an altitude of about 200 m, on the right hand bank of the Arso River, between that river and the Obiakoer; Staal, 1912: 217). It is indicated by Anon. (1944: 196) as situated at 3°01'S 140°46'E (possibly it is the same as Sawia 2°59'S 140°38'E also listed there). The crabs were taken, during the 1911 Netherlands Noord Nieuw Guinea Expeditie under the leadership of J. T. E. ten Klooster, by the zoologists Drs. K. Gjellerup and P. N. van Kampen; a report of the expedition was given by Staal (1912). Text-fig. 3.

2 (t, d). "Rivière de Mosso, 11.V.1903" (Roux, 1911: 99, under *Potamon* (*Geotelphusa*) *wichmanni* n. sp.; specimens also examined by Roux, 1917: 604 under *Paratelphusa* (*Liotelphusa*) *wichmanni*). Roux (1917: 604) used

2) See note 2 on p. 5.

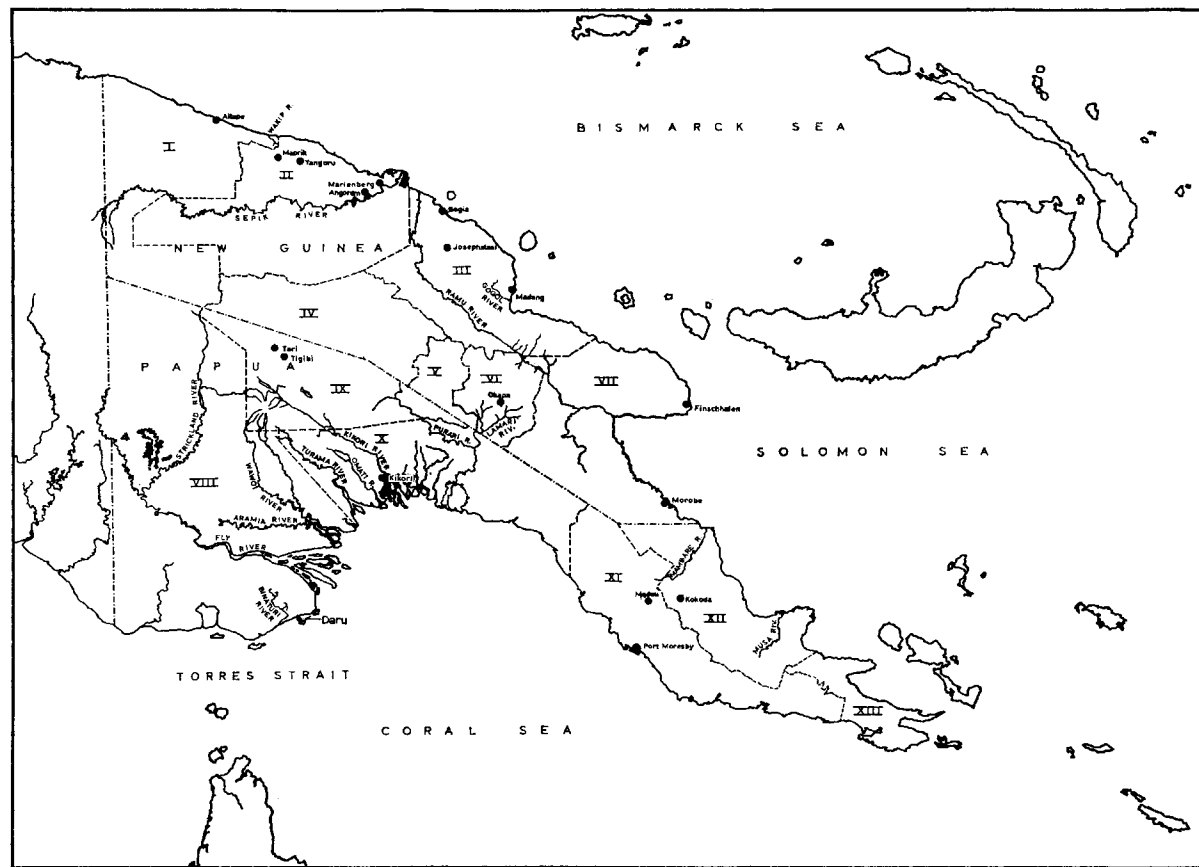


Fig. 2. The Territories of New Guinea and Papua. The roman numerals indicate the districts. These are in New Guinea: I, West Sepik; II, East Sepik; III, Madang; IV, Western Highlands; V, Chimbu; VI, Eastern Highlands; VII, Morobe. In Papua: VIII, Western; IX, Southern Highlands; [V, Chimbu]; X, Gulf; XI, Central; XII, Northern; XIII, Milne Bay.

the name Moso for this river, which name was also used by Wichmann (1917: 224); Lorentz (1905: 102) spelled it Möso, while Anon. (1944: 152) cited it as Mossu River,  $2^{\circ}41'S$   $141^{\circ}02'E$ . The latter name is accepted here. Roux's type material was collected during the 1903 Netherlands Noord Nieuw Guinea Expeditie under the leadership of Dr. C. E. A. Wichmann. Narratives are given by H. A. Lorentz (1905), who on pp. 102-104 described the exploration of the Mossu River, and by Wichmann (1917), who dealt with this locality on pp. 224-228. The Mossu joins the Tami River at some distance above its mouth, and lies close to the border between West Irian and the Territory of New Guinea. The crabs have been collected close to the mouth of the Mossu River. Wichmann (1917: 226), namely, indicated that on 11 May 1903 the zoologists of the Noord Nieuw Guinea Expeditie stayed in the camp near the mouth of the Mossu River (about  $\frac{1}{2}$  hour by canoe up the river), while the geologists explored somewhat farther in the interior. Wichmann (1917: 224) described the Mossu River near its mouth as about 20 m wide, "seine Fluten zeigten, gleich denen des Tami, eine gelbliche Färbung, waren aber weniger trübe. Die Strömung war nur schwach und dennoch hatte unverkennbar kurz zuvor eine starke Überschwemmung stattgefunden. Nicht allein waren die Ufer mit einem grauen Schlamm bedeckt, in dem man bis über die Knie einsank, sondern auch

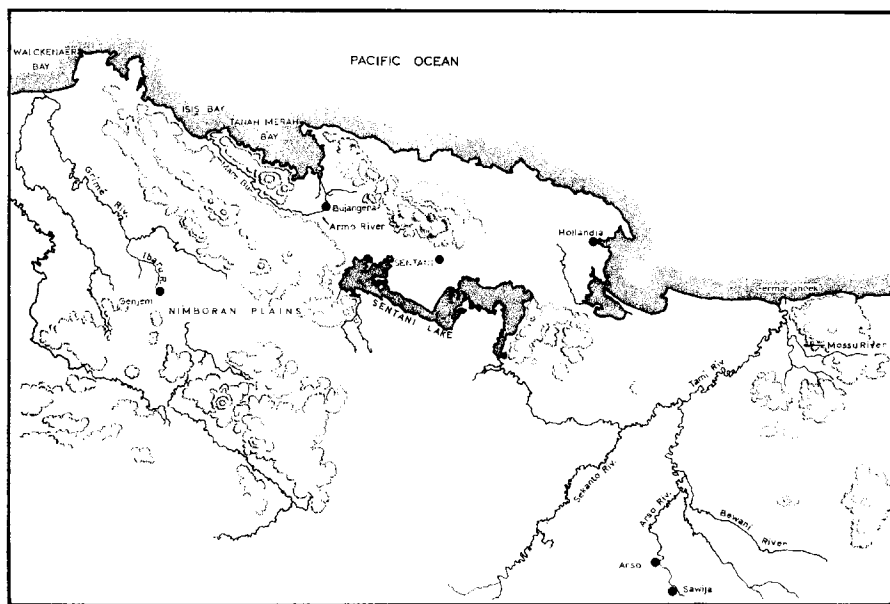


Fig. 3. North-eastern West Irian, from Walckenaer Bay to the border with the Territory of New Guinea. Scale 1 : 1,000,000.

die Zweige und Blätter der Bäume waren bis etwa 1 m über dem Wasserspiegel mit einer grauen Kruste bedeckt". The Mossu River runs through dense forests as is well shown in Wichmann's (1917: 225) fig. 94; the same figure is reproduced by Lorentz (1905: 103). The area is in the lowlands of Northern New Guinea. Text-fig. 3.

West Irian (south of the Central Mountain Range):

3 (d). "Mimika River" (Calman, 1914: 309, under *Parathelphusa* (*Liotelphusa*?) *aruana* (Roux); see remarks below). The Mimika River is a river in S.W. West Irian, emptying in the Arafura Sea. The British Ornithologists' Union 1909-1911 New Guinea Expedition followed the Mimika from its mouth (where the main base was at Wakatimi, 4°39'S 136°27'E) up to Parimau (4°21.5'S 136°38.5'E, alt. 33 m). It is not known where on this stretch (alt. 0-33 m) the crabs were taken. Text-fig. 1.

Territory of New Guinea:

4. "Éilapé, Berlinerhafen, N.G. septentr., Nov. 1906, (coll. H. Schoede)" (Roux, 1927: 327 under *Paratelphusa* (*Liotelphusa*) *wichmanni* J. Roux; "Neu Guinea (1 ♀ MBa 731a)", Bott, 1970: 84, under *Rouxana ingrami* (Calman); "Berlin Harbour, Aitape (Éilapé, Berliner Hafen), 3°10'S 142°30'E, 1 ♂ (MBe 12551), 1 ♀ (MBa 751a)", Bott, 1974: 11 under *Rouxana ingrami* (Calman)). This locality is Berlin Harbour, near Aitape, Aitape Subdistrict, West Sepik District, 3°10'S 142°30'E. It lies on or near the coast. The coastal plain near Aitape is about 10 miles wide (cf. Anon., 1972, vol. 2: 1031), it is, therefore, likely that the crabs were taken at a low altitude. Text-fig. 2.

5 (t, d). "At foot of mountain range, close to head waters of Wakip River, north coast of New Guinea" (Rathbun, 1926: 179 under *Cylindrotelphusa wakipensis*, sp. nov.). This locality lies about 4½ km from the north coast of Aitape Subdistrict, West Sepik District, at about 3°21'S 143°00'E. Text-fig. 2.

6 (s). Teigwaka Swamp near the Lamari River, Okapa Subdistrict, Eastern Highlands District, at about 6°26'S 146°04'E, 1962 (leg. D. C. Gajdusek). This specimen came from a muddy swamp in the highlands. Text-fig. 2.

Territory of Papua:

7. "Gulf-Distrikt, Gihiteri-Bach am Omati (1 ♀ MMü)" (Bott, 1970: 84, under *Rouxana ingrami* (Calman)). This is Gihiteri Creek near the Omati River, Kikori Subdistrict, Gulf District. According to Anon. (1944: 69), the village of Gihiteri lies at 7°29'S 143°55'E. The Omati River arises in the foot hills and flows for the larger part of its length through the lowland area. Gihiteri also lies in the lowlands; probably the altitude is only slightly

above sea level. Bott (1970: 84) listed under *R. ingrami* also a specimen from "Golf-Distrikt (1 ♂ SMF 4274)", this evidently comes from the same locality, as Bott (1974: 11) enumerated among the examined material from Gihiteri both his 1970 ♀ of the Munich Museum and the male (no. 4274) from Senckenberg Museum. Text-fig. 2.

8 (t). "Madeu, St. Joseph River, British New Guinea, 2000-3000 feet, W. Stalker coll." (Calman, 1909: 961, under *Gecarcinucus ingrami*, sp. n.). The Joseph River lies to the north of Port Moresby in Port Moresby Sub-district, Central District, at about 8°56' 147°20'E. The crabs were caught at an altitude of 700 to 1000 m. Bott (1974: 11) examined and reported on the same material. Text-fig. 2.

Habitat and biology. — As to the type material of *Gecarcinucus ingrami* (loc. 8), Calman (1909: 61) remarked that the collector "informs me that the species probably burrows in swampy ground, although he did not actually see specimens taken from the burrows". Rathbun (1926: 180) gave the following details of the habitat and biology of her material (loc. 5): "clay castings from the burrows of this species occurred on the banks of the Wakip River close to its headwaters, which are about 2½ miles from the sea coast. Upon excavation, tunnels about four inches in diameter were revealed running down obliquely into the earth for a distance of about two feet. Similar castings and burrows were plentifully distributed on both banks of the stream for a distance of about 300 yards. In this area the surface of the banks is hard yellow clay, but at a little depth this becomes soft and moist. In this moist clay the burrows of the crabs terminated in a water-filled chamber, which invariably contained a specimen".

Dr. Gajdusek's specimens (loc. 6) came from a muddy swamp.

As to the altitudes, the only exact figures are 0-33 m (loc. 3), about 200 m (loc. 1), 700-1000 m (loc. 8, type locality), lowlands (loc. 2, 4, 7), highlands (loc. 6). Of the other localities no altitude is known.

Colour. — Little is known about the colour of the species. Roux (1911: 100; 1917: 605) stated that the fingers of the chelae are "couverts sur les deux faces de petites points brun foncé irrégulièrement dispersés, nombreux".

Remarks. — The specimen from Teigwaka Swamp was collected by Dr. Gajdusek during a survey of the food of the native population in the Okapa area, this species forming part of their diet.

The female specimen from Berlin Harbour in the possession of the Basel Museum was not listed by Roux (1927: 327) in his paragraph "Localités", in which only the males from Sawia and Eilapé (coll. Mus. Berlin) are mentioned. On p. 328, however, Roux dealt with "une ♀, appar-



tenant à la collection de Bâle", but no locality was mentioned here by Roux. This evidently is the same specimen as that listed by Bott (1970: 84) as MBa 731a from "Neu Guinea", and of which Bott (1974: 11), though as MBa 751a, gave the more accurate locality "Berlin Harbour, Aitape".

Bott (1970: 75, 82, 83) gave a reference to *Parathelphusa* (*Liotelphusa* ?) *aruana* (as cited by Calman, 1914, Trans. zool. Soc. London, 20: 307-309), under three different species, viz., under *Sundathelphusa aruana* (Roux, 1911) on p. 75, under *Mainitia calmani* (Roux, 1927) on p. 82, and under *Rouxana ingrani* (Calman, 1908) on p. 83. Although this is not definitely stated by Bott, the reference under *Sundathelphusa aruana* probably is only to Calman's (1914: 309) specimens "(a)" from the Aru Islands, as those are the only ones of Calman's material found within the range of *S. aruana* as defined by Bott (1970). The reference to Calman, 1914 under *Mainitia calmani* (Roux) is clearly to Calman's (1914: 309) specimens "(c)" from the Utkwa [= Otakwa] River as these are the types of *Mainitia calmani*. The reference under *R. ingrani* therefore, by elimination, must perforce apply to the only other lot mentioned by Calman (1914: 309) under *Parathelphusa* (*Liotelphusa* ?) *aruana*, namely lot "(b)" from the Mimika River. The locality Mimika River, however, is not mentioned by Bott in his 1970 paper, while in his 1974 publication (Bott, 1974: 10) the above reference to Calman, 1914, is entirely omitted from the synonymy of *Rouxana ingrani*, and neither is the locality Mimika River included in the list of localities at the end of Bott's paper.

### ***Rouxana papuana* (Nobili, 1899)**

Bott, 1974: 11, text-fig. 2, pl. 1 figs. 7-10.

Localities. -- West Irian (north of the Central Mountain Range):

1 (t, d). "Andai", "Penisola Berou" (Nobili, 1899: 232, 264 under *Potamon* (*Geotelphusa*) *pictum papuanum* n. subsp.; Roux, 1927: 342, under *Potamon papuanum*; Bott, 1970: 85 under *Rouxana papuana*). Andai is a village S.W. of Manokwari in the northern part of the east coast of the Vogelkop Peninsula in northwestern West Irian, at 0°51'S 134°01'E. It was visited by L. M. d'Albertis from 5 August to 2 November 1872 (see d'Albertis, 1880, vol. 1: 72-144) during which time also an excursion to Hatam in the interior (up to an altitude of 1200 m) was made (4 September-1 October). It is not known when and where d'Albertis collected the crab. If it was near Andai, the altitude must have been quite low. Text-fig. 1.

West Irian (south of the Central Mountain Range):

2 (s). Ok Bon (= Bon River), Digul River basin west of the Antares Mountain at about 4°53'S 140°45'E, 1300-1450 m altitude, 30 June-5 July

1959, 1959 Netherlands Sterrengebergte Expeditie, (leg. W. Vervoort, no. 39-41). The Ok Bon flows, as Dr. Vervoort informed me, through virgin forest. It is a very rapid stream, the bottom of which is entirely covered with stones. Text-fig. 4.

3 (s). Base camp, Ok Sibil (= Sibil River), Digul River basin, west of the Antares Mountain, at  $4^{\circ}54'43''\text{S}$   $140^{\circ}37'49''\text{E}$ , 1260 m altitude, 7 July 1959, 1959 Netherlands Sterrengebergte Expeditie (leg. W. Vervoort no. 44). The bed of this river was practically dry at the time the crabs were taken, it consisted of sand and stones with here and there a pool of water. Text-fig. 4.

#### Territory of New Guinea:

4 (s). Purosa, near Okapa, Okapa Subdistrict, Eastern Highlands District, at about  $6^{\circ}35'\text{S}$   $145^{\circ}35'\text{E}$ , July 1963, (leg. D. C. Gajdusek, no. 45). The altitude of the district generally varies from 1700 to 3000 m, but in the south and the north it goes down to less than 300 m (Anon., 1972: 284). Text-fig. 2.

#### Territory of Papua:

5 (t). "Katau: Nuova Guinea Meridionale presso le foci del fiume Fly (D'Albertis)" (Nobili, 1899: 232, 263 under *Potamon* (*Geotelphusa*) *pictum papuanum* n. subsp.; Bott, 1970: 85 under *Rouxana papuana*). The Katau River as it was known to D'Albertis, is at present named Binaturi River (see Anon., 1944: 28), it is situated W.S.W. of the mouth of the Fly River, Daru Subdistrict, Western District at about  $9^{\circ}09'\text{S}$   $142^{\circ}58'\text{E}$ . This area was visited by L. M. d'Albertis four times between 1875 and 1887, viz., 2 and 3 December 1875, from 7 August to 2 November 1876 and from 17 to 19 May and 23 November to 5 December 1877 (see D'Albertis, 1880, vol. 2: 9-14, 162-207, 230-232, and 346-348). The altitude at which the crab was collected is not known, but it is likely very low as the entire S.W. part of New Guinea, including the far greater portion of the Fly River, and certainly the whole of the Binaturi River, lies much below 100 m altitude. As during his stays at "Katau" D'Albertis apparently has not gone into the interior, the crab probably was collected at a few meters altitude at the most. Text-fig. 2.

6 (s). Tigibi, Tari Subdistrict, Southern Highlands District,  $5^{\circ}56'\text{S}$   $143^{\circ}3'\text{E}$ , altitude 1600 m, 4 June 1966 (leg. W. Vink, no. 49). The material was taken during a botanical expedition to the Territories of Papua and New Guinea organized under the joint auspices of the Rijksherbarium at Leiden and the Division of Botany, Department of Forests at Lae, Territory of New Guinea. Text-fig. 2.

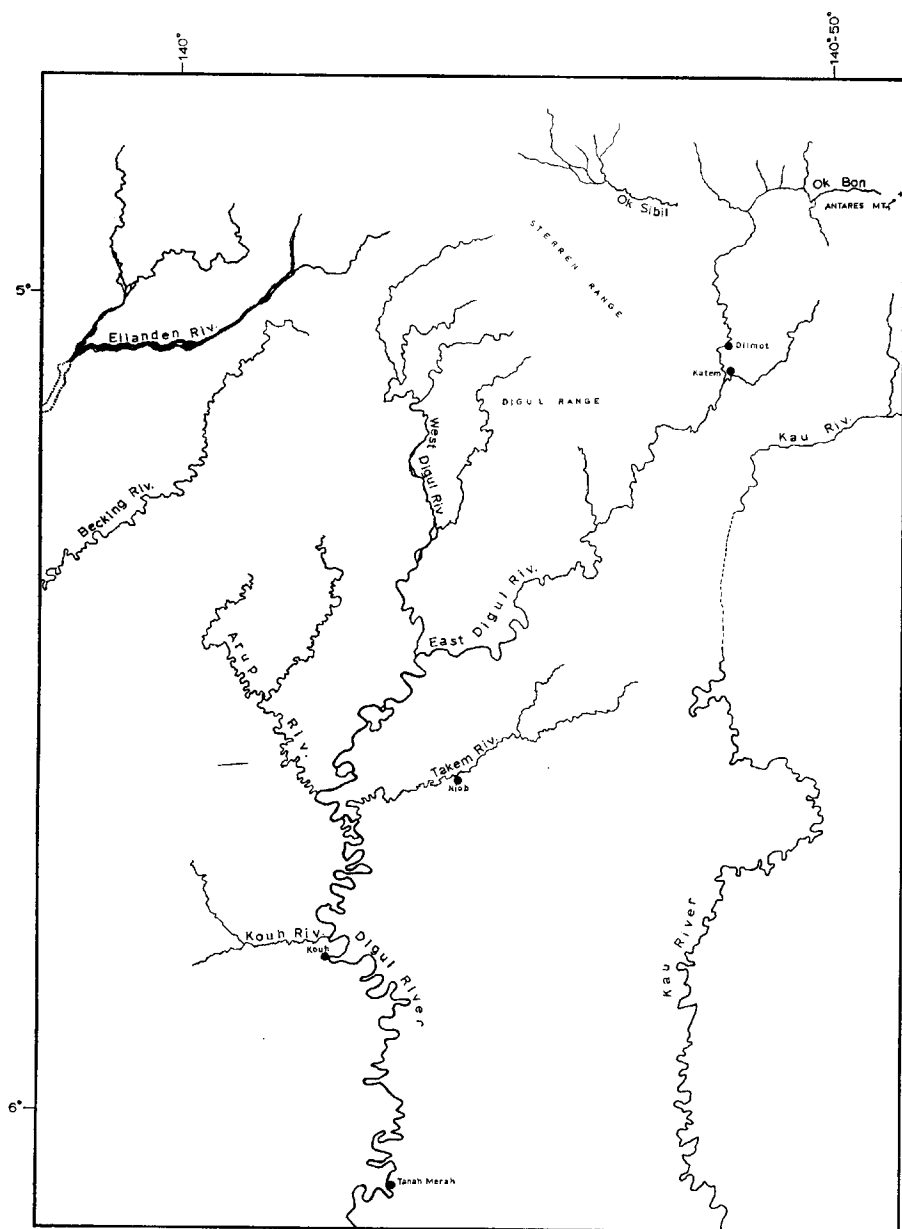


Fig. 4. Digul River and Sterrengebergte area, south-eastern West Irian.

Habitat and biology. — The animals from the Ok Bon (loc. 2) were not found in the river itself, but under stones on the banks just above the water line (see also Brongersma & Venema, 1960: 160; 1962: 173). Those from the Ok Sibil (loc. 3) were found under stones in the almost dry bed of the river.

The specimens from Tigibi (loc. 6) were collected in the fresh water of a water cress swamp, where they were found together with the Hymenosomatid crab *Halicarcinus angelicus* Holthuis (see Holthuis, 1968: 109).

The altitudes from which the present species is reported are: lowlands (locs. 1?, 5), highlands (loc. 4), 1260 m (loc. 3), 1300-1450 m (loc. 2), 1600 m (loc. 6). It is interesting to see that only the type localities of the species are at very low altitudes, while all or practically all the examined material originates from over 1000 m.

Native names. — According to Dr. D. C. Gajdusek (in litt., 9 August 1963), the native name near Purosa, South Fore area, Okapa Subdistrict, Eastern Highlands District is "Wagigaba", while at nearby Atigina it is "Waguguba".

Remarks. — Dr. Gajdusek (in litt.) informed me that the species "is used rather extensively as food by the populations along the Lamari River in the Eastern Highlands" of the Territory of New Guinea.

Brongersma & Venema (1962: 173, 174) gave the following account of the way the expedition to the Sterrengebergte obtained these crabs from the Papuans: "The crabs were shown to them and they soon set about catching them with a great deal of zeal. These Papuans very soon twigged that for five crabs they would be paid the — to them — fantastic price of a small hand-mirror. This gave rise to a busy trade; again and again they would arrive with five crabs wrapped up in a leaf and receive their reward. Not until one consignment had been paid for was the next brought out of the carrying-net. When supplies became too plentiful Vervoort tried to reduce the price, but the Ok Bonners would have none of this. They preferred to throw the creatures away rather than agree to provide more than five crabs for one mirror. On this score they were tougher than the Sibillers, who were prepared to let the price come down if they could not sell their wares".

Bott (1970: 85) indicated the specimen from "Katau" [= Binaturi River] (loc. 5) as the "holotype" of *Potamon* (*Geotelphusa*) *pictum papuanum* Nobili. However, as Nobili (1899) brought two specimens to his new subspecies, viz. the "Katau" male and the juvenile from Andai, both are only syntypes. As the Andai specimen is young, and most authors considered the "Katau" specimen the important one, it is logical to select the latter as the lectotype. The Binaturi River thereby becomes the restricted type locality.

**Rouxana plana** (Calman, 1914)

Bott, 1974: 13, text-fig. 3.

Localities. — West Irian (north of the Central Mountain Range):

1 (d). "Siwi, Nouvelle-Guinée hollandaise, à l'intérieur du Vogelkop, 7-III-1929" (Roux, 1933: 9 under *Paratelphusa* (*Liot.*) *plana*). Siwi is a locality in the eastern part of the Vogelkop Peninsula, south of the Anggi Lakes at 1°29'S 134°02'E. It lies in the Siwi Valley at an altitude of 800 m, the mountains nearby go up to over 1500 m (cf. Mayr, 1930: 21, 22). The material was collected during the 1928-1929 expedition to the Netherlands East Indies of their Royal Highnesses the Prince and Princess Leopold of Belgium. Text-fig. 1.

West Irian (south of the Central Mountain Range):

2 (t). "Utakwa River" (Calman, 1914: 311, under *Parathelphusa* (*Liotelphusa*?) *plana*, sp. n.; this material was also examined by Bott, 1970: 86, under *Rouxana plana*). This locality is the Otakwa River, a river emptying into the Arafura Sea on the S.W. coast of New Guinea at 4°35'S 137°15'E. The 1912-1913 British Wollaston New Guinea Expedition spent a long time (18 September 1912-March 1913) in exploring the Otakwa from its mouth up to an altitude of about 5000 feet (= 1700 m); there is no indication where along the river the crabs were collected. Text-fig. 1.

3. "Biwak IV  $\pm$  1050 m" (Roux, 1921: 605, under *Paratelphusa* (*Liotelphusa*) *plana*; Roux (1927: 344) cited the locality as "Bassin de la Riv. Lorentz", and Bott (1974) as "Van der Sande-Fluss, ein Seitenfluss des Lorentz (Nord-) Flusses"). "Biwak IV" is the "Perameles Bivak" of the 1909 Netherlands Zuid Nieuw Guinea Expeditie, and also served the 1912-1913 Netherlands Zuid Nieuw Guinea Expeditie as a bivouac. It lies at an altitude of 1050 m on the Van der Sande River, a large tributary of the Lorentz (or Noord) River at 4°34'S 138°42'E. This bivouac was reached by the 1909 expedition on 12 October 1909 and named Perameles Bivak because when setting up camp a large marsupial was caught. The area is described by Lorentz (1913: 91, 92) as follows: "erg gunstig is het terrein niet, de boomen in de omgeving zijn armoedig en krom gegroeid, ik denk, dat de rifkalk een zeer onvruchtbare bodem is" (the terrain is not very favourable, the trees in this area are poor and have grown crooked, I suppose that the reefchalk is a very poor soil). The camp was on a steep slope near a river. Pulle (1914: 121-125), the botanist of the 1912-1913 expedition, also described this bivouac and remarked that the slope of Perameles Mountain, on which the bivouac was situated, consisted of two

different formations, viz., chalk and sandstone. He furthermore (Pulle, 1914: 123) noted (in translation) that "the ground as well as the trunks and branches of the trees, even the thinnest, are clothed by a layer of bright green moss, a layer so thick that the diameter of the trunks is often ten times enlarged. All the holes and depressions in the block-shaped sandstone are grown over by moss"; in this connection it is interesting that Van Heurn (in Holthuis & Husson, 1973: 61) stated that he found crabs under moss (see also in the present paper p. 15, under *Rouxana minima*, and p. 40 under *Holthuisana subconvexa*). Text-fig. 1, 5.

Habitat. — No notes have been made on the habitat in which the collected material has been found. The altitude of the localities is 0-1700 m (loc. 2), 800 m (loc. 1), and 1050 m (loc. 3).

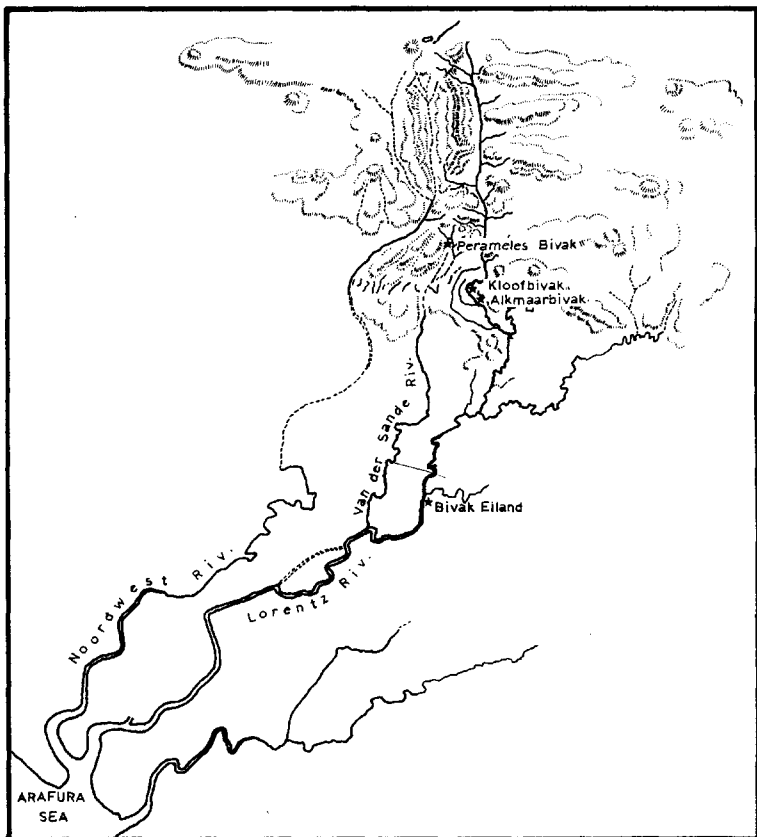


Fig. 5. Lorentz River basin, southern West Irian. Scale 1 : 700,000.

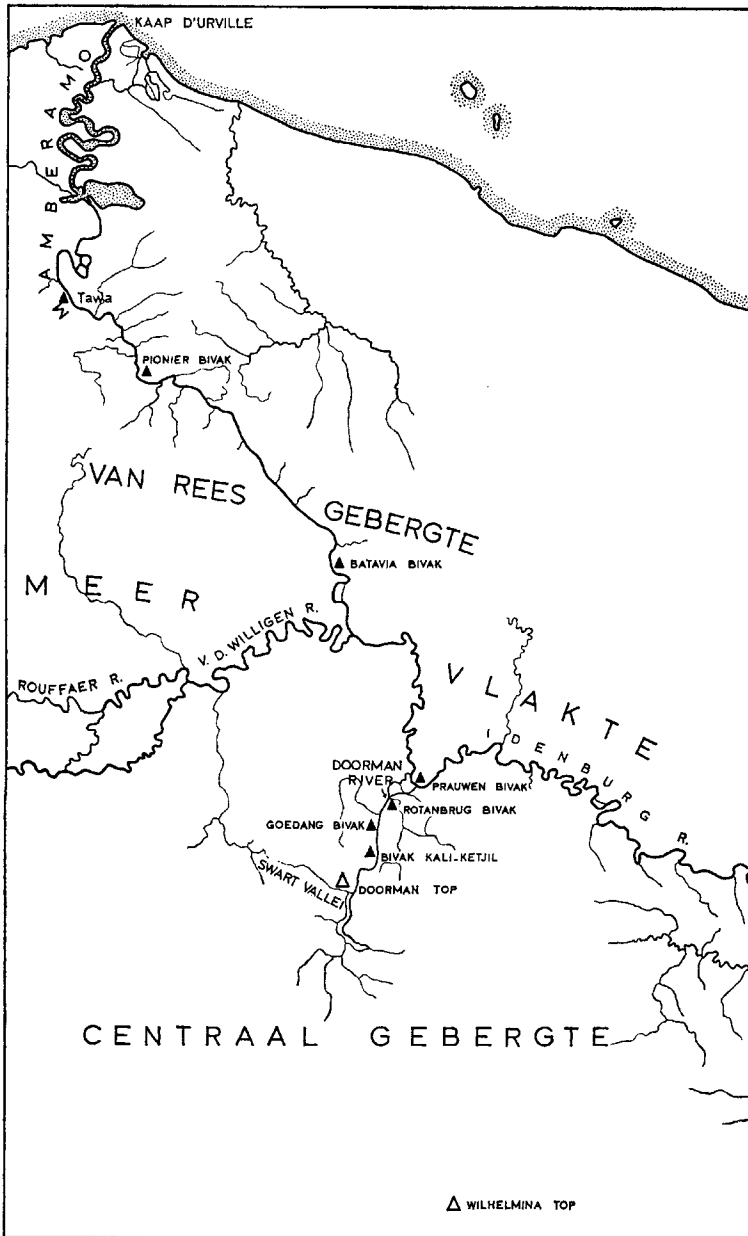


Fig. 6. Mamberamo River basin, northern West Irian. Adapted from Holthuis & Husson, 1973.

**Rouxana minima** (Roux, 1927)

Bott, 1974: 14, text-fig. 4, pl. 1 figs. 11-13, pl. 2 fig. 14.

Localities. — West Irian (north of the Central Mountain Range):

1 (t). "Nouv. Guinée holl. sept.: ? bassin du Mamberamo. (Le tube contenant ces exemplaires était dépourvu d'étiquette, mais accompagnait ceux qui contenaient les espèces du Mamberamo, décrites ci-devant)" (Roux, 1927: 335, under *Paratelphusa* (*Liotelphusa*) *minima* n. sp.; part of this material has also been examined by Bott (1970: 84-85, under *Rouxana minima*)). The Mamberamo collection was made during the 1920-1921 Netherlands Noord Nieuw Guinea Expeditie under the leadership of A. J. A. van Overeem, with W. C. van Heurn as zoologist. Van Heurn collected mostly at Pionierbivak ( $2^{\circ}15'S$   $138^{\circ}E$ , alt. 60-70 m, see *Holthuisana biroï*, loc. 3, p. 31) and Prauwenbivak ( $3^{\circ}15'S$   $138^{\circ}40'E$ , alt. 110 m), both situated on the Mamberamo River; furthermore he made one collecting trip to Goedang bivak (= Doormanpad bivak, at about  $3^{\circ}24'S$   $138^{\circ}38'E$ , altitude 1410-1450 m) about 25 km due S. of Prauwenbivak (see Holthuis & Husson, 1973: 20-32, fig. 4). In his general notes on the zoological collections of this expedition Van Heurn (in Holthuis & Husson, 1973: 61, 62) stated about the crabs that he collected (in translation): "We found sporadically a small form of crabs, up to high in the mountains (at least as far as 1500 m), under moss, etc., while in the lower areas the ground in the virgin forests in many places was riddled by crab burrows; we were not able, however, to catch a single one of the inhabitants of these burrows, be it dead or alive". As Van Heurn collected several more species of fresh water crabs during this expedition (see *Holthuisana festiva* (Roux), *H. biroï* (Nobili) and *H. subconvexa* (Roux)) it is impossible to indicate with certainty to which of the species his remarks refer. Text-fig. 1, 6.

Territory of New Guinea:

2 (t). "Ci-devant Nouv. Guin. allem. Fl. Impératr. Augusta, 3 Ex. (2 ♂, 1 ♀), (Coll. Dr. Bürger, 1912-13)" (Roux, 1927: 335, under *Paratelphusa* (*Liotelphusa*) *minima* n. sp.). The name "Fleuve Impératrice Augusta" is a translation of "Kaiserin Augusta Fluss", the old name for what at present is called Sepik River. The material from this locality was obtained by Dr. Th. J. O. Bürgers (not Bürger), zoologist of the 1912-1913 German Neu Guinea Expedition sent out jointly by the "Reichskolonialamt", the "Königliche Museen" and the "Deutsche Kolonialgesellschaft". The expedition explored the greater part of the Sepik River from its mouth up; also the surrounding area was visited and altitudes of up to about 1750 m were reached. It is not known where on this very long tract the crabs were collected. Text-fig. 2.



Colour. — “La carapace est d’une couleur allant du gris foncé au gris-brun. Cette teinte est aussi celle de la face supérieure des chélipèdes et des pattes ambulatoires. La moitié distale des doigts des chélipèdes est plus foncée que la partie proximale. La face ventrale est blanc jaunâtre” (Roux, 1927: 336, description of the preserved Mamberamo material).

Remarks. — Roux’s (1927: 335) statement: “Nous prendrons comme types de notre description les spécimens provenant de la Nouvelle Guinée hollandaise” restricts the type locality to the Mamberamo basin.

***Rouxana roushdyi* Bott, 1974**

Bott, 1974: 15, text-fig. 5, pl. 2 figs. 15-19.

Localities. — West Irian (south of the Central Mountain Range):

This species so far is only known from the Wissel Lakes area in the central mountain range of West Irian (text-fig. 1, 7). The lakes are three in number: Paniai Lake is the largest, being roughly quadrangular, about 16 km long and 9 km wide, lying at an altitude of 1742 m. Tigi Lake, the next in size, lies to the south of Paniai Lake, it is roughly triangular with a

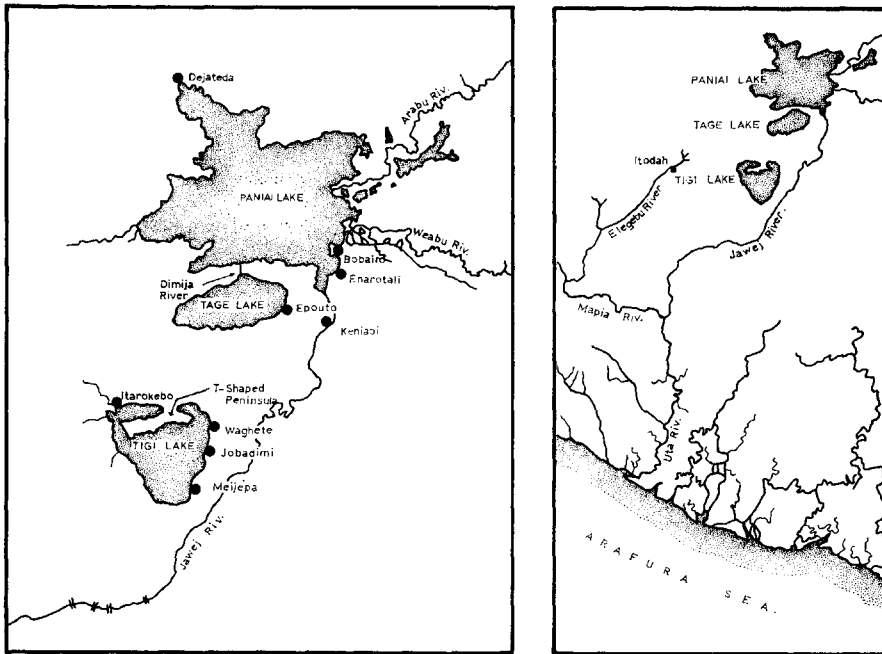


Fig. 7. Wissel Lakes in the Central Mountain Range, West Irian. Adapted from Boeseman, 1963. Scale of left figure 1 : 600,000.

maximum diameter of about 8 km, its altitude is 1640 m. The third lake, Tage, is the smallest (8 km long, 3 km wide, elongate oval in outline), it lies between Paniai and Tigi, much closer to the former, from which it is separated by a narrow strip of land; it has the highest altitude of the three lakes, lying at 1749 m. Tage Lake is connected with Paniai by a small stream, which traverses the narrow strip of land separating the two lakes, and which for a large part of its length is subterranean. Several rivers enter Paniai Lake, which has only one large effluent, viz., Jawej River, which leaves the lake in its S.E. part and runs southward to empty in the Arafura Sea. Tigi Lake is connected with the Jawej River by a short branch river. Part of the shores of the lakes are deforested and open, this is especially true of Tigi and Paniai. In places, especially where the rivers enter the lakes, the shores are low and swampy, the muddy soil being covered by a grass-like vegetation; but some of the shores are steep and rocky, while here and there in the swampy part, there are rocky outcroppings like Bobairo Peninsula in Paniai Lake just N. of Enarotali, and the so-called T-shaped peninsula in Tigi Lake. Also the banks of Jawej River in many places are steep and rocky. In their shallower parts the lakes show a dense vegetation of *Potamogeton*- and *Chara*-like plants. The plankton samples taken were extremely poor in organisms. Descriptions of the area are given by Boschma (1943: 504-522), Boeseman (1963: 232-234) and Holthuis (1956: 130-136).

Crabs were found by us only in Paniai and Tigi Lakes and in the Jawej River. From Tage Lake we did not obtain any crabs; this might be due to our very short stay there, but on the other hand, Papuans asserted us that absolutely no crabs occur in the lake. The species was taken at the following localities:

1 (t, s). Dejjateda, N.W. shore of Paniai Lake, 3°49'S 136°15'E, alt. 1742 m, 3 and 10 September 1939. Collected by Dr. H. Boschma, zoologist of the 1939 Netherlands Nieuw Guinea Expeditie van het K.N.A.G. (= Koninklijk Nederlands Aardrijkskundig Genootschap, Royal Netherlands Geographic Society). Dr. Boschma, in his field notes described the locality as a shore with stones. Under these stones there were many Collembola, and, where the soil becomes more humid, many earthworms which show rows of spots of a beautiful iridescent colour. The worms are rather agile, and jump like autotomized lizard tails when touched. On the shore, at the edge of the water line, there was a windrow of the exuviae of a small aquatic Hemipteron, resembling *Corixa*; this windrow was about 20 cm wide and 10 cm high.

2 (t, s). Southern shore of Bobairo Peninsula, N. of Enarotali (see

locality 3), alt. 1742 m, 25 August 1939 (leg. H. Boschma), 25 December 1954 (leg. M. Boeseman), 10 January and 14 February 1955 (leg. L. B. Holthuis, nos. 671 and 699). Bobairo is a peninsula with a rocky and stony shore projecting into the lake from the otherwise swampy S.E. shore of Paniai Lake. Pl. 1 fig. 1.

3 (t, s). Enarotali, on the southeastern shore of Paniai Lake just east of the outflowing Jawej River,  $3^{\circ}56'S$   $136^{\circ}22'E$ , alt. 1742 m, 1938 (leg. A. Roushdy), 20 August-30 November 1939 (leg. H. Boschma). Adang Roushdy from Amboina, was the first government physician at the Wissel Lakes; he came there as soon as the government post at Enarotali was established. He made some zoological collections, which were found in Enarotali, after his death in 1939, by Dr. Boschma during the 1939-1940 expedition. It is quite well possible that the material does not come from Enarotali itself but from nearby Bobairo Peninsula. The other material obtained by Dr. Boschma and labelled Enarotali was brought in by the Papuans and also may have come from Bobairo or other nearby localities.

4 (t, s). East bank of the upper part of the Jawej River near the place where it leaves the S.E. corner of Paniai Lake,  $3^{\circ}57.5'S$   $136^{\circ}21.5'E$ , 1742 m, 28 December 1954 (leg. M. Boeseman), 7 January 1955 (leg. L. B. Holthuis, no. 669). Here the Jawej is a rather wide river with wooded banks, which are steep and rocky. Pl. 2 fig. 1.

5 (t, s). Eastern shore of the T-shaped peninsula, which projects from the northern shore of Tigi Lake,  $4^{\circ}02'S$   $136^{\circ}16'E$ , alt. 1640 m, 12 January 1955 (leg. L. B. Holthuis, no. 674). The shore is rocky with stones. Pl. 1 fig. 2.

Habitat and biology. — In Paniai and Tigi Lakes the crabs were found under stones on the rocky shores of Bobairo Peninsula and the T-shaped peninsula respectively. The stones were in very shallow water, 0 to 0.5 m deep. Nowhere did we obtain crabs from the swampy shores.

In the Jawej River I observed the crabs sitting quite exposed on, not under, the rocks. They were quite numerous there and were especially common on those rocks that were densely covered with Prosobranch Gastropoda belonging to the species *Bellamya wisseli* Van Benthem Jutting, 1963 (cf. Van Benthem Jutting, 1963: 432-434), a species, the original description of which is partly based on the Jawej material observed with the crabs. The crabs, sitting in clear view on the rocks, were the more conspicuous as they were of a bright orange or yellow colour, while the rocks and the prosobranchs were very dark green or greenish grey. The crabs were visible as orange spots down to a depth of about 50 cm or more and in places were so numerous that the rocks gave the impression of being orange-speckled.

It is highly peculiar that the crabs that live well hidden under rocks have such a neutral greenish colour, while those that are living fully exposed have a very bright colour strongly contrasting with the environment. It seems very unlikely that the crabs are free from predators, as, at the same occasion at which I collected the orange crabs, I observed also waders, probably the Common Sandpiper, *Tringa hypoleucos* L., on the bank of the Jawej, while probably other water birds pass through here during migration.

Colour. — The crabs from Bobairo Peninsula of Paniai Lake had the carapace uniform olive green with small irregular pale yellowish spots, the rugae also being yellowish. The pereopods are olive green with white spots. The large cheliped is yellowish, the upper part of the palm and the dactylus show an olive tinge, as does the tip of the fixed finger; the lower side of the chelae is yellowish. The carpus and the distal part of the merus are yellowish with olive. Young animals are darker, being almost entirely olive green. In one specimen the yellow spots on the carapace were dominant, and also the rest of the body was lighter; this colour was quite irregular, however, and possibly abnormal.

The animals from Tigi Lake have the carapace likewise olive green over a yellowish background, at several places the yellowish colour is visible. The legs are spotted olive green on a yellowish background. The large cheliped of the male is yellowish with the upper part of the palm and the dactylus olive, the fixed finger is yellowish, like the lower part of the palm; carpus and merus are olive coloured. The smaller cheliped is similar but somewhat darker than the larger. The lower surface of the carapace is olive, the rest of the body is yellowish.

Although the specimens from Paniai and Tigi Lakes are very similar, if not identical, in colour, those from the Jawej River are conspicuously different. As already mentioned above, these Jawej animals are orange red to bright yellow, rarely with a slight olive tinge mixed with the orange; sometimes an inconspicuous grey pattern being visible in the anterior part of the carapace. The ventral surface is likewise orange to yellow, it is lighter than the dorsal surface. The eggs are pale orange. This orange colour is most peculiar as it makes the animals very conspicuous, being visible for human eyes to some distance below the water surface as bright orange spots.

Natives names. — On the Jawej River the names “kamè” and “oedi kanija”, were given to the orange specimens; the word “oedi” being the general term for crayfish in the region. Dr. Boeseman, when on the Jawej River, was told the name “Degelene Lagiodene” for the orange coloured form, while the name “Buna” was indicated as the name for the greenish crabs. In Tigi Lake we noted the name for the crabs as “oedi kènijá”,

while near Enarotali the names "Kenia" and "Kenekario" were in use.

Remarks. — So far as we could notice, the crabs are not used for food; possibly they are too small, especially in comparison to the several species of Parastacidae that are found abundantly in the area.

It is a very thoughtful gesture of Dr. Bott to name this species for Dr. Adang Roushdy, the first resident physician of the Wissel Lakes area. Dr. Roushdy, who originated from Amboina, during his stay at the Wissel Lakes brought together a small zoological collection among which the present species of crabs. Dr. Roushdy died while fulfilling his duties; he drowned in Paniai Lake. Strong NW winds, which usually blow every afternoon, can cause a very strong wave action, especially in the S.E. corner. The native canoes are low and made of such heavy wood that they sink when full of water. It is during one of these strong winds that Dr. Roushdy lost his life. The collections that he made were handed by his successor, Dr. Tjokrosoepatma, to the zoologist of the 1939-1940 expedition.

### **Geelvinkia calmani** (Roux, 1927)

Bott, 1974: 18, text-fig. 6, pl. 2 figs. 20-24.

Localities. — West Irian (south of the Central Mountain Range):

1 (t). "Utakwa River" (Calman, 1914: 309, under *Parathelphusa* (*Liotelphusa* ?) *aruana* (Roux); "Utakwa Riv. N. Guin. holl. mérid." Roux, 1927: 332, under *Paratelphusa* (*Liotelphusa*) *calmani* n. sp.; Bott, 1970: 82, under *Mainitia calmani* (Roux)). This is the Otakwa River, at 4°35'S 137°15'E, alt. 0-1700 m (see under *Rouxana plana*, loc. 2, p. 13). The type specimens of this species were collected together with those of *Rouxana plana* by the 1912-1913 British Wollaston New Guinea Expedition. The species is only known from the types (see also under *Rouxana ingrami*, p. 9). Text-fig. 1.

### **Geelvinkia ambaiana** Bott, 1974

Bott, 1974: 19, text-fig. 7, pl. 2 figs. 25, 26, pl. 3 figs. 27-29.

Localities. — West Irian (north of the Central Mountain Range):

1 (t, s). Small stream near Ambai village, on the island of Ambai, Menawi Bight, slightly east of Serui, on the south coast of Japen Island in the Geelvink Bay, at about 1°55'S 136°21'E, 22 February 1955 (leg. L. B. Holthuis, no. 705), altitude less than 30 m. The stream is narrow, rather shallow and very fast flowing, it cascades down from a fairly great height, and passes through a forested area. The bottom is rocky with large stones,

the water is clear. We caught eel and other fishes, shrimps and molluscs in it. Text-fig. 1.

West Irian (south of the Central Mountain Range):

2 (t, s). Forest stream S. of the village of Gariau situated on the southern shore of Jamur Lake, in the "neck" of the Vogelkop Peninsula, at  $3^{\circ}38'S$   $135^{\circ}01'E$ , 7-12 December 1954 (leg. L. B. Holthuis, no. 648). Jamur Lake (Pl. 2 fig. 2) is a large lake (about  $6 \times 8$  km) which is connected by a long effluent river with the Arafura Sea. The small stream in which the crabs were taken is rather fast and flows through a level forested area south of Jamur Lake. In the wet season it empties in Jamur Lake, but, at the time of our visit to the area, the water of the stream gradually disappeared in the sandy stream bed, the distal part of which before reaching the lake was perfectly dry. About 1 or 2 km upstreams, where we collected the crabs, the stream was 1 to 3 m wide and had an average depth of about 0.2 m. The bottom consisted of sand and stones; the water being very clear, with pH about 6. The stream flows with many curves through rather dense forest. At the outside of the curves the water was deepest (up to 0.6 m)

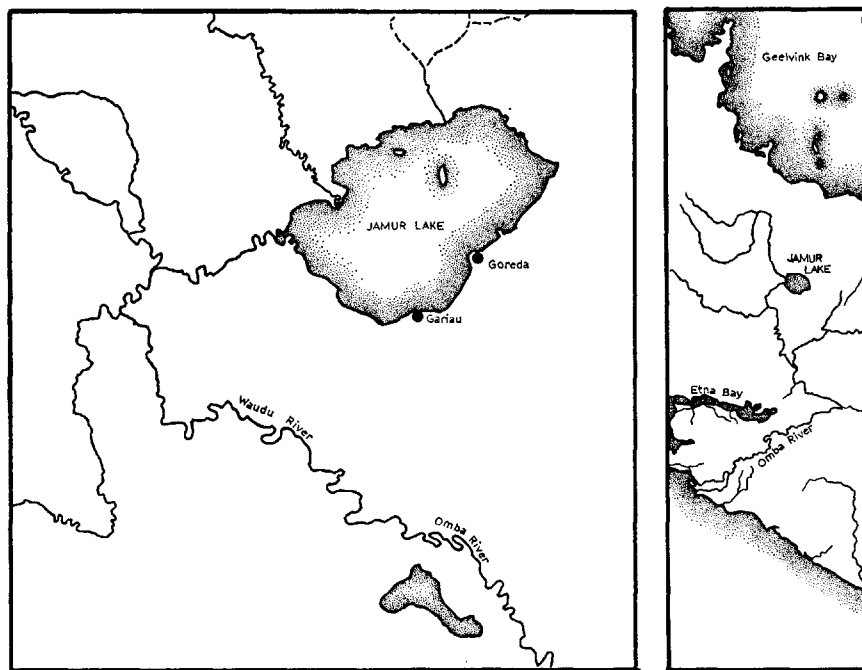


Fig. 8. Jamur Lake in the "neck" of the Vogelkop Peninsula, West Irian. Adapted from Boeseman, 1963. Scale of left figure 1 : 250.000.

and several small fishes were observed there. The altitude of Jamur Lake is about 90 m, that of the locality, where the crabs were taken, at the most a few meters higher. Pl. 3 fig. 2; text-fig. 1, 8.

Habitat. — The crabs from the creek near Gariau were found under stones in a part of the stream that even in the dry season contains water.

Colour in life. — The colour notes on the living animals from near Gariau are as follows: The upper part of the carapace and the legs is greenish grey with uniformly distributed small reddish brown spots. The dactylus of the chelipeds is white at the tip, the rest is spotted. The fixed finger and the lower half of the palm are entirely white, the upper part of the palm is greenish with reddish brown spots. The ventral surface of the animals is whitish, unspotted. Larger animals have a more brownish tinge.

Native names. — The small Papuan boys that helped me collecting near Gariau gave the crabs the name "nipporo" (in the Napiti language). Checking with other Papuans confirmed the correctness of this name.

### ***Geelvinkia holthuisi* Bott, 1974**

Bott, 1974: 21, text-fig. 8, pl. 3 figs. 30-34.

Localities. — West Irian (south of the Central Mountain Range):

1 (t, s). Tanah Merah on the Digul River in the lowlands of southern West Irian, more than 300 km from the nearest sea coast, 6°05'S 140°18'E, alt. 15 m, 8 and 12 September 1959, 1959 Netherlands Sterrengebergte Expeditie (leg. W. Vervoort, no. 34 and 35). The Digul River is here a fast, wide lowland river, flowing through virgin forest. The greatest depth here is 2 or 3 m. Text-fig. 1, 4.

Habitat. — Dr. Vervoort informed me that the crabs were taken in fish traps placed in the river.

### ***Holthuisana festiva* (Roux, 1911)**

Bott, 1974: 22, text-fig. 9, pl. 3 figs. 35-38.

Localities. — West Irian (north of the Central Mountain Range):

1 (t, d). "En cours de route, entre 1410 → Prauwenbivak, Nov. 1920, (coll. W. C. van Heurn)" (Roux, 1927: 333, under *Paratelphusa* (*Liotelphusa*) *vanheurni* n. sp.). The specimen, holotype of *P. vanheurni*, was collected by W. C. van Heurn, zoologist during the 1920-1921 Netherlands Noord Nieuw Guinea Expeditie. On 5 November Van Heurn left "Goedang bivak" (= Doormanpad bivak, = Goenoeng Boetak bivak), a bivouac situated at 1410-1450 m altitude, about 25 km S. of Prauwen bivak. He

partly followed the valley of the Doorman River and on 10 November reached Prauwen bivak, which is situated at the confluence of the Doorman and Idenburg Rivers (about  $3^{\circ}15'S$   $138^{\circ}40'E$ ; altitude 110 m). The specimen of *Paratelphusa vanheurni* was most likely taken at Rotanbrug bivak as Van Heurn stayed there from 7 to 9 November "teneinde nog enkele desiderata te bemachtigen, die hier op den heenweg waren gesignaleerd geworden" (in order to collect some desiderata, which I had noticed in coming up) (Van Heurn in Holthuis & Husson, 1973: 26). Rotanbrug bivak (or Brug bivak) lies about halfway Goedang bivak and Prauwenbivak at an altitude of 240 m. It received its name from a rotan suspension bridge built here over the Doorman River, in a densely wooded area. The bivouac is described by Lam (1945: 72) as follows: "Brug-bivak is built some meters above the water-level. Immediately behind the camp the hills rise steeply. In the vicinity we see the high walls of a deeply cut ravine, where a beautiful mountain-stream, 30 to 35 m. wide, either flows smoothly against the slippery rocks, or hastens in waves along the banks strewn with large boulders [should actually be: either hits against the smoothly polished rocks or, in the rapids, tumbles down past shallows formed by large boulders] or finally, swiftly and silently flows along the small narrow terraces". Lam (1928: 265-274, figs. 33, 34) published photographs of the Doorman River near Brugbivak. Text-fig. 6.

2 (t, d). "Environs de Tanah Merah, 8.VII.1903" (Roux, 1911: 104, under *Potamon (Peritelphusa) festivus*, n. sp.; "Environs de la baie de Tanah Merah, 8.VII.1903" Roux, 1917: 608, under *Paratelphusa (Liotelphusa) festiva*). The specimen from this locality, the holotype of *Potamon festivus* Roux, was collected by the 1903 Netherlands Noord Nieuw Guinea Expeditie under the leadership of Dr. C. E. A. Wichmann. According to the narrative of the expedition (Wichmann, 1917: 297), all members went on 8 July 1903 by boat to the southern tip of Tanah Merah Bay (on the north coast of West Irian, N.W. of Sentani Lake, at about  $2^{\circ}27.5'S$   $140^{\circ}21'E$ ), where "der sich dahinter erhebende Hügellücken überschritten wurde. Damit war man zugleich in das Stromgebiet des Armo, wie der in die Isis-Bai mündende Mare Bu in seinem Oberlaufe genannt wird, gelangt". It is likely that the crabs were collected during the trip along the Armo River, a rather strongly winding and fast flowing stream in a forested area. Wichmann (1917: 297, fig. 136) provided a photograph of the southernmost point of this river reached by the expedition, at Bujangena,  $2^{\circ}30'S$   $140^{\circ}19.5'E$ ; a map of the about 6 km long explored part of the river is given by Wichmann (1917: 296) as fig. 135. The Armo was found to flow among hills in the soil of which gabbro, sandstone and diabase was noticed, while



near Bujangena coral chalk and black swamp soil were found. The altitude is not known, but cannot be very high. Text-fig. 1, 3.

3 (s). Ibaru River near Genjem, Nimboran Plains west of Sentani Lake, at about  $2^{\circ}37'S$   $140^{\circ}11'W$ , altitude 65-100 m, 13 January 1954 (leg. L. van der Hammen), 3 November 1954 (leg. L. B. Holthuis, no. 618). The Ibaru River near Genjem is wide (about 20 m) and shallow (depth 0.2-1.5 m), it has a sandy bottom with stones, rocks and boulders. It flows rather slowly in an open area and could be crossed afoot. The crabs were found under rocks. Text-fig. 1, 3.

4 (s). Marinierspoeltje, a pool in a small river N.E. of Sisiri, a village situated on the northern shore of Sentani Lake at the foot of the Cycloop Mountains (about  $2^{\circ}32'S$   $140^{\circ}26'E$ ), 30 November 1954 (leg. L. B. Holthuis no. 641). The altitude is not known, but may be about 100 m (Sentani Lake lies at 75 m alt.). The pool forms part of an about 8 m wide stream in a secondary forest. The bottom is covered with larger and smaller stones. The current is rather fast, and the water clear. The depth is about 0.1 to 0.5 m, in some places slightly deeper. The crabs were found under stones. Pl. 3 fig. 1; text-fig. 9.

5 (s). Ifar, in the Cycloop Mountains north of Sentani Lake, at  $2^{\circ}35'S$   $140^{\circ}31.5'E$ , altitude about 400 m, 30 November 1954 (leg. L. B. Holthuis no. 640). The crabs were found in a small stream, about 1 m wide and quite shallow. The bottom consists of many stones and shows a heavy algal growth. The creek flows along a banana grove, and through secondary forest. The current is rather weak. Apart from the crabs, Atyidae, fishes and tadpoles were observed here. Text-fig. 9.

6. "Sentani See (3 ♂ MBa 730)" (Bott, 1970: 90 under *Holthuisana festiva* (Roux)). The fact that the specimens are from the Basel Museum, which holds the many duplicates that J. Roux obtained from collections studied by him, at first makes one think that these three specimens also belong to material collected by a Dutch New Guinea Expedition. That this is not true is shown by the fact that Roux (1917, 1921, 1927) did not report the present species from Sentani Lake. The material, therefore, must have been acquired from a different source. Text-fig. 1, 3, 9.

7 (d). "Bassin du Tami (coll. L. Schulze)" (Roux, 1927: 337, under *Paratelpusa* (*Liotelpusa*) *festiva*). The material (1 ♂, 1 ♀) was collected by the well known zoologist and explorer Dr. L. Schultze during the 1910 German-Netherlands Border Commission's exploration of the northern part of the border region between German and Netherlands New Guinea (the present West Irian and Territory of New Guinea). On 12 June 1910 the group left the north coast of the island near the mouth of the Tami River

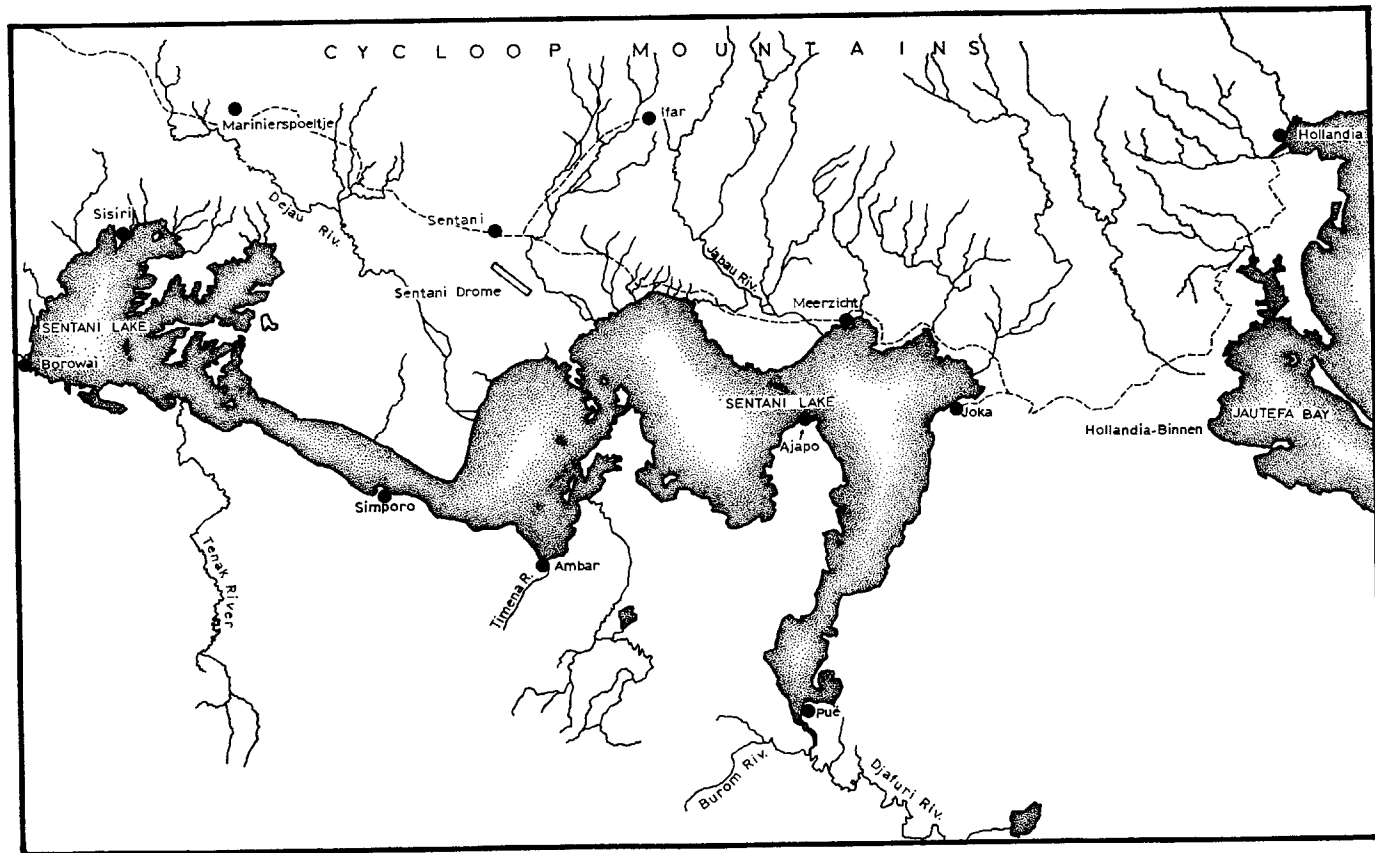


Fig. 9. Sentani Lake and Cycloop Mountains, north-eastern West Irian. Adapted from Boeseman, 1963. Scale 1 : 200.000.

(about  $2^{\circ}36'S$   $140^{\circ}56'E$ ) and went up this river, following it and its tributary the Bewani. They crossed the 800 m high watershed south of the Bewani and came to the Keerom River. Here, at  $3^{\circ}20'S$   $140^{\circ}55'E$  they turned back and arrived on 5 August again at the mouth of the Tami River. The crabs can be collected anywhere in the Tami or Bewani Rivers. Their habitat is not known. The altitude is definitely less (probably much less) than 800 m. Text-fig. 3.

Territory of New Guinea:

8. "Yangoru 800 ft" (Bott, 1970: 90 under *H. festiva*). This is Yangoru, Maprik Subdistrict, East Sepik District,  $3^{\circ}41'S$   $143^{\circ}35'E$ , alt. 250 m. Text-fig. 2.

9 (d). "Ci-devant Nouvelle Guinée allemande: Fleuve de l'Impér. Augusta, (coll. Dr. Bürger)" (Roux, 1927: 337, under *Paratelphusa* (*Liotelphusa*) *festiva*). The present name of the locality is Sepik River; for a discussion of this locality and the name of the collector, see under *Rouxana minima* loc. 2, p. 17. Text-fig. 2.

10. "Madang-Distrikt, Bangasap, Josephstal" (Bott, 1970: 90 under *H. festiva*). Bangasap, Josephstaal, Bogia Subdistrict, Madang District, about  $4^{\circ}44'S$   $145^{\circ}01'E$ . Neither the altitude nor the habitat of the locality where the animal is found is known. Text-fig. 2.

11 (s). Koropa, Ramu Valley, Madang Subdistrict, Madang District, altitude about 125 m, from slowly flowing shallow stream, 12 August 1955 (leg. R. D. Hoogland, no. 361). Text-fig. 2.

12 (s). Jal, Gogol Valley, Madang Subdistrict, Madang District,  $5^{\circ}20'S$   $145^{\circ}46'E$ , alt. about 125 m, from slowly flowing shallow stream, 7-15 July 1955 (leg. R. D. Hoogland, no. 346). Text-fig. 2.

Territory of Papua:

13 (s). Budi Barracks, Northern District, lowlands, August 1954 (leg. R. D. Hoogland, nos. 233-235).

Habitat. — The crabs collected by myself (locs. 3, 4, 5) were all found under rocks in very shallow water of fair sized to small streams with a not too fast current and a bed of sand and stones. Also the specimens collected by Dr. Hoogland came from slowly flowing shallow streams (locs. 11, 12). The altitudes at which the species is found are: lowland (loc. 13), 65-100 m (loc. 3),  $\pm$  100 m (loc. 4),  $\pm$  125 m (locs. 11, 12), 110-1450 m, probably 240 m (loc. 1), 400 m (loc. 5), less than 800 m (loc. 7), less than 1750 m (loc. 9).

Colour. — Roux (1911: 105) stated of the chelipeds: "les doigts sont en outre couverts de nombreux points bruns". Later, when dealing with the

same material Roux (1917: 609) changed the words "points" to "poils". Roux (1927: 338) described the colour of the (evidently preserved) material of the Sepik River (loc. 9) as follows: "Le céphalothorax et les pattes sont d'un brun rougeâtre, les régions branchiales et hépatiques noires. Cette couleur s'étend sur le dessous de la carapace, dans la région subhépatique". The living crabs from the Marinierspoeltje (loc. 4) were noted by me to have the carapace of a uniform dark colour. The living specimens from Ifar (loc. 5) were described in my notes as having the carapace and legs uniformly dark violet brown.

Native name. — Near Genjem, in the Nimboran Plains (loc. 3) the species is named "isup".

Remarks. — *Potamon* (*Potamonantes*) *loriae* Nobili, 1899, which Bott (1970: 90) indicated as a doubtful synonym of the present species, was later regarded by Bott (1974: 30) as completely unidentifiable (see present paper, p. 42).

### **Holthuisana biroï** (Nobili, 1905)

Bott, 1974: 24, text-fig. 10, pl. 3 figs. 39, 40, pl. 4 figs. 41, 42.

Localities. — West Irian (loc. 1 probably south, locs. 2-15 north of the Central Mountain Range):

1 (t, d). "Manikion, 14-28.II 1903" (Roux, 1911: 101, under *Potamon* (*Geotelphusa*) *beauforti* n. sp.; "Manikion, 14-28.II.1903" Roux, 1917: 606, under *Paratelphusa* (*Liotelphusa*) *beauforti* (Roux)). The Manikion area lies south of Ransiki (1°34'S 134°11'E) in the extreme eastern part of the Vogelkop Peninsula. It was explored by the 1903 Netherlands Noord Nieuw Guinea Expeditie. The expedition landed on the east coast of Vogelkop Peninsula in Roemberpon Strait (1°46'S 134°08'E) and went inland as far as Horna (1°39'S 133°43'E). The area visited was hilly with dense forests and many larger and smaller streams. The altitude varied from 0 (at the sea coast) to at least 640 m. An account of the trip was given by the leader C. E. A. Wichmann (1917: 103-128, figs. 39-44), and by H. A. Lorentz (1905: 218-242, 7 figs.). Text-fig. 1.

2 (d). "Riv. Mamberamo, Ruisseau près Tana, Bassin du Mamberamo, 27 juillet 1910 (1 ♂, 1 ♀ (coll. Moszkowski))" (Roux, 1927: 330 under *Paratelphusa* (*Liotelphusa*) *beauforti* J. Roux). The spelling Tana is a lapsus for Taua, a locality which Moszkowski (1912: 271-288, pl. 3) indicated on his map (pl. 3) as being visited by him from 10 July to 21 August 1910. The present spelling (Anon. 1944: 216) is Tawa. The locality lies on the Mamberamo somewhat below Pionier bivak (see *II. subconvexa*, loc. 1, p. 39), at 2°09'S 137°49'E. The altitude is less than 70 m. Text-fig. 6.

3 (d). "Riv. Mamberamo, Pionierbivak, 1 ♀, 1 ♂ juv., (coll. W. C. van Heurn)" (Roux, 1927: 330, under *Paratelphusa* (*Liotelphusa*) *beauforti* Roux). The material was collected during the 1920-1921 Netherlands Noord Nieuw Guinea Expeditie of which W. C. van Heurn was the zoologist. Van Heurn stayed at Pionierbivak from 13 June to 21 August 1920 and from 8 December 1920 to 12 January 1921 (see Van Heurn, in Holthuis & Husson, 1973: 21-26, fig. 4). Pionierbivak lies on the Mamberamo River at its confluence with the Otken River at 2°15'S 138°E, it is about 100 km from the sea coast in a direct line, and more than twice that distance when the river is followed. The Mamberamo near Pionier bivak is a wide river, deep enough for sea-going vessels. The botanist of the expedition, Dr. H. J. Lam (1945: 26, 27, fig. 2; 1927: 155, figs. 2, 4, 5) described the bivouac as follows: "The region about Pionier-bivak, which, according to estimates, has an altitude of 60-70 m, is controlled especially by the river, inasmuch as the hills do not approach the bank. The flat parts consist of a heavy clay rich with humus and are intersected by a number of creeks with nearly impassable beds of soft deep mud. ... Here and there are small marshes between the elevations of land". Text-fig. 6.

4 (t, d). "Rivière Tawarin, 1903" (Roux, 1911: 101, under *Potamon* (*Geotelphusa*) *beauforti*, n. sp.; "Rivière Tawarin, 20.VI.1903" Roux, 1917: 606, under *Paratelphusa* (*Liotelphusa*) *beauforti* Roux). The Tawarin River is a rather small river on the north coast of West Irian, emptying in Walckenaer Bay. The material was collected by the 1903 Netherlands Noord Nieuw Guinea Expeditie. The exploration of the Tawarin was dealt with by the leader of the Expedition C. E. A. Wichmann (1917: 256-267, figs. 109-116), and by H. A. Lorentz (1905: 140-149, 5 figs.). This river was followed up from the mouth. On 20 June (the day that the crabs were collected) the expedition was on the Tawarin somewhat S. of Suma (Wichmann, 1917: 266). The position of Suma is about 2°23'S 139°48'E. The Tawarin, in the area where the crabs were caught, is up to 30 m wide, with steep, often 10 m high, banks of pliocene clay, in places with gravel and loam. The exposed parts of the stream bed were muddy with stones. Collecting with fish poison (*Derris elliptica*) was done in a small stream entering the Tawarin River. The exact altitude is not known, but probably it is only a few meters above sea level. Text-fig. 1.

5 (s). Borowai a small native village on the western shore of Sentani Lake, 2°36'S 140°23.5'E, alt. 75 m, 27 October 1954, (leg. L. B. Holthuis no. 614) The shore is low and swampy, the crabs were found there under boards and stones lying on and partly embedded in the swampy soil. Pl. 4 fig. 1; text-fig. 9.

6 (s). Sisiri, a small native village on the N.W. shore of Sentani Lake,  $2^{\circ}34'S$   $140^{\circ}25'E$ , alt. 75 m, 27 October 1954 (leg. L. B. Holthuis no. 613). The crab was collected under a stone in shallow water. Text-fig. 9.

7 (s). Simporo (or Simboro), a small native village on the southern shore of the narrow western part (Simporo Straits) of Sentani Lake, at  $2^{\circ}38'S$   $140^{\circ}29'E$ , alt. 75 m, 27 October 1954 (leg. L. B. Holthuis no. 612). The shore here is so swampy that it is practically impossible to reach the open water except at one or two places. The crabs were found under wooden boards partly embedded in the soft swampy ground. Text-fig. 9.

8 (t, d). "Rivière Timmena, 1903" (Roux, 1911: 101, under *Potamon* (*Geotelphusa*) *beauforti* n. sp.; "Rivière Timená, 7.IV.1903", Roux, 1917: 606, under *Paratelpusa* (*Liotelphusa*) *beauforti* Roux). The Timena River is a stream which empties into Sentani Lake near Ambar (also written Abar), a village on the southern shore of the lake E. of Simporo, lying at  $2^{\circ}30.5'S$   $140^{\circ}31.5'E$ . The crabs were taken during the 1903 Netherlands Noord Nieuw Guinea Expeditie, which explored the Timena River from 6 to 8 April 1903 (Wichmann, 1917: 183-187, fig. 77; Lorentz, 1905: 62-66, 1 fig.). Wichmann (1917: 184) remarked that the river "sein Bett in Ton eingeschnitten hat" and also the photograph shows a stream with high and steep clay banks and with many large stones in its bed. It flows through a dense forest and is quite shaded. Wichmann described the capture of small fishes, but did not mention the crabs. The altitude is more than 75 m, but probably not much more. Text-fig. 9.

9 (s). Ajapo on the southern shore of Sentani Lake, farther east than Ambar, at  $2^{\circ}36.5'S$   $140^{\circ}35'E$ , alt. 75 m, 6 November 1954 (leg. L. B. Holthuis no. 623). The crabs were found under stones on the shore of the lake in about 10 cm of water. Text-fig. 9.

10 (s). "Meerzicht", at the N.E. shore of Sentani Lake,  $2^{\circ}35.5'S$   $140^{\circ}36'E$ , alt. 75 m, 16 October 1954 (leg. L. B. Holthuis no. 605). "Meerzicht" is a small restaurant on the shore of Sentani Lake. There the shore is muddy but rather firm with a low vegetation. The crabs were found under stones at the water line, both slightly above and slightly below it. Text-fig. 9.

11 (s). Joka on the S. E. shore of Sentani Lake,  $2^{\circ}36.5'S$   $140^{\circ}37.5'E$ , alt. 75 m, 20-29 October 1954 (leg. L. B. Holthuis no. 610). In Joka, a missionary post on Sentani Lake, Dr. Boeseman and I stayed several days in order to collect. The shore of Sentani Lake is very flat and grassy here, it is muddy but not too swampy. The water becomes very gradually deeper and shows many aquatic plants which resemble *Myriophyllum*, *Vallisneria*, etc. Under rocks and pieces of wood, partly embedded in the mud of the wet shore, the crabs were found. Pl. 4 fig. 2; text-fig. 9.

12 (s). Joka, as above (see loc. 11), 24 November 1954 (leg. L. B. Holthuis no. 634). A small pool, about  $5 \times 7$  m in diameter, shallow, with dead leaves on the bottom. This pool is situated south of the missionary post, rather deep in the forest, it is fed by a minimal trickle of a stream, while its effluent is of about the same size. The altitude is somewhat more than 75 m (the altitude of Sentani Lake), but not more than 100 m.

13 (t, d). "Lac Sentani, 14.IV.1903" (Roux, 1911: 101, under *Potamon* (*Geotelphusa*) *beauforti*, n. sp.; Roux, 1917: 606, under *Paratelphusa* (*Liotelphusa*) *beauforti* Roux; "Sentani-See" Bott, 1970: 89 under *Holthuisana* (*H.*) *biroi*). This type material was collected during the 1903 Netherlands Noord Nieuw Guinea Expeditie. On 14 April 1903 most of the members of the expedition, including the zoologists L. F. de Beaufort and H. A. Lorentz were on an exploring trip in the Cycloop Mountains (see Wichmann, 1917: 192, 193), but the anthropologist and physician of the expedition, G. A. J. van der Sande, stayed at Jåga (= Joka, see above, loc. 11). It seems most likely that the crabs came from Joka, where the 1954-1955 expedition also obtained them, and not from the Cycloop Mountains. Text-fig. 3, 9.

14 (d). "Sekanto, 4-8.VI.1903" (Roux, 1917: 606, under *Paratelphusa* (*Liotelphusa*) *beauforti* Roux). The Sekanto River is a tributary of the Tami River in the northeastern part of West Irian, it extends from about  $2^{\circ}52'S$   $140^{\circ}38'E$  to about  $2^{\circ}44'S$   $140^{\circ}48'E$ . Wichmann (1917: 246-249) described the exploration of the river by the 1903 Netherlands Noord Nieuw Guinea Expeditie during which Roux's material was collected. The river was reached after a descent from a ridge, the altitude of which was 207 m. The altitude of the river is not given, but as it is below Sentani Lake it is certainly less than 75 m. The stream that the expedition followed meandered through dense forests; it was at first an insignificant brook. "Die zahlreichen Gerölle, welche in seinem Bette lagen, bestanden vorherrschend aus dichten Kalksteinen, zwischen denen auch braune Tonniere lagen" ... "Was an diesem [= riverbed] auffiel, waren die Kalksinterbildungen mit denen die Gerölle in zunehmendem Masse bedeckt waren und zwar nicht allein diejenigen der Kalksteine, sondern auch die Tone und Schiefertone. Mit der zunehmenden Verbreiterung des Sekanto nahmen auch die Sinterbildungen zu, so dass es zu regelrechten Terrassenbildungen kam" (Wichmann, 1917: 246, 247). In the afternoon "hatte der Sekanto bereits die Breite von 12 m erreicht. Auch die Abmessungen der in seinem Bett liegenden Geschiebe waren grössere geworden, so dass sich ganz ansehnliche Blöcke vorfanden". The exact habitat of the crabs is not known. Text-fig. 3.

15 (d). "Nouv. Guin. holl. sept.: Sawia, Août 1911 ... (coll. P. N. van

Kampen et K. Gjellerup)". (Roux, 1927: 330, under *Paratelfhusa* (*Liotelfhusa*) *beauforti* Roux). This locality, Sawija on the Arso River in the Tami basin, N.W. West Irian, at  $3^{\circ}01'S$   $140^{\circ}46'E$ , alt. 0-200 m, has already been dealt with under *Rouxana ingrami* (loc. 1) on p. 5, 6. Text-fig. 3.

#### Territory of New Guinea:

16 (t, d). "Headwaters of the Wakip River, north coast of New Guinea" (Rathbun, 1926: 181 under *Paratelfhusa* (*Liotelfhusa*) *briggsi*, sp. nov.). This locality lies in the Aitape Subdistrict, West Sepik District, at  $3^{\circ}21'S$   $143^{\circ}00'E$ . According to Rathbun (1926: 182) "the headwaters of the Wakip River ... rise in the mountain ranges about  $2\frac{1}{2}$  miles inland from the sea". Text-fig. 2.

17. "Sepik, Marienberg" (Bott, 1970: 89, under *II. (II.) biroï*). Marienberg is a locality on the Sepik River, Angoram Subdistrict, East Sepik District, at  $3^{\circ}58'S$   $144^{\circ}15'E$ . It lies in the extreme lower part of the Sepik River basin, and probably at a very low altitude. Text-fig. 2.

18 (s). Koropa, Ramu Valley, Madang Subdistrict, Madang District, altitude about 125 m, from shallow slowly flowing stream, 12 August 1955 (leg. R. D. Hoogland, no. 361) (see also *Holthuisana festiva*, loc. 11). Text-fig. 2.

19 (s). Jal, Gogol Valley, Madang Subdistrict, Madang District,  $5^{\circ}20'S$   $145^{\circ}46'E$ , altitude about 125 m, from shallow, slowly flowing stream, 7-15 July 1955 (leg. R. D. Hoogland, no. 346-360) (see also *Holthuisana festiva* loc. 12). Text-fig. 2.

20 (t, d). "Sattelberg" "Nuova Guinea Tedesca" (Nobili, 1905: 480, 491, under *Potamon* (*Geotelfhusa*) *Birói* n. sp.). Sattelberg is a mountain, and a village of the same name near Finschhafen, Finschhafen Subdistrict, Morobe District, at  $6^{\circ}29'S$   $147^{\circ}47'E$ . The altitude is not known to me. Text-fig. 2.

#### Territory of Papua:

21 (s). Kokoda, Kokoda Subdistrict, Northern District,  $8^{\circ}53'S$   $147^{\circ}44'E$ , altitude about 350 m, from fast flowing mountain stream, 25 September 1953 (leg. R. D. Hoogland, no. 183-188). The locality, although belonging politically to the Territory of Papua, lies like all other known localities of this species north of the watershed and the rivers empty in the Solomon Sea. Text-fig. 2.

Habitat. — Specimens collected by myself along Sentani Lake (locs. 5, 6, 7, 9, 10, 11) all were found on a muddy, often swampy bottom, under stones or pieces of wood just above or just below the water line. The



specimen from a wood behind Joka (loc. 12) was found in a shallow pool with rocks and dead leaves. Rathbun (1926: 182) remarked about her specimens from the headwaters of the Wakip River (loc. 16): "They were found under stones in the bed of the stream at the foot of a waterfall. Where the species occurred the water was perfectly fresh and flowing, but the specimens were not very plentiful". The specimens from Madang District (locs. 18 and 19) were found in shallow, slowly flowing streams, but that from Kokoda (loc. 31) from a fast flowing mountain stream (Hoogland, in litt.).

The altitudes from which the species has been reported are: lowland (locs. 4, 17), below 70 m (loc. 2), 60-70 m (loc. 3), below 75 m (loc. 14), 75 m (locs. 5, 6, 7, 9, 10, 11, 13<sup>2</sup>), slightly more than 75 m (locs. 8, 12), 125 m (locs. 18, 19), below 200 m (loc. 15), 350 m (loc. 21), below 640 m (loc. 1).

Colour. — "Per quanto si può distinguere della colorazione in esemplari conservati in alcool, pare vi siano delle numerose macchie rossicie" (Nobili, 1905: 493 for the type of *Potamon biroï*). "Le corps est gris brun chez le mâle et violacé chez la femelle" (Roux, 1911: 103 for the types of *P. beauforti*, evidently preserved material). "Les régions branchiales et hépatiques sont d'un brun noir, le reste du céphalothorax brun et les chélipèdes plus clairs" (Roux, 1927: 331, for the two (preserved) specimens from Tawa of which the identity according to Bott is not certain).

Of living specimens, collected near "Meerzicht", Sentani Lake (loc. 10) I noted the following colour pattern: Carapace pale grey with a purple trapezium-shaped figure in the anterior part. The base of the trapezium is formed by the anterior margin of the carapace and ends at either side just to the exterior of the eyes; the top of the trapezium is formed by the cervical groove and is as wide as the H-shaped depression. The chelipeds are grey with slightly darker tips; the upper part of the dactylus also is darker than the rest; the articulations of the segments are orange-brown. The other legs are dark purple, especially the carpus, propodus and dactylus of P2 to P4 and all the segments of P5. The ventral surface is pale yellowish brown, being darker anteriorly. The third maxilliped is purplish. Small animals are uniformly dark purplish brown, almost black. Their chelae are pale: the palm is yellowish, the fingers pale purple. The ventral surface is grey. The crabs taken at other localities around Sentani Lake (Borowai, loc. 5; Sisiri, loc. 6; Joka, loc. 11) were noted to be similar in colour and colour pattern as those from "Meerzicht".

Biology. — The crabs taken at "Meerzicht" (loc. 10) carried *Temnocephala*.

Vernacular names. — Near Joka on Sentani Lake the name "angglam" is given to the freshwater crabs, the Malay name "kattam" or "ketam" for crab in general, is also widely used there.

Remarks. — It is interesting that among the "Frühere unbestätigte Meldungen" Bott (1974: 26) lists all the type localities of the present species and its synonyms *P. beauforti* and *P. briggsi*.

### **Holthuisana boesemani** Bott, 1974

Bott, 1974: 26, text-fig. 11, pl. 4 figs. 43-46.

Localities. — West Irian (south of the Central Mountain Range):

1 (t, s). Ajamaru on Ajamaru (or Jow) Lake, interior of Vogelkop Peninsula, N.W. West Irian, about  $1^{\circ}17'S$   $132^{\circ}6'E$ , altitude about 250 m, June 1952 (leg. L. D. Brongersma and W. J. Roosdorp), 1 March 1955 (leg. M. Boeseman). Boeseman (1963: 234, 235, fig. 8) gave a description and map of this and the following localities (locs. 2 and 3). Ajamaru (or Jow) Lake is 7 km long and 2 km wide. It is surrounded by a marshy plain and is very shallow (depth rarely more than 3 m). The water is clear, almost stagnant, except near the entrance and the exit of the Ajamaru River, pH is 6.4. The bottom consists of soft mud and is covered by a rich aquatic vegetation. Along the shores the vegetation consists mostly of grasses and low shrubs. The Ajamaru River forms part of the basin of the Kais River, which empties on the south coast of the Vogelkop Peninsula. Text-fig. 1, 10.

2 (t, s). Jate Lake near Djitmau, about 14 km S.E. of Ajamaru, 13 June 1952 (leg. L. D. Brongersma and W. J. Roosdorp), 7 March 1955 (leg. M. Boeseman). This lake lies to the east of Ajamaru Lake and is connected with it by the Ajamaru River, of which both lakes can be considered to be only widened parts. Jate Lake is 3 km long and less than 1 km wide. It lies at a slightly lower altitude than Ajamaru Lake. It is of the same type as Ajamaru Lake. Text-fig. 10.

3 (t, s). Aitinjo on Aitinjo Lake, 25 km S.E. of Ajamaru,  $1^{\circ}26'S$   $132^{\circ}14'E$ , altitude about 90 m, 12 March 1955 (leg. M. Boeseman). Aitinjo Lake also is actually a widened river, and probably forms (through a subterranean connection) part of the Kais River basin. The lake is 4 km long and up to 350 m wide. The shores are steep and rocky in most places, but lower and marshy in others. "The depth is said to be about 15 or 20 m, but large shallow parts occur; the water is clear, pH about 6.5, flowing rather strongly only at the narrower parts of the lake, including the upper reaches;

the bottom is rocky, at most places covered with sand, stones, or large rocks, but muddy at some places. Both the aquatic and terrestrial vegetation are dense, at least where the stony substratum allows growth. Plankton sampling was disappointing" (Boeseman, 1963: 235). Text-fig. 1, 10.

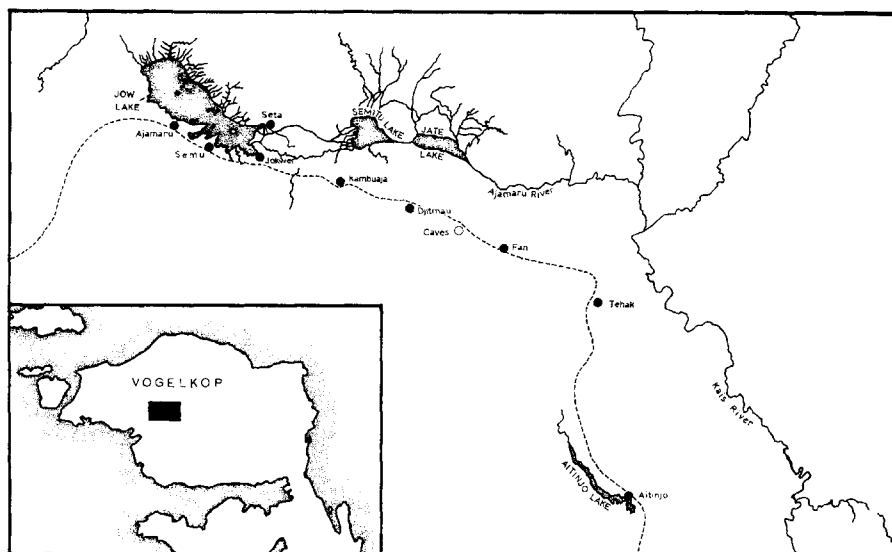


Fig. 10. Ajamaru Lakes, Vogelkop Peninsula, north-western West Irian. After Boeseman, 1963. Scale 1 : 350,000.

4 (t, s). Biak Island, Schouten Islands, Geelvink Bay, to the interior of the villages Mokmer and Boruku, at about  $1^{\circ}6'S$   $136^{\circ}8'E$ , in a small stream, 26 December 1954 (leg. L. B. Holthuis no. 656). A small brook, about 1 m wide, 20 cm deep, flowing over chalk in virgin forest. The water was clear, flowing slowly. The bottom was covered with dead leaves. The crab was found under these leaves. Text-fig. 1.

Habitat. — The crabs from Ajamaru, Djitmau and Aitinjo were mostly obtained from the natives. The known altitudes are about 90 m (loc. 3), and about 250 m (locs. 1, 2).

Colour. — Dr. Boeseman noted the colour of living specimens from Ajamaru as follows: "Carapace grey to slate-blue, sometimes slightly more brownish with dark spots. Walking legs somewhat greyish, chelipeds almost white".

Native name. — The species is named "kabai" near Ajamaru, "kabair" near Aitinjo (Boeseman, in litt.).

**Holthuisana wollastoni** (Calman, 1914)

Bott, 1974: 28, text-fig. 12, pl. 4 figs. 47-49.

Localities. --- West Irian (south of the Central Mountain Range):

1 (t). "Utakwa River" (Calman, 1914: 310, under *Parathelphusa* (*Liotelphusa* ?) *wollastoni*, sp. n.; Roux, 1927: 328, pl. 3 figs. 1, 2 under *P. wollastoni* (Calman); "Otakwa-River" Bott, 1970: 92 under *Holthuisana wollastoni* (Calman)). The Otakwa River (this is the correct spelling according to Anon., 1944: 173) lies in S.W. West Irian at about  $4^{\circ}35'S$   $137^{\circ}15'E$ , the altitude is 0-1700 m. The locality is dealt with under *Rouxana plana* (loc. 2, p. 13, 14) and *Geelvinkia calmani* (loc. 1, p. 23), all three species being collected there by the 1912-1913 British Wollaston New Guinea Expedition. Text-fig. 1.

2 (d). "Biwakeiland: 1 ♂, 18.IX.1912" (Roux, 1921: 603, under *Paratelphusa* (*Liotelphusa* ?) *ingrami* Calman). Bivak Eiland, an island in the Lorentz (or Noord) River at  $5^{\circ}0.5'S$   $138^{\circ}39'E$ , was the main base for the 1907, 1909-1910, and 1912 Netherlands Zuid Nieuw Guinea Expeditions. The altitude is slightly above sea level, the tidal influence is still noticeable. The river is wide and deep here and is still navigable for ocean-going steamers, although it is about 100 km up from the mouth of the river, which empties in the Arafura Sea. The area of Bivak Eiland is covered by dense forests, it is described and figured in Lorentz's (1913: 64-69, figs.) narrative of the 1909-1910 expedition, and in Pulle's (1914: 47-73, figs. 9, 10) account of the 1912 expedition. The crabs were collected during the latter expedition. Text-fig. 5.

3 (d). "Alkmaar: 1 ♂ juv., 9.VIII.1907" (Roux, 1921: 603, under *Paratelphusa* (*Liotelphusa* ?) *ingrami* Calman). Alkmaar, a bivouac of the 1909-1910 Netherlands Zuid Nieuw Guinea Expeditie, is situated on the Lorentz (or Noord) River at  $4^{\circ}40'10''S$   $138^{\circ}43'30''E$  at an altitude of 30 m. It lies about 40 km directly north of Bivak Eiland and more than 60 km when following the river. Here the Lorentz River is a wide, but rather shallow stream, only navigable by canoe; it is enclosed by virgin forest. The riverbed is exposed in several places and shows gravel banks, with boulders and stones. The bivouac has been described and illustrated by Lorentz (1913: 78-83, 229-230) in his narrative of the expedition. Text-fig. 5.

4 (d). "Kloof-Bivak: 1 ♂, 27.III.1912; 1 ♂, 31.X.1912; 1 ♀, 4-12.XII.1912" (Roux, 1921: 603, under *Paratelphusa* (*Liotelphusa* ?) *ingrami* Calman). Kloof Bivak is a bivouac of the 1912 Netherlands Zuid Nieuw Guinea Expeditie and is situated on the Lorentz River at about 2 km above Alkmaar Bivak, at  $4^{\circ}39'S$   $138^{\circ}43.3'E$ , altitude 39 m. The environment is

practically the same as that of Alkmaar Bivak; it was described and illustrated in Pulle's (1914: 81-109, figs. 15, 18, 19) narrative of the 1912 expedition. The date 27.III.1912 should be 27.III.1913. Text-fig. 5.

5 (d). "Biwak IV:  $\pm$  1050 m. 1 ♂ juv., 12.X.1909, trouvés avec *Paratelphusa plana*" and "Perameles-Biwak: 2 ♂ juv., 20.XI.1912" (Roux, 1921: 603, under *Paratelphusa* (*Liotelphusa* ?) *ingrami* Calman). Biwak IV and Perameles Bivak are two names for the same bivouac. It was visited both by the 1909-1910 Netherlands Zuid Nieuw Guinea Expeditie, which first made camp there, and by the 1912 Netherlands Zuid Nieuw Guinea Expeditie. The camp, at an altitude of 1050 m on a steep muddy forested slope close to running water, has been dealt with under *Rouxana plana* loc. 3, p. 14, 15) and has been described by Lorentz (1913: 91, 92) and Pulle (1914: 121-125). The heavy growth of mosses in this locality remind one of the Goedang Bivak of the 1920-1921 Netherlands Noord Nieuw Guinea Expeditie. Text-fig. 5.

Habitat. — The exact habitat of the crabs is unknown. They have been taken at the following altitudes: less than 10 m (loc. 2), 30 m (loc. 3), 39 m (loc. 4),  $\pm$  1050 m (loc. 5), 0-1700 m (loc. 1).

Remarks. — Although Bott (1974: 28) included a reference to Roux's (1921) *Paratelphusa* (*Liotelphusa* ?) *ingrami* in the synonymy of *Holthuisana wollastoni* as he did in 1970 (Bott, 1970: 91), all the localities mentioned by Roux are arranged by him under "Frühere unbestätigte Meldungen".

### **Holthuisana subconvexa** (Roux, 1927)

Bott, 1974: 28, text-fig. 13, pl. 4 figs. 50-53.

Localities. — West Irian (north of the Central Mountain Range):

1 (t, d). "Ruisseau près de Tana, 27 Juillet 1910 ... (coll. Moszkowsky)" (Roux, 1927: 328, under *Paratelphusa* (*Liotelphusa*) *ingrami subconvexa* n. subsp.). As already indicated under *Holthuisana biroi* (loc. 2), the present locality is a brook near Tawa on the lower Mamberamo River at 2°09'S 137°49'E, altitude less than 70 m. Text-fig. 6.

2 (t, d). "Pionierbivak, 4 Août 1920, 1 ♂ (W. C. van Heurn coll.)" (Roux, 1927: 328, under *Paratelphusa* (*Liotelphusa*) *ingrami subconvexa* n. subsp.). This locality has already been dealt with under *Holthuisana biroi* (loc. 3); it is situated on the Mamberamo River, at 2°15'S 138°E, altitude 60-70 m. Text-fig. 6.

3 (t, d). "Bassin du Mamberamo N. Guin. holl. sept.: Doorman Pad Bivak, Point 1410 m" (Roux, 1927: 328, under *Paratelphusa* (*Liotelphusa*)

*ingrami subconvexa* n. subsp.). This bivouac is also known under the names "Goedang Bivak" or "Goenoeng Boetak Bivak", it was made during the 1920-1921 Netherlands Noord Nieuw Guinea Expeditie. It is situated on the northern slopes of the Central Mountain Range in the Mamberamo River basin at about 25 km S. of Prauwen Bivak. The position is about  $3^{\circ}24'S$   $138^{\circ}38'E$ , the altitude 1410-1450 m. It was described by Lam (1945: 81) as being "located on a broad less exposed swampy plateau, whereas the narrow ridge, with its precipitous slopes [which leads towards the bivouac], is very much exposed". Lam further remarked (p. 83) that one of the most striking phenomena of the flora of this midmountain slope is "the enormous moss covering. Not only is the ground, particularly on the narrow ridges, covered with a thick layer, but also the lower parts of the tree-trunks are concealed, while the branches bear isolated cushions frequently of large size". "Only the outermost layer of such coverings is living moss; the remainder consisting of a more or less decayed mass which serves exclusively to absorb water". Near the bivouac there was "a small stream that plunges down at the side of the bivouac" (Lam, 1945: 91). The relative humidity in the forest was 100%, the air temperature ranged between  $16^{\circ}$  and  $20^{\circ}C$ , the water temperature of the brook was  $17.4^{\circ}C$ . The environment of this bivouac seems to have had much in common with that of *Perameles Bivak* (= Bivak IV) of the 1907 Expedition (see p. 14, 15 under *Rouxana plana*, loc. 3). Text-fig. 6.

4 (t, d). "Germania-hoek, ci-devant N. G. Allemande, Août 1910... (L. Schulze coll)" (Roux, 1927: 328, under *Paratelphusa* (*Liotelphusa*) *ingrami subconvexa* n. subsp.). Germania Point (known formerly as Germania Huk or Germaniahoeck), situated on the sea shore just E. of the mouth of the Tami River, does not lie in the Territory of Papua (the former German New Guinea or Kaiser Wilhelmland), as indicated by Roux, but in the present West Irian (former Netherlands New Guinea), although it is only slightly west of the border which is formed by the meridian of  $141^{\circ}E$ , its position being  $2^{\circ}33'S$   $140^{\circ}52'E$ . The material was collected during the 1910 German-Netherlands Border Commission's exploration of the border area. The leader of the German group was Dr. L. Schultze (not Schulze), a well known explorer and zoologist. The crabs were evidently collected at the end of the expedition when the group returned to the mouth of the Tami River, which they reached on 5 August 1910. The altitude here is at most slightly above sea level. Text-fig. 3.

West Irian (south of the Central Mountain Range):

5. "Nord-Fluss" (Bott, 1970: 91, under *Holthuisana* (*H.*) *subconvexa*

(Roux)). As can be seen from Bott's (1974) paper, with this locality the Lorentz- or Noord-River is meant and the material was collected by the 1909 Netherlands Zuid Nieuw Guinea Expeditie of which H. A. Lorentz was the leader. As Bott's material (2 males) came from the Basel Museum, and as J. Roux, who studied Lorentz's collection placed his duplicates in the Basel Museum, it seems most likely that Bott's specimens had already been studied and reported upon by Roux. However, Bott in his synonymy of *H. subconvexa* did not cite the paper by Roux (1921) dealing with Lorentz's crabs, and in Roux's original description of *H. subconvexa* (the only reference cited by Bott) no material from the Lorentz River was mentioned. The only freshwater crab material of the 1909 Lorentz Expedition that Roux (1921: 603-605) mentioned is a juvenile ♂ of *Paratelphusa ingrami*, and a ♂ and a ♀ of *P. plana*, all three from Bivak IV (= Perameles Bivak). Bott (1970: 91) referred Roux's (1921) record of *P. ingrami* to *Holthuisana wollastoni* and (: 86) his record of *P. plana* to *Rouxana plana*. The origin of Bott's two males from "Nord-Fluss" thus remains mysterious. Text-fig. 1, 5.

6 (s). Kouh on the Digul River, about 32 km above Tanah Merah, 5°44'S 140°16'E, 8 September 1959, 1959 Netherlands Sterrengebergte Expeditie. The material was obtained from school-children and nothing is known about its habitat. The altitude is somewhat more than 15 m (the altitude of Tanah Merah). Text-fig. 4.

7 (s). Niob on the Takum River, a branch of the Digul River, about 5°37'S 140°15'E, altitude about 200 m, 10 September 1959, 1959 Netherlands Sterrengebergte Expeditie. This material was also obtained from school-children and the habitat is unknown. Text-fig. 4.

8 (s). N. of Dilmot, 4 km N. of Katem on the East Digul River, 5°8'S 140°43'E, altitude 250 m, July 1959, 1959 Netherlands Sterrengebergte Expeditie (leg. A. G. de Wilde). No other data are known. Text-fig. 4.

#### Territory of Papua:

9. "Golf Distrikt" (Bott, 1970: 91, under *Holthuisana subconvexa* (Roux)). This locality was elaborated by Bott (1974: 29) to "Bach bei Omati, Kikori Subdistrikt, Golf District, ca. 7°15'S 143°52'E, 10. Oktober 1959, leg. Reimers". This is possibly the same as the "Gihiteri-Bach am Omati" (*Rouxana ingrami*, loc. 7) although in the latter case Omati seems to refer to the Omati River, while in the present case with Omati the village of that name seems to be intended, viz. Omati, Kikori Subdistrict, Gulf District, 7°15'S 143°52'E. This locality lies in the lowlands of Papua. Text-fig. 2.

Habitat. — Very little is known about the habitat of the crabs referred

to the present species. Van Heurn (in Holthuis & Husson, 1973: 61), when dealing with the crabs of the 1920-1921 Netherlands Noord Nieuw Guinea Expeditie, made the following remark, which probably pertains to the specimens of the present species from locality 3: "Van krabben vond men sporadisch een kleinen vorm, en dezen tot hoog (minstens 1500 M.) in de bergen, onder mos, etc." (Of the crabs we found sporadically a small form, up to high in the mountains (at least 1500 m), under moss, etc.). The fact that no other species in Van Heurn's material have been reported from this altitude, and that the Goedang Bivak area was described as having a moss cover over the ground, the tree trunks, etc., makes it most likely that his material was found there under the moss layer.

The altitudes from which this species has been reported are the following: lowland (locs. 4, 9), more than 15 m (loc. 6), less than 70 m (loc. 1), 60-70 m (loc. 2), 200 m (loc. 7), 250 m (loc. 8), 1410-1450 m (loc. 3). Of these only loc. 6 (15 m), 7 (200 m), 8 (250 m) and 9 (lowland) are not considered dubious by Bott.

Remarks. — It is interesting to note that the type localities of the present species, all of which Bott considered to be "unbestätigt", lie to the north of the Central Mountain Range, while all the other localities are found to the south of the watershed.

#### DUBIOUS SPECIES

"*Potamon (Potamonautes) Loriae* n. sp." Nobili (1899: 232, 261) from "Haveri (distretto di Moroka, 700 m. s.m.)". According to Bott (1970: 90) this is probably a synonym of *Holthuisana festiva*, but in 1974 the same author (Bott, 1974: 31) remarked that it might as well be *Rouxana papuana*. Haveri lies near Meroka (= Moroka), Port Moresby Subdistrict, Central District, Territory of Papua, at about 9°26'S 147°31'E, altitude 700 m. The material was collected by Lamberto Loria between May and October 1892 (see Wichmann, 1912: 528). The fact that *Rouxana papuana* is only known south of the Central Mountain Range of New Guinea, and *Holthuisana festiva* only from north of it, might be an indication that *Potamon loriae* is more likely a synonym of the former than of the latter species.

"*Potamon (Geotelphusa) transversum* (von Martens)" Nobili (1899: 232, 262) from "Katau: Nuova Guinea Meridionale presso le foci del fiume Fly". Roux (1927: 342), who examined Nobili's material, stated that the crabs are not the same as Von Martens' Australian species, but more likely represent juveniles of *Paratelphusa vanheurni* (= *Holthuisana festiva*) or *P. papuana* (= *Rouxana papuana*). Bott (1970: 94) cited Nobili's (1899)



record under *Holthuisana* (*Austrothelphusa*) *transversa* (Von Martens), but did not discuss or even mention the locality Katau, neither did he include New Guinea in the range of the species. Bott (1974: 5) suggested that Nobili's material was incorrectly labelled as to the locality and that it actually came from Australia. The locality given by Nobili (1899) for his material, viz., "Katau" (= Binaturi River, Daru Subdistrict, Western District, Territory of Papua, about 9°09'S 142°58'E) is also the restricted type locality of *Rouxana papuana* (see there, loc. 5, pp. 10, 12, text-fig. 2).

"*Paratelphusa* (? *Barytelphusa*) *gjellerupi* n. sp." Roux (1927: 339, pl. 4 figs. 5-7) from "Nouv. Guinée holl. sept.: Sawia, Août 1911 (coll. P. N. van Kampen et K. Gjellerup)". Bott (1970: 88) brought the species to the genus *Sendleria*, but in 1974 (Bott, 1974: 4) considered the types of Roux to be incorrectly labelled as to the locality and supposed the material to originate either from Borneo or the Bismarck Archipelago. "Mit Sicherheit ist aber die Art aus der Fauna Neu-Guineas zu streichen". As, however, the material was found together in one sample with the typical New Guinea species *Paratelphusa beauforti* (= *Holthuisana biroi*), and as Van Kampen and Gjellerup together collected only in New Guinea, I would hesitate to be as positive as Dr. Bott is on this point, especially as our knowledge of the New Guinea fresh water crabs is still so fragmentary. Only new collections made in the area may finally decide this question. The type locality of *Paratelphusa gjellerupi*, Sawija, has been dealt with extensively as loc. 1 under *Rouxana ingrami* (pp. 5, 6, text-fig. 3).

#### REMARKS ON ZOOGEOGRAPHY AND ECOLOGY

Compared with that of the New Guinea Parastacidae, the distribution and ecology of the freshwater crabs of New Guinea is most peculiar. Evidently the zoogeographic barriers for the two groups are entirely different:

1. For the Parastacidae the shallow seas around New Guinea did not form a zoogeographic barrier: crayfish occurring both on the "mainland" of New Guinea and on the islands situated on the Sahul shelf, like the Aru Islands and Misool. Parastacidae lack entirely on any of the islands of the Indo-Australian Archipelago, which are separated from the Sahul shelf by depths of over 200 m. So neither Waigeo, nor the Kei Islands or any of the other Moluccas, the Lesser Sunda Islands, etc., has any Parastacid species, while these crayfishes do occur in Australia and Tasmania (and New Zealand). The genus *Cherax*, the only Parastacid genus in New Guinea, is also widely distributed in Australia. The single species of Parastacid in the Aru Islands, *Cherax lorentzi aruanus* Roux, is only subspecifically distinct from *C. l. lorentzi* Roux of the S.W. part of New Guinea proper.

In the freshwater crabs, we see that two of the three New Guinea genera are restricted to New Guinea proper, while the third is represented there by a single endemic subgenus (the other subgenus occurring in Australia). The freshwater crabs occurring in the Aru Islands, belong to *Sundathelphusa aruana* (Roux), a species that is not only generically distinct from the New Guinea freshwater crabs, but its genus is widely distributed in the eastern part of the Malay Archipelago (Philippines, Celebes, Moluccas, Lesser Sunda Islands); the species itself is not restricted to the Aru Islands, but occurs in the Lesser Sunda Islands (Lombok, Sumbawa and Flores) as well.

(2). For the Parastacidae, as far as our present knowledge shows, the Central Mountain Range of New Guinea is a formidable barrier. All finds of Parastacidae in New Guinea have so far been from rivers south of the east-west watershed; these rivers flow to the S. and S.W. coast of the island. Although, during our stay in New Guinea, we have made special efforts to obtain Parastacidae from rivers flowing north (Hollandia area, Biak, Manokwari), we have not in a single instance managed to obtain such material, while also the extensive explorations by others (e.g., of the Mamberamo and Sepik Rivers) did not produce any Parastacidae either. All the specimens that we obtained or that have been reported upon in the literature are from basins like those of the Fly, Digul, Lorentz, Mimika, Otakwa, Jawej, and Balim Rivers, the Wissel Lakes, Jamur Lake, Ajamaru Lakes, etc., all of which belong to the southern drainage system.

Judging by the records of the freshwater crabs, a number of species is only known from either south or north of the watershed: *Rouxana minima* (north), *R. roushdyi* (south), *Geelvinkia calmani* (south), *G. holthuisi* (south), *Holthuisana festiva* (north), *H. biroi* (north), *H. wollastoni* (south); some of these species are only known from one or very few localities, so that it is not surprising that these all are from one side of the watershed. In *H. festiva*, however, all of the 13 localities (certain and doubtful) are from north of the watershed. Of *Rouxana papuana* all the certain records are from south of the watershed, only one doubtful (Andai) being from north of it. Of each of the species *Rouxana ingrami*, *Geelvinkia ambaiana*, and *Holthuisana boesemani*, however, there are records (regarded as reliable by Bott, 1974) from both north and south of the watershed. Very peculiar is the situation with *Holthuisana subconvexa*, of which the four type localities (all considered uncertain by Bott) are from north of the watershed (only the Manikion material may have been collected at either side, as the expedition crossed the watershed when exploring the area), while the entire material actually examined by Bott came from 5 localities to the south of it.

The horizontal distribution of the New Guinea freshwater crabs therefore still offers intriguing problems.

(3) In the Parastacidae the range of the various species seems to be limited by altitude; I know of no single species that is found both in the lowlands and in the mountains; the altitudinal range of each seems, judging by the known data, to be quite restricted. In the freshwater crabs the situation seems to be quite different. The incomplete information about the altitudes at which the various specimens were taken is a handicap in judging the data, but in general terms we can say that only a few species have been found exclusively at great altitudes (e.g., *Rouxana roushdyi* at 1640-1740 m), others are only known from the lowland (e.g., *Geelvinkia ambaiana*, *G. holthuisi*). But some species are reported from a wide range of altitudes: *Rouxana ingrani* from lowlands to 700-1000 m, and *R. papuana*, of which the type was obtained in the lowlands, but the material in the collection examined by Bott came from altitudes between 1260 and 1600 m. Other species have a less excessive range: *Holthuisana festiva* 65-400 m, *H. biri* 60-350 m, *H. subconvexa* 15-250 m (with a doubtful record of 1410 m). Here too an interesting field of research is still open.

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Plate 1

Fig. 1. Paniai Lake with Bobairo Peninsula. Houses of Enarotali in the fore-ground. January 1955.

Fig. 2. Tigi Lake seen from Waghete in the direction of the T-shaped peninsula. January 1955.

Plate 2

Fig. 1. Jawej River near Paniai Lake. 7 January 1955.

Fig. 2. Jamur Lake seen from Gariau village. 7-12 December 1954.

Plate 3

Fig. 1. Marinierspoeltje, N. of Sentani Lake. 30 November 1954.

Fig. 2. Forest stream near Gariau near Jamur Lake. 7-12 December 1954.

Plate 4

Fig. 1. Borowai, Sentani Lake. 2 November 1954.

Fig. 2. Joka, Sentani Lake. 10 April 1955.





