



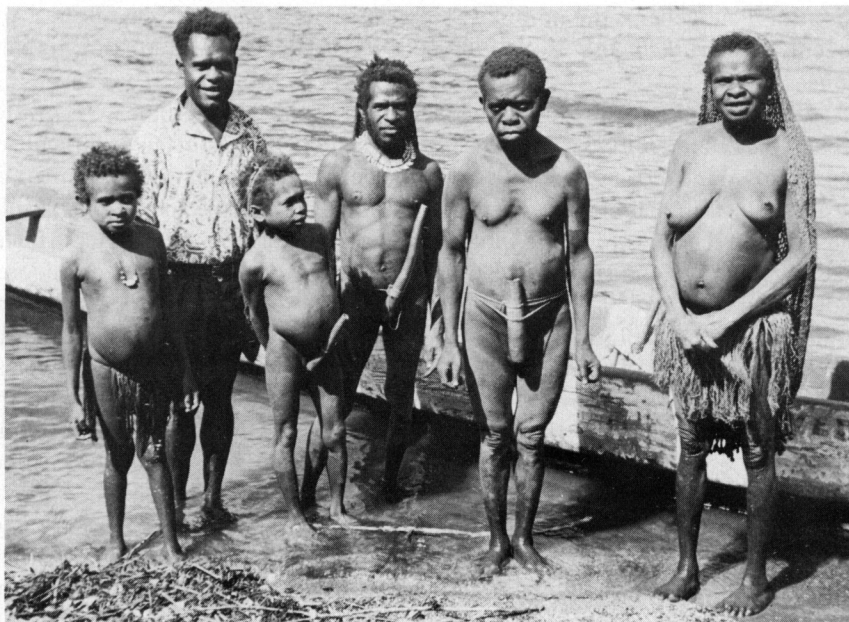
*Fig. 3a.* Paniai Lake (Wissel Lakes complex) near Enarotali, Central Mountain Range, Irian. Boats used for fishing Parastacidae; the foremost boat carries sink nets.



*Fig. 3b.* Paniai Lake near Enarotali. Boats used for fishing crayfish.



*Fig. 4.* Jawej River near Paniai Lake. Woman returning home from crayfish fishing.



*Fig. 5.* Jawej River near Paniai Lake. Kapauku Papuan family and their boat.

*Ptychognathus demani*, from a freshwater river in northern Irian; the species, closely related to *P. riedelii*, has not been found outside New Guinea.

The three categories recognized above in the New Guinea freshwater shrimps can also be distinguished here: (1) the species with a very wide range (*Varuna litterata*); (2) those occurring in Malaysia with their eastern limit in New Guinea (*Pseudograpsus crassus*, *Ptychognathus riedelii*), and (3) endemics (*P. demani*).

2.3.3 *Hymenosomatidae*. The Hymenosomatidae contain many genera and species, most of which are marine. Six species (belonging to two genera), however, have been reported from fresh water, and one of these occurs in New Guinea: *Halicarcinus angelicus* Holthuis 1968. This species so far is only known from the type material, which was collected in the Southern Highlands District of Papua, at an altitude of 1600 m in pure fresh water of a watercress swamp. Other freshwater species of the genus *Halicarcinus* inhabit New Zealand, Norfolk and Lord Howe islands and SE Australia (*H. lacustris* (Chilton)), northern Mindanao, Philippines (*H. wolterecki* Balss), and New Caledonia (*H. pilosus* (A. Milne Edwards)).

2.3.4 *Sundathelphusidae*. In contrast to the two other families of Brachyura, the Sundathelphusidae contain only true freshwater species. The family as such therefore should be of great interest to zoogeography.

A revision of the New Guinea Sundathelphusidae was recently published by Bott (1974), with 3 genera: *Rouxana* Bott 1969, with 5 species, *Geelvinkia* Bott 1974, with 3 species, and *Holthuisana* Bott 1969, with 5 species. *Rouxana* and *Geelvinkia* are restricted to New Guinea. *Holthuisana* was considered by Bott to consist of 2 subgenera: the nominate subgenus is confined to New Guinea, the subgenus *Austrothelphusa* Bott 1969, occurs in Australia, but not in New Guinea.

A difficulty in assessing the zoogeography of the New Guinea freshwater crabs is that the identity of previously recorded specimens often is difficult or even impossible to ascertain without direct examination of the specimens in question. Bott, in his revision, tried to examine as many specimens as possible, but many records are still indicated by him as "unbestätigte frühere Meldungen", and one species, "*Potamon loriae* Nobili 1899," was considered unidentifiable by him. Even when excluding all uncertain records, the distribution (both geographical and ecological) of New Guinea fresh water crabs remains confusing. As pointed out by Holthuis (1974:43), the beautifully clear picture shown by the Parastacidae is not at all matched by that of the Sundathelphusidae. Could the Parastacidae be divided in lowland and mountain species, in the New Guinea Sundathelphusidae there is no such distinct division. Only one species (*Rouxana roushdyi* Bott 1974) is exclusively known from high altitudes (1640–1740 m), and 2 (*Geelvinkia ambaiana* Bott 1974, and *G. holthuisi* Bott 1974) are only reported from below 100 m altitude. Six others have been reported from both the lowlands (below 100 m altitude) and from more than 200 m: *Rouxana ingrami* (Calman 1909), *R. papuana* (Nobili 1899), *Holthuisana festiva* (Roux 1911), *H. biroi* (Nobili 1905), *H. boesemani* Bott

1974, and *H. subconvexa* (Roux 1927). Of the remaining species the exact altitudes of their occurrence are unknown.

Also the geographic distribution of the freshwater crabs within New Guinea does not show a clear pattern. The Central Mountain Range, which gave the impression to be an unsurmountable barrier to the Parastacidae, does not seem to be so to the freshwater crabs. Only a few Sundathelphusid species are known from one side of the watershed only: *Rouxana minima* (Roux 1927) (2 localities; both north of the watershed), *R. roushdyi* Bott 1974 (4 localities in a restricted area; south), *Geelvinkia calmani* (Roux 1927) (1 locality; south), *G. holthuisi* Bott 1974 (1 locality; south), *Holthuisana festiva* (Roux 1911) (13 localities; north), *H. biroi* (Nobili 1905) (21 localities; north), and *H. wollastoni* (Calman 1914) (5 localities; south). All 6 other species have been reported from both north and south of the watershed.

The possibility exists, of course, that the picture is obscured by wrong specific assignments and incorrect identifications, and that a re-examination of previously published material, and the study of carefully documented new material from numerous localities will lead to better understandable results.

As to the zoogeographic relation of the New Guinea Sundathelphusidae to the other Australasian taxa of that family, here too the Sundathelphusidae offer a picture totally different from that shown by the Parastacidae. The close relation between the species of the Aru Is and those of New Guinea proper, as shown by the Parastacidae, is totally lacking in the Sundathelphusidae. The freshwater crabs of the Aru Is were assigned by Bott (1970:75) to the species *Sundathelphusa aruana* (Roux 1911), thus to a genus entirely different from any of the genera of New Guinea Sundathelphusidae. Bott (1974) evidently did not consider the Aru species to belong to the New Guinea fauna and therefore did not include it in his revision of the New Guinea freshwater crabs. *Sundathelphusa aruana* was mentioned by Bott (1970) from the "Aru- und Kei Inseln, Kleine Sunda-Inseln." The mention of the species from the Kai Is must be a slip of the pen, as both Nobili (1899:263) and Roux (1911:91; 1919:345) reported it only from the Aru Is, while also Bott saw no Kai Is material. Bott, however, did examine specimens from the Lesser Sunda Is (Lombok, Sumbawa, Flores). As to the genus *Sundathelphusa*, this was reported by Bott (1970) from the Philippines, Celebes, the Moluccas, the Aru Is and the Lesser Sunda Is. The Aru Is freshwater crabs thus seem to have closer links to the species from the eastern Malay Archipelago (Philippines, Moluccas, and especially Lesser Sunda Is) than to those of New Guinea, a most unexpected phenomenon.

Bott (1974:6-8) rather extensively propounds a theory concerning the "colonization" of New Guinea by freshwater crabs and gave as his opinion that this has occurred in several "Besiedlungsschübe" (invasions). The species of *Rouxana* are considered by him to have reached New Guinea before the other genera and in several invasions from the west; those of *Geelvinkia* were supposed by him to have reached New Guinea in an invasion from the North(west) and those of *Holthuisana* were the most recent to invade New Guinea and came from the west. The invasions, according to Bott, took place between the early Tertiary and the late Pleistocene. Bott's theory is so speculative and based on so few hard facts, that it is totally unacceptable to me.

With our very imperfect knowledge of the systematics, distribution and ecology of the New Guinea freshwater crabs, and with the confusion and evident errors in these disciplines, it is altogether unrealistic to theorize about the way in which the crabs reached New Guinea, it is even not certain that they actually did come from somewhere else. I regret not to be able to give a more constructive opinion about this problem.

### 3. Summary

We can say that Decapods can be found in practically all New Guinea fresh waters, from the lowlands to the high mountains, in lakes, swamps and slow flowing rivers, but also in small fast flowing streams with cataracts and riffles. They are found in waters with sandy, muddy or rocky bottoms, among living waterplants and dead leaves, under stones, etc. Some species seem to be restricted to certain altitudes, while others evidently occur both in the mountains and the lowlands. For a number of species (especially the Parastacidae) the Central Mountain Range seems to be a very important zoogeographic barrier, but others occur both to the north and the south of it.

Zoogeographically the New Guinea freshwater Decapoda can be arranged in 3 groups: (1) the species with a very wide distribution in the Indo-West Pacific region (western Indian Ocean to Polynesia); (2) the species with a restricted distribution which find in New Guinea the eastern limit of their range, the western limit being in eastern, central or western Malaysia; and (3) the endemic species, known only from New Guinea itself.

When considered at generic level, most New Guinea freshwater Decapoda belong to genera with a wide distribution throughout the Indo-West Pacific (*Atya*, *Caridina*, *Palaemon*, *Macrobrachium*, *Sesarma*, *Varuna*, *Pseudograpsus*, *Ptychognathus*, and *Halicarcinus*), two have clear affinities with Australia (*Cherax*, *Holthuisana*), and two are endemic (*Rouxana*, *Geelvinkia*). It is interesting that the latter two categories are formed by the genera of the only 2 families of true freshwater Decapoda of New Guinea.

The picture still is far from clear and much more collecting and research is needed before a satisfactory account of the zoogeography and ecology of the New Guinea freshwater Decapoda can be given.

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