THE FRESHWATER THERAPONTIDAE OF NEW GUINEA

by

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and

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(With 15 text-figures and 6 tables)

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1. Introduction

The Therapontidae [2]) constitute a small family of Perciform fishes, the members of which are of a remarkably homogeneous appearance, notwithstanding the fact that it includes marine as well as freshwater species. The distribution of the family as a whole is Indo-Pacific, from the Red Sea and the eastern coast of Africa, east to the Tonga Islands, north to Japan and south to the seas around Australia, including its south coast. Records from Hawaii are suspect. As was to be expected, some of the marine species are the most widely distributed members of the family, and of one, *Therapon jarbua* (Forskål), the range almost co-incides with the family range. On the other hand some marine species have a far more restricted distribution, for

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2) There exists some confusion in literature about the spelling of the family name, Theraponidae or Therapontidae. On the advice of Dr. G. Steyskal we are using the latter spelling.

example *Therapon humeralis* Ogilby which is only known from a comparatively small area in the subtropical and temperate waters off south-western Australia.

The point of gravity in the distribution of the freshwater species is without any doubt tropical Australia with the opposite southern part of New Guinea. Many species are known from Australia, and more remain to be described (cf. Lake, 1971; Allen, 1975). In New Guinea the family is also much more richly represented than was hitherto known. Some of the freshwater species have a wide distribution, in particular *Therapon unicolor* Günther, *T. percoides* Günther and *T. fuliginosus* Macleay, but others are on present evidence very restricted in their distribution, being confined to a single river system or lake.

The only freshwater species known from outside Australia and New Guinea are *Therapon plumbeus* (Kner), an inhabitant of rivers and lakes in northern Luzon, and *T. micracanthus* (Bleeker), endemic to the southern peninsula of Celebes (records from New Guinea are due to misidentification). From time to time freshwater therapontids have been described from Madagascar, two of which were still recognized by Fowler (1931): *Therapon elongatus* (Guichenot) and *T. lambertoni* Fowler, but their validity is at most very dubious: they are probably synonyms of familiar marine and semi-marine species, and in recent literature on freshwater fishes of Madagascar there is no mention of Therapontidae.

From New Guinea and surrounding islands, thirteen species of the family Therapontidae are recognized in the most recent work on the ichthyofauna of that region (Munro, 1967). Eight of these are widely distributed marine and semi-marine species (some of these may freely enter freshwater), the remaining five are freshwater species endemic to New Guinea.

Since Munro's book was published, one additional endemic freshwater species has been described (Mees, 1971), bringing the number of freshwater species to six. These were unevenly divided: four species in south-western New Guinea, two in south-eastern New Guinea, and not a single species was known from the whole of northern New Guinea, with its mighty rivers the Ramu, the Sepik and the Mamberamo. Similarly in southern New Guinea practically nothing was known from the Fly River, the largest river of New Guinea, and other rivers in western Papua.

Recently, collecting activities by personnel of the Kanudi Fisheries Research Station and by other government officials, stimulated and directed by P. Kailola, have led to the discovery of a whole series of additional freshwater species, proving a previously entirely unsuspected abundance, especially in the great rivers of southern New Guinea. This has doubled the number of freshwater species, so that now twelve are known. Considering how restricted the distribution of several of the species is and how many rivers, including some of the largest, remain ichthyologically unexplored, it appears a safe prediction that more species, perhaps even many more species, are still to be discovered.

The main purpose of this paper is to record and describe the new species; some of these appear to be endemic to New Guinea, whereas others are closely related to or identical with species previously known from northern Australia. It is perhaps relevant to state that this paper was originally conceived as a far more modest contribution. It began with a single species from the Ramu River, which PK sent GM for identification; this species was found to be new and we expected to do nothing more than publish a short description with, perhaps, a few notes on its supposed relationships. Very soon afterwards, however, the collecting programme instigated by PK began to bear fruit and more material arrived. All this had, obviously, to be identified and to be compared with extant descriptions and material. A renewed examination of previously described species led to the discovery that several characters which have been regarded as of great importance in the classification at the generic level had been erroneously described or overlooked in certain species. This means that the keys published by Weber & de Beaufort (1931) and Munro (1967) do not work, and modifications in the classifications proposed by these authors became necessary. Fowler's (1931: 326-328) key is of even less use, as he confused several very distinct species. Thus, we had to provide a new key and had to re-describe several of the previously known species. Our notes continued to expand until they reached the shape in which they are now presented. From the preceding discussion it will be clear, however, that we never planned to write a comprehensive revision and that is the reason why this paper may not look very well-organized.

For easy reference we place here a list of the twenty species known from New Guinea with a rough indication of their habitat: marine, semi-marine and freshwater. Actually several of the marine species are known to penetrate brackish and even fresh water, but the three species listed as semi-marine, *T. argenteus, T. cancellatus* and *T. caudavittatus,* appear to be equally at home in fresh as in salt water. These species, bridging the ecological gap between marine and freshwater species, are of interest for an understanding of the evolution of the family and therefore we devote a few more lines to them. Weber & de Beaufort (1931: 153) state that *T. cancellatus* may be found in rivers far from the sea, but all localities listed by them are more

A list of the Therapontidae recorded from New Guinea

Genus *Helotes* Cuvier, 1829

Helotes sexlineatus (Quoy & Gaimard, 1824): marine

Genus *Therapon* Cuvier, 1816

1. marine and semi-marine

Therapon jarbua (Forskål, 1775): marine.
Therapon quadrilineatus (Bloch, 1797): marine.
Therapon theraps Cuvier, 1829: marine.
Therapon puta Cuvier, 1829: marine.
Therapon argenteus (Cuvier, 1829): semi-marine.
Therapon cancellatus (Cuvier, 1829): semi-marine.
Therapon caudavittatus (Richardson, 1845): semi-marine.

2. freshwater

Therapon lorentzi (Weber, 1910).
Therapon jamoerensis Mees, 1971.
Therapon lacustris sp. n.
Therapon habbemai Weber, 1910.
Therapon adamsoni Trewavas, 1940.
Therapon trimaculatus Macleay, 1883.
Therapon transmontanus sp. n.
Therapon obtusifrons sp. n.
Therapon fuliginosus Macleay, 1883.
Therapon roemeri Weber, 1910.
Therapon affinis sp. n.
Therapon raymondi sp. n.

or less coastal. In Western Australia *T. caudavittatus* has been recorded over a hundred miles from the sea, but in New Guinea there is not much evidence that any of the three species penetrates far inland and we have the impression that they do rarely or never occur together with the true freshwater species. A study of the life histories and the physiology of the semi-marine species might be rewarding.

The following abbreviations have been used in the lists of material: AMS = Australian Museum, Sydney; BM = British Museum (Natural History), London; DPI = Department of Primary Industry, Port Moresby; QM = Queensland Museum, Fortitude Valley, Brisbane; RMNH = Rijksmuseum van Natuurlijke Historie, Leiden; USNM = United States National Museum, Washington, D. C; ZMA = Zoölogisch Museum, Amsterdam.

2. Acknowledgements

It will be evident that this paper owes its genesis to the collectors in the field who have obtained the material upon which it is based, often in remote places and under difficult circumstances.

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Mr. J. J. A. M. Wessendorp, artist on the staff of the Rijksmuseum van Natuurlijke Historie, is responsible for the majority of the illustrations; his skill has contributed much to such value as this study may have. Fig. 6 is by Mrs. Christina Croft (Kanudi Fisheries Research Station). X-ray photographs were taken by Mr. J. Simons (Zoölogisch Laboratorium, Leiden), except those of *Therapon adamsoni*, which were provided by Mr. Wheeler.

3. History of classification

Although a few species of Therapontidae were described and named before the end of the XVIIIth century, by Forskål and Bloch, it was only Cuvier (1816) who, by describing the genus *Therapon*, recognized them as representing a separate group. In later years, as more species became known, Cuvier (1829a, 1829b) described the additional genera *Datnia, Pelates* and *Helotes*. Through his custom of giving the higher systematic categories French names only, it is not quite clear whether in these publications *Therapon* has been elevated to family status or some lower systematic category; thus it was Richardson (1846: 235) who first used the name Theraponinae and definitely treated the group as a family (the name Theraponinae employed by Richardson suggests a subfamily, but he called it a family). This was not, however, generally accepted: Günther (1859) recognized only the two genera *Therapon* and *Helotes*, which he placed in the family Pristopomatidae, and Bleeker (1876a), whose knowledge of the Indo-Australian ichthyofauna probably surpassed that of all his contemporaries, treated them as a subfamily, the Datniaeformes of the family Percoidei. Bleeker (1873, 1876a, 1876b) placed all species in the genus *Therapon*, but divided them over three subgenera: *Datnia, Pelates* and *Helotes*. He placed *T. jarbua*, type of the genus *Therapon*, in the subgenus *Datnia*, a systematic practice that under present-day rules would not be permissible. Previous to this, Canestrini (1860) recognized in a family Percoidei six groups of genera, of which on purpose he did not exactly define whether he regarded them as subfamilies or tribes or what, although each group received a Latin name with the ending -ini; the second of his groups is that of the Theraponini, in which he placed four genera: *Therapon* (with synonyms *Pelates* and *Dules*), *Helotes, Datnia* and *Datnioides* [1]). The genus *Datnioides* is now placed in the Lobotidae, and *Dules* has also been removed to a different family; nevertheless Canestrini's was quite a commendable classification for his time. Weber (1913) listed the genera *Therapon* and *Helotes* in the Serranidae, as did Regan (1913), who also mentioned that Boulenger would refer *Therapon* to the Lutjanidae. Other authors placed *Therapon* in the Haemulidae (cf. Seale, 1906: 45), a family otherwise confined to the Atlantic.

Early in this century, American authors re-introduced a family Theraponidae (Jordan & Dickerson, 1908: 611; Kendall & Goldsborough, 1911: 288), although it was only, to use their own words: "provisionally adopted" as such (Jordan & Thompson, 1912: 535), and in the ichthyological literature of the past sixty years this has become generally accepted (Weber & de Beaufort, 1931; Berg, 1958; Greenwood et al., 1966; Lindberg, 1971). Admittedly, this was not accompanied by much elucidation of what the family-characters are and how the family can be distinguished from related families, except that Freihofer (1963) found that the Therapontidae (four species were examined) differ from the Serranidae (s. s.) in the pattern of the Ramus Lateralis Accessorius, and thus gave some support to the opinion that these two groups should be kept apart. However, as Gosline (1966: 97) observed, no serious study of the systematic position of *Therapon* and its allies seems ever to have been made.

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1) Whitley (1943: 181) appears to have been under the impression that: "*Datnioides* Canestrini.... Not *Datnioides* Bleeker, 1853, another genus of fishes", was proposed as a new genus by Canestrini and therefore was "preoccupied". However, Canestrini's *Datnioides* was not a new name, but only a subsequent usage of Bleeker's name, and the diagnosis given is a translation into German of Bleeker's Latin diagnosis, except that: "Vomer et palatum glabra" of the latter, has been changed to: "Vomer bezahnt, Palatum zahnlos". The fact that Canestrini (l.c.) ascribed authorship of *Datnioides* to "Briss." instead of "Bleek." must be due to a misprint. There is no genus *Datnioides* Brisson.

We are aware that several workers are currently studying the Australian representatives of the family on the basis of a far better and larger material than is at our disposal, and that they will pay special attention to the family-characters and to major subdivisions. Thus it is not for us to delve into this matter, and for the moment we will follow current practice. We are obliged, however, to go into the matter of generic classification (chapter 5).

4. Character variation

In this chapter we shall give a short review of those characters that have been most commonly used for specific distinction and also very frequently for discrimination at the generic level (there is of course no clear difference between specific and generic characters). This is a necessary introduction to the next chapter in which we shall discuss the genera and classifications previously proposed, and shall attempt to justify the classification we have adopted.

Dentition. One of the main characters used for generic distinction by previous authors is that of dentition, more in particular shape of teeth (conical, or flattened, or flattened and tricuspid) and arrangement (in rows, or in bands).

When the type-species of *Helotes*, *H. sexlineatus*, is compared with the species with conical teeth, the difference in dentition is striking, but it is

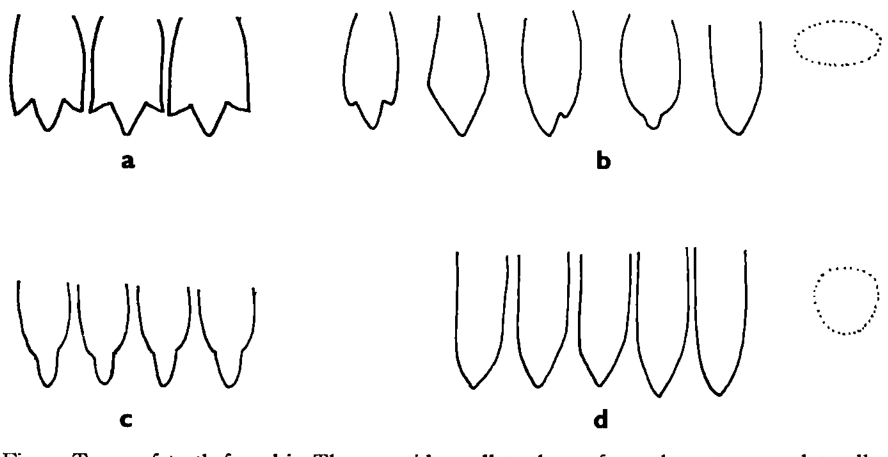

Fig. 1. Types of teeth found in Therapontidae; all teeth are from the outer row, laterally, in the upper jaw. (a) *Helotes sexlineatus*, very regular tricuspid, close together; (b) *Therapon lorentzi*, very variable (the various types are all from the same row in the same individual), in cross-section the teeth are flattened; (c) *Therapon quadrilineatus*, it deserves mention that the gums reach to the "shoulders" of the teeth so that only the narrow tips protrude; (d) *Therapon roemeri*, simple teeth, in cross-section round.

an unfortunate fact that that means comparison between the opposite ends of a graded series bridged by *Helotes lorentzi* and *Therapon quadrilineatus* (fig. 1). Thus, in a classification based on dentition it becomes a purely subjective matter where one wants to draw the dividing line between *Helotes* and *Therapon*. Although for the sake of continuity in nomenclature we would have been inclined to follow tradition in drawing it between *H. lorentzi* and *T. quadrilineatus*, we found that in all other characters *H. lorentzi* is closer to typical *Therapon* than to *H. sexlineatus*; therefore we have transferred *H. lorentzi* to the genus *Therapon*. Other authors have sought a way out by providing for each of these species a separate genus, a point of view that will be discussed in the next chapter.

Some authors have paid much attention to the colour of the teeth; Munro (1967: 320), for example, used it as a key character. Two of the species to which Munro ascribed teeth that are brown or have brown tips are *Helotes sexlineatus* and *Therapon quadrilineatus*. Some of our specimens of both species do indeed have brownish teeth, but in others the teeth are almost colourless right to the tips. Although we have mentioned the tooth-colour in the descriptions, we get an impression that it may at least partly be a matter of preservation and postmortem discoloration, with freshly preserved material having brown teeth, older specimens pale teeth. Anyway, it is apparent that tooth-colour is at most a character of very limited value in preserved material.

Gill-membranes. Apparently Ogilby & McCulloch (1916: 125) were the first authors to use gill-membranes as a generic character, diagnosing *Pelates* as: "well differentiated from *Therapon* by having the gill-membranes united to the isthmus". They were followed by Weber & de Beaufort (1931: 140) who ascribed to *Therapon*: "Gillmembranes separate, with slight adhesion to isthmus", to *Pelates*: "Gillmembranes united, nearly free from isthmus", and to *Helotes*: "Gillmembranes united, their posterior border free from isthmus".

Examination of several species revealed that in *Helotes lorentzi*, indeed the gill-membranes are united across the isthmus, but that in *Helotes sexlineatus*, type species of the genus *Helotes*, the slit separating the gill-membranes of each side of the body is continued as far forwards as in any species of *Therapon* examined by us. Some species of *Therapon* (*T. fuliginosus, T. caudavittatus*), on the other hand, have it continued less far: the second of these species is in this character quite similar to *Helotes lorentzi*. In some recently-collected specimens of *T. trimaculatus* the membranes are clearly connected across the isthmus, the connection being broader than in *H. lorentzi*. It is also evident that this connection tears very easily when specimens are manipulated, especially when gill-raker counts are made. The result is that in old and well-studied material the connection is nearly always torn and for that reason can rarely be properly evaluated. Nevertheless it is likely that there is a slight variation between the species, but the statement given under *Helotes*, quoted above, is misleading as in no member of the family examined by us are the gill-members broadly connected with each other or with the isthmus and any specific differences, even between the extremes, would be slight. Moreover, as these differences are not correlated in any way with other characters that have been held to be of generic value, we fail to see how they can assist in generic discrimination.

Squamation. All evidence points to the number of scales being subjected to fairly rapid change in evolution. This is not only borne out by the considerable individual variation found in most species (even when the puzzling *T. transmontanus* is excluded), but also by the fact that it is exactly this character in which closely related forms tend to differ (see chapter 6). This being so, it is clear that great discretion should be exercised in the use of this character for the delimitation of genera. At the specific (and subspecific) level it is, however, very useful (table 1).

Supracleithrum (suprascapular bone). In recent years the supracleithrum has been considered more important than any other character in the classification of Therapontidae. The mere fact of the supracleithrum being "exposed" or "hidden" was enough to place species in different genera. If so much value is attached to a single character, at least attention should be paid to it, but we found that in two species, *T. habbemai* and *T. adamsoni*, which had been described as having the supracleithrum concealed, actually it is exposed. This means that it is covered with skin, and its anterior part with scales, but that the posterior edge is free, although inconspicuous. We found also that in at least one species, *T. habbemai*, small specimens have the exposed posterior border of the supracleithrum denticulate, but large specimens (may?) have it smooth, so that the difference between smooth and denticulate cannot be regarded as a reliable specific character. Mees (1971: 198-199, 214, 222) has already drawn attention to the fact that the value of the supracleithrum-character has been overestimated and it appears now that it is of even less value than he thought at the time. It should be mentioned that, as the supracleithrum has traditionally been considered an important character in the Therapontidae, the skin and scales which normally cover it have usually been scraped away in older museum material that has been examined repeatedly.

TABLE I

Supracleithrum; rows of scales below lateral line

	supcl.	40 – 70
T. lorentzi	X	45-51
T. jamoerensis	-	60-65
T. lacustris	-	58-67
T. habbemai	X	54-59
T. adamsoni	X	46-55
T. trimaculatus	X	45-48
T. transmontanus	X	46-58
T. obtusifrons	X	48-51
T. fuliginosus	X	50-52
T. roemeri	X	55-62
T. affinis	-	41-47
T. raymondi	X	60-65

The only species in New Guinea with a concealed supracleithrum are *T. caudavittatus, T. jamoerensis, T. lacustris* and *T. affinis*. In Australia the widely-distributed *T. unicolor* can be mentioned as belonging to this group.

Lower opercular spine. The lower opercular spine is long in *Helotes sexlineatus, T. jarbua, T. theraps* and *T. puta*, short in all other species. We find it difficult to evaluate the systematic value of this character (if any). Certainly, the four species which share it are usually divided over several genera. It is, however, a useful key character, although it should be noted that the description: "produced beyond opercular lobe" as found in keys (Weber & de Beaufort, 1931; Munro, 1967) is not quite correct as at least in smaller specimens of these species the opercular flap extends backwards to the tip of the spine. We have therefore used a slightly different terminology to describe this character in our key.

Spines and rays. Number of spines and rays have been widely used as generic and specific characters. In this there has, however, been a tendency to consider these as rigidly fixed and to ignore a certain amount of individual variation, a matter to which Mees (1971: 198) has already drawn attention. We present here a table of the finray numbers actually found by us in the material examined (table 2). Allowance should be made for the fact that of some species very few specimens were available, and that a larger material would certainly extend the range of variation of each species. Nevertheless, it is evident that some species can be separated from each other on the basis of finray-counts, but that others can not, and that there are no clear groups that, in themselves, would suggest the possibility of their use for generic subdivision.

Gill-rakers. There is little variation in this character: the two members of the *T. fuliginosus*-group (*T. fuliginosus* and *T. roemeri*) have the gill-rakers longer, more slender and more numerous, 14-18 on the hypobranchial of the first gill-arch, whereas all other freshwater species have them somewhat shorter, less slender and less numerous, 9-12 on the hypobranchial of the first gill-arch. Two semi-marine species which will freely enter freshwater, *T. cancellatus* and *T. argenteus*, have also the higher gill-raker count.

Vertebrae. In many groups of fishes, and particularly in long and slender species, the number of vertebrae can be an extremely useful specific character. On the other hand, in compactly-built species like Therapontidae it

TABLE 2

Dorsal spines and rays and anal rays

	D											A				
	X	XI	XII	XIII	XIV	9	10	11	12	13	14	8	9	10	11	12
T. lorentzi				x	x			x	x	x		x				
T. jamoerensis			x	x	x		x	x				x	x			
T. lacustris				x			x	x				x	x			
T. habbemai			x	x				x	x	x				x	x	
T. adamsoni			x	x			x	x	x				x	x		
T. trimaculatus				x				x	x	x				x	x	
T. transmontanus		x	x				x	x						x	x	
T. obtusifrons			x				x	x					x	x		
T. fuliginosus			x						x	x			x			
T. roemeri			x						x	x	x		x			
T. affinis				x		x	x					x	x			
T. raymondi			x								x			x	x	

was not to be expected that there would be much systematically useful interspecific variation in this character. Nevertheless, as a matter of routine, a few specimens were X-rayed. The results confirmed our expectation that the usefulness of the vertebrae count is limited as we found, in diverse species, a variation of only from 25 to 29 vertebrae (table 3).

TABLE 3

species	number of vertebrae
Helotes sexlineatus	25
Therapon puta	25, 25, 25
Therapon lorentzi	25, 25
Therapon jamoerensis	25, 25, 25, 25
Therapon lacustris	25
Therapon habbemai	26, 27, 27
Therapon adamsoni	27, 28, 28, 28, 28, 29, 29
Therapon trimaculatus	27, 27
Therapon transmontanus	27, 27
Therapon obtusifrons	27, 27
Therapon fuliginosus [1]	25, 25
Therapon affinis	25, 26
Therapon percoides [2]	25, 25, 25
Therapon raymondi	27
Therapon carbo [3]	27, 27

The usual number of vertebrae is either 25 or 27, except in *T. adamsoni* which has 28 (unexpectedly, as in other characters this is not an aberrant species).

Proportions. Size of head, depth of body, length of spines and rays of fins, etc., are all useful at the specific level and have sometimes also been used as generic characters, see for example Whitley's (1943) diagnosis of *Scortum*. Proportions should, however, be used with caution for specific and generic discrimination, and only when specimens of similar size can be compared. It is, for example, well-known that in fishes smaller individuals usually have relatively larger eyes than larger individuals. There is good evidence that this is also the case in Therapontidae, see description and discussion of *T. lorentzi*, *T. habbemai*, and *T. trimaculatus*. As in several instances only material of a limited size-range was available to us, it will be clear that the proportions given in the descriptions will not necessarily be correct for specimens falling far outside the size-range described.

Even more discouraging for those who want to describe exact specific dif-

1) From New Guinea (RMNH no. 27577).
2) From Batten Creek, N. T., Australia.
3) Syntype of *Therapon carbo* and holotype of *Leiopotherapon suavis*.

ferences in proportions, is the change in relative length of fins (both spines and soft rays) with growth. Mees (1971: 203, 211) has shown how much confusion this has caused in Australian species of the *T. fuliginosus* group: he found not only changes in proportions between spines and rays with growth, but also that: "the fins, at least the dorsal spines, are shorter, relative to the standard length, in large specimens than in small specimens". There is ample evidence that the same holds true for several, if not all, New Guinea species.

5. Generic classification

The most controversial systematic problem in the family is undoubtedly that of the generic classification. Previous authors have usually considered it impractical to subdivide the large genus *Therapon* (Ogilby & McCulloch, 1916; Taylor, 1964; Mees, 1971). On the other hand, Whitley (1943), a faithful member of the Iredale school of Australian zoology, created six new genera, all based on previously known species, and five of these genera monospecific. Two years later he described yet another new genus, based on a single familiar Australian species (Whitley, 1945). The result was that Whitley (1964) divided the 27 nominal species then known from Australia over 15 different genera and two subgenera. As at least three of the species-names listed by Whitley are synonyms, there is an average of only 1.6 species to the genus.

As it is generally agreed that generic limits in zoology are to a remarkable degree matters of personal and subjective judgement, and arguments for and against small genera have been given many times, there would be little point in discussing this matter again, were it not for the fact that Munro (1967), in a work that will certainly remain for many years the standard reference to New Guinea fishes, has adopted Whitley's classification. He placed the ten species then known from eastern New Guinea in nine genera. Adding the three species from western New Guinea, included in his key but not described, improves the score somewhat: thirteen species in ten genera.

It is not our intention to discuss at length the merits of larger genera; we will confine ourselves to stating our reasons for deviating from the classification with many small genera introduced by the authors just mentioned. The philosophical background of the binary system of nomenclature certainly is twofold: the specific name is intended to divide, to indicate that a species differs from all others, whereas the purpose of the generic name is exactly the opposite, to unite what resembles each other, with (since Darwin) in the background the thought that this resemblance is due to a common origin in the not-remote past. It is this dual purpose of the binary system, to divide at the one level, to unite at the higher levels, that is its great strength and has allowed it to survive for over two centuries without showing any sign that in the foreseeable future it will be replaced by a different system. It will be clear that the proliferation of small genera to the point or almost to the point that every species is placed in its own genus, is contrary to the purpose of the binary system of nomenclature.

The same sort of argument can also be used against very large genera. When genera are expanded so much that they approach in size the next higher level of classification, the family (or subfamily), again a lot of information may be lost when this leads to an amorphous mass of species of unclear interrelationships.

Theoretically, therefore, our preference goes to genera of moderate size, large enough to indicate true (or assumed!) relationships between its members, small enough for this indication of relationships to have some meaning. The practical consequences of this are that in families containing a large number of similar (closely related) species, the generic limits may be somewhat finely drawn, whereas in families containing a smaller number of more distinctive species we would be inclined to require a higher degree of morphological differentiation to qualify for generic division. Of course the preceding paragraphs should never be construed as meaning that we reject monotypic genera as such. Monotypic genera exist in every classification, whatever the bias of its authors, just as there are monotypic families and even orders.

Finally, in the discrimination of genera, it should be kept in mind that every species must differ in some characters from all other species, for if it did not it would not be a valid species. The existence of morphological differences between species is therefore not, by itself, a reason for generic separation. This would seem obvious, but nevertheless is not generally understood (cf. Collette & Berry, 1965). In general, species belonging to one genus should share at least a few characters in which they differ from all species placed in other genera of the same family. It is especially important that this should be more than one character; for example in the Therapontidae (or in other groups) there must always be one species which grows to the largest size, or remains smallest, or is the most slender, or the deepest-bodied, or has the largest teeth, or the smallest scales, or the greatest number of dorsal spines. None of these characters alone would qualify its bearer for generic discrimination, but if a combination of them occurred in one species, the position might be evaluated differently.

After this long theoretical diversion we return to discussing the classification in current use. It may be assumed that authors like Whitley (1964) and Munro (1967) who recognize small genera, consider the few species which they retain together in one genus as more closely related to each other than to species placed by them in other genera. If such was not the case, their use of genera would be meaningless. Whereas the recognition of many small genera may — quite apart from theoretical and practical objections that can be made against small genera as such: we have already discussed this — be used as a means of expressing fine degrees of relationship in well-known groups, one of us has on a previous occasion presented evidence that the Therapontidae are not nearly well-enough known for such fine treatment and that as a consequence several of the small genera that have been used are artificial, hence misleading (Mees, 1971). With artificial, we mean that the species brought together in one genus are not particularly closely related. In the following paragraphs we shall illustrate this with a few examples.

Leiopotherapon was introduced as a subgenus for species with "Suprascapular not exposed, hidden by scales" (Fowler, 1931). In this subgenus Fowler placed four species: *T. caudavittatus*, *T. plumbeus*, *T. unicolor* and *T. percoides*. The next author to discuss *Leiopotherapon*, now as a full genus, was Whitley (1943: 182), who expanded the diagnosis as follows: "*Leiopotherapon*, is based on *Datnia plumbea* Kner, which is very similar to *Mesopristes*, but has the supracleithrum and cleithrum covered by scales and the preorbital smooth". This, however, is true only as regards the supracleithrum, the character originally given by Fowler, for in *T. plumbeus*, the type-species of *Leiopotherapon*, the cleithrum (postcleithrum) is exposed (cf Mees, 1971: fig. 6) and the lower margin of the preorbital is serrated. Whitley (1943) also removed *T. caudavittatus* as well as *T. percoides* from *Leiopotherapon* to new monotypic genera, leaving only *T. plumbeus* and *T. unicolor* (by implication: not mentioned by him) in *Leiopotherapon*. It is well now to remember that when two species are placed together in one genus and separated from all other genera, this means that they are believed to be much more closely related to each other than either of them is to any other species in their family. Zoogeographically a genus consisting of two species, one in freshwater of Luzon, the other in freshwater of tropical Australia, is not easy to explain, but anyway Whitley (1945) removed *T. unicolor* also from *Leiopotherapon* to its own little genus, leaving *Leiopotherapon* monospecific.

The zoogeographical and historical implication of Fowler's (1931) original concept of *Leiopotherapon*, with four species of which one is semi-marine and meets the ranges of all three freshwater species, is that the latter three have been derived from the former through independent colonizations of freshwater. With the creation of separate genera for each of these four species, as done by Whitley, any zoogeographical interest the group might have was effectively concealed. Unexpectedly, however, a few years later Whitley (1948) added a freshwater species from northern Queensland to *Leiopotherapon*. This must mean that Whitley considered his supposedly new species *Leiopotherapon suavis*, to be more closely related (morphologically and historically) to *T. plumbeus* of Luzon than to any of the freshwater and marine species recorded from Queensland. How artificial Whitley's concept of *Leiopotherapon* is in our opinion, is best shown by the fact that we consider *Leiopotherapon suavis* to be a synonym of *T. carbo* (see the discussion of *T. raymondi*) and that Whitley referred *T. carbo* to a genus *Hephaestus*, that he did not even place near *Leiopotherapon* (cf. Whitley, 1964: 42).

We shall now follow the recent history of the genus *Madigania*, created by Whitley (1945) for *T. unicolor*. Whitley's diagnosis is rather more extensive than we have come to expect from this author; we quote it in full:

"Mouth large, reaching below middle of the small eye. Teeth villiform on jaws, outer ones enlarged; palate toothless. Preorbital entire and with a few denticles. Lower opercular spine not reaching gill-opening. Body elongate-elliptical. Supracleithrum not exposed, hidden by scales. Less than 60 rows of lateral scales: 8 or 9 between l. lat. and spinous dorsal. Normally 12 dorsal spines. General characters as for the family Terapontidae. Colouration greyish, usually with small scattered dark spots. No dark blotch on spinous dorsal, no stripes on body. Caudal fin plain. Freshwater, tropical and subtropical Australia.

Differs from the true marine *Terapon*, in having long, low, first dorsal fin, without dark blotch; body not silvery with stripes, lower opercular spine much shorter, and caudal fin emarginate".

Unfortunately, whereas the diagnosis looks at first sight rather impressive, closer scrutiny leaves little that is of use as practically all characters given are shared by the great majority of species. A nice touch is the comparison with "true marine *Terapon*" but not with the numerous freshwater genera Whitley himself had introduced only two years previously. The coloration of *T. unicolor* is admittedly unique, but we have to point out that Whitley's description of it is erroneous, being based on preserved material. This was also how the species originally received the misnomer *T. unicolor*. In life this species, for that reason known as Spangled Perch, is densely covered with rust-red spots. In preservative these change gradually to greyish (the stage at which Whitley described them) and finally fade altogether.

Madigania was regarded as having only this one species until Munro

(1964: 175) gave under *T. adamsoni*, called *Madigania adamsoni* by him, the following discussion:

"In common with *M. unicolor* (Günther 1859) .... it has the suprascapular bone hidden beneath scales and skin, 12 spines in the dorsal fin, and plain body colouration. For this reason it is placed in the genus *Madigania* Whitley 1945. Its nearest relatives in New Guinea are *Amphitherapon habbemai* (Weber 1910) and *A. caudavittatus* (Richardson 1845) but these have relatively deeper bodies and 13 spines in the dorsal fin".

But *T. adamsoni* has an exposed supracleithrum and its young have longitudinal bands; moreover, as mentioned above, *T. unicolor* does not have a "plain body colouration" and *T. adamsoni* has either twelve or thirteen dorsal spines. All the characters used by Munro to define *Madigania* and *Amphitherapon* were therefore based on incorrect observation (as regards the supracleithrum), or due to insufficient material, except for the slightly deeper bodies which the two species of *Amphitherapon* would have in common. It is our opinion that *T. habbemai* and *T. adamsoni* are closely related and that neither of these species is particularly close to either *T. unicolor* or *T. caudavittatus.*

It is relevant to quote here also Whitley's (1943) diagnosis of *Amphitherapon* (type and only species originally included, *T. caudavittatus*):

"Lower opercular spine not reaching beyond lobe. Mouth small, barely reaching below eye. Suprascapular bone hidden by scales. Less than sixty lateral and 8 supralateral scales. Thirteen dorsal spines, the longest longer than the rays. Caudal fin with a conspicuous black blotch on each lobe".

T. habbemai, placed by Munro in *Amphitherapon,* does not have markings on the caudal fin and was mistakenly thought to have no exposed supracleithrum. When *Amphitherapon* is expanded to include *T. habbemai,* as Munro did, it cannot be defined any longer against other groups of species. We believe to have shown that Munro's concept of the two genera *Madigania* and *Amphitherapon,* small as they are with only two species each, is nevertheless artificial.

We conclude with the genus *Scortum* Whitley (1943), which has as type-species *Therapon parviceps* Macleay:

"Head small, about one-fourth standard length. Lower opercular spine not reaching lobe. Supracleithrum exposed. Scales in 70 or less lateral series and 8 or more supralateral. Thirteen dorsal spines, the longest much longer than the rays. Body without bands and tail without spots, the coloration uniform .... This genus also includes *Therapon hilli* Castelnau, 1878, which has head 3½ in standard length ....".

According to Ogilby & McCulloch (1916), however, the head of *T. par-*

viceps measures 3.0-3.5 in standard length and on their plate we measure 3.5. Therefore the main character used by Whitley in the discrimination of this genus is invalid. Not having studied the four species which Whitley (1960, 1964) united in *Scortum*, we cannot say whether they form a natural group.

With these examples we believe to have shown sufficiently why we do not regard the classifications with many small genera as proposed by Whitley and Munro as a realistic approach to a natural system.

Although we believe that we are able to recognise in the Therapontidae several groups of related species, we consider the overall similarity too great to subdivide *Therapon* on the basis of these groups. From the preceding chapter it will also have become clear that we doubt the phylogenetic significance of several of the characters that have been used for subdividing *Therapon*. In the next chapter we shall present our ideas on interrelationships.

6. Affinities and zoogeography

Northern Australia and southern New Guinea have a number of freshwater fishes in common; indeed, the close affinity between the two regions is generally recognized (cf. Whitley, 1947 and 1959; Munro, 1964; Tyler, 1972) [1]). It was to be expected that this close affinity would also be found between the freshwater Therapontidae of both regions. Below we shall present our evidence for this relationship, but first we must discuss the three species that at one time or another, before we started our investigations, have been thought to occur in Australia as well as in New Guinea. These species are *Therapon trimaculatus*, *T. roemeri* and *T. lorentzi*.

The record of *T. trimaculatus* from the Cape York Peninsula goes back to Ogilby & McCulloch (1916: 121), who observed that: "this locality is uncertain and requires verification". Later the species has been included, with or without a query, in all lists and books on Australian fishes. However, since 1916 not a shred of evidence has been produced that *T. trimaculatus* would really occur in Australia and it appears entirely justified to

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1) Tyler (1972: 240) has given a list of freshwater fishes which northern Australia and southern New Guinea have in common, but it is not very good. For example, of the Belonidae he lists two species, *Eurycaulus persimilis*, a synonym of *Belone platyura*, a purely marine species never to our knowledge found in fresh water, and *Strongylura strongylura* = *Belone strongylura*, an inhabitant of estuaries of which the wide distribution, as well as what is known of its ecology indicate that it is not a true freshwater fish. On the other hand the one freshwater species of the family that should have been listed, *Belone krefftii*, has been omitted. Also, we miss in the list all reference to the families Plotosidae and Toxotidae. Apparently Tyler did not know Munro's (1964) zoogeographical analysis, where he would have found all the information required.

reject definitely the one doubtful record from Australia. Our confidence is strengthened by the apparent fact that *T. trimaculatus* has a very restricted range in the Port Moresby area and does not occur in the New Guinea lowlands opposite Australia. The one record in literature of this species from the Fly River (Whitley, 1938) was due to misidentificaton as will be explained elsewhere in this paper.

T. roemeri was included in the ichthyofauna of Australia by Lake (1971) under the name *Pelates romeri*. This was evidently based on Nichols (1949), who recorded a series of small fishes from the Archer River, Cape York Peninsula, under the name *Therapon bidyana*, with the following discussion: "I identify these with *Pelates römeri* from New Guinea, and they are presumably *T. bidyana* as recognized elsewhere in Australia". The specimens in question were examined by Mees (1971: 207) who assigned them to *T. bancrofti*, an Australian species.

Recently Munro (1972) listed *Pingalla lorentzi* as occurring in tropical Australia, but about this Mr. Munro (in litt., 24.IX.1973) supplied the following information: "My inclusion of *Pingalla lorentzi* must be a mistake and I can find nothing in literature to confirm its presence in Australia".

Having thus disposed of all previous records of occurrence in New Guinea and Australia, we can start looking at the evidence provided by our fresh material. Examination of the list reproduced on the opposite page, reveals only a single species that Australia and New Guinea have in common, *T. fuliginosus*. Confining ourselves to forms actually identical in the two regions, however, masks the close affinity that exists between others. In this connection it deserves mention that we have seriously considered introducing ternary nomenclature to express relationships, but have decided to refrain from doing so as the Therapontidae are not yet sufficiently well-known, so that ternary nomenclature might be in some cases misleading rather than helpful. In the list we have, however, used it to indicate our opinions on closeness of relationships; in one column are given the names of the New Guinea forms, in the other those of their Australian counterparts or representatives (when we believe that these exist and are clearly discernible as such).

It will be seen that of the six groups of species known to occur in New Guinea, four have close relatives in Australia. In two cases the differences are at most of subspecific value, in two others (*T. gilberti* and *T. carbo*, both known from very few specimens) they appear to be somewhat greater. The absence of *T. jamoerensis* in northern Australia is not surprising as the lake habitat preferred by it must be scarce there, but one would expect a representative of the *T. trimaculatus* group of species to occur. Perhaps one

New Guinea	Australia
T. lorentzi	*T. gilberti*
T. jamoerensis jamoerenis *T. jamoerensis lacustris*	—
T. habbemai *T. adamsoni* *T. trimaculatus* *T. transmontanus transmontanus* *T. transmontanus obtusifrons*	—
T. fuliginosus fuliginosus *T. fuliginosus roemeri*	*T. fuliginosus fuliginosus*
T. percoides affinis	*T. percoides percoides*
T. raymondi	*T. carbo*

remains to be discovered, or possibly we may not have recognized it in the description of one of the little-known species from tropical Queensland, not examined by us. Note that *T. habbemai*, the representative of the group occurring in southern New Guinea, appears to be confined to the headwaters and might not have crossed a lowland landbridge easily; therefore the explanation might in this case also be ecological.

The comparative list deserves a close examination: whereas on the one hand, the near relationship between the species from New Guinea and Australia is evident, on the other hand the point must be stressed that in all cases except one there are already clear morphological differences. It is tempting to relate this to the more recent geological history of the region. None of the species treated here has ever been found in the sea and there is no evidence that they can cross saltwater-barriers; indeed, if they did, their present distribution and morphological differentiation would not make sense. It appears not to be known when exactly the Torres Strait came into existence, but it: "is unlikely to have been a water barrier between Australia and New Guinea until middle to late Pleistocene times" (Doutch, 1972). With the lowering of the sea-level in glacial times, the land connection was restored, and consensus of opinion is that the final breakthrough of the sea between Australia and New Guinea, creating the present Torres Strait, took place between 6500 and 8000 years B. P. (Jennings, 1972). This obviously does not prove that all the differentiation between the Therapontidae of the two countries must have taken place in the last six to eight thousand years, but only that the complete separation between the populations must at least date back that far. It is likely that most if not all populations became separated much earlier, perhaps around 14500 years B. P. when, after its maximal extension, the Sahul Shelf started to shrink (Jongsma, 1970). An age of ca. 15000 years appears to us very acceptable for the degree of differentiation found.

Without for the present offering an explanation, we want to draw attention to the fact that in each of the four pairs of forms listed, the New Guinea one differs by an increased number of scales.

We are surprised by the apparent absence from New Guinea of *Therapon unicolor* Günther, the most widely distributed of all Australian species (as already mentioned, we do not agree with Munro, who linked it to *T. adamsoni*). Admittedly, the major feature of this species consists of its ability to colonize arid regions (cf. Shipway, 1947; Lake, 1971: 35), but it is also common throughout the better watered parts of tropical Australia, including eastern Queensland and the Cape York Peninsula (cf. Nichols, 1949). This indicates that its absence from New Guinea is not necessarily due to ecological factors.

Although a discussion of *T. unicolor* falls outside the scope of this paper, we take this opportunity to provide a few notes on it, which otherwise might remain unpublished. *T. unicolor* is not only the most widely distributed freshwater fish of Australia in a geographical sense, but also on a smaller scale: within its range, in waters which support only a single species of fish, that species is *T. unicolor*; if two species are present, one of them is *T. unicolor*, and so on. In other words, we know of no waters in tropical Australia, inhabited by fish, where *T. unicolor* does not occur (personal observations).

As Lake (1971: 11) mentioned that no fishes are known from his area 15, the most arid part of Australia, of uncoordinated drainage, we want to report that in August 1968 GM obtained *T. unicolor* and two other species of fishes from the Wolf Creek near Carranya, W. A.; this is a tributary of the Sturt Creek, with internal drainage to Gregory Lake in the desert. In January 1975, GM and Veronica J. Mees found *T. unicolor* in large numbers dying in a drying creek-bed near Elliott, N. T., and plentiful (and very much alive) in the Morphett Creek, south of Banka Banka, N. T., which was in flood at the time. No other species of fish occurred in these places, but the Morphett Creek yielded also crabs of the species *Holthuisana transversa* (von Martens), identified by Prof. L. B. Holthuis. In the same month, in a pool in the otherwise dry bed of the Finke River near the Stuart Highway bridge, N. T., not only *T. unicolor* but also *T. percoides* was obtained, besides several other species.

Llewellyn (1968) stated that *T. unicolor* is able to survive in mud for long periods when waters in which it lives dry out, but he added: "Experimental evidence of aestivation is hard to obtain as only one fish in numerous laboratory tests survived partial dehydration. However, aboriginals are reputed to collect them from the mud of dried up waterways". Thus, the actual evidence is reduced to a story about aboriginals that has little value when it is not known how dry "dried up" is. In a review of drought adaptation in Australian fishes, Whitley (1959) did not mention aestivation in this species, and our experience at Elliott (quoted above) and elsewhere, although admittedly anecdotal, does not support Llewellyn's opinion. In Australia, aestivation is only known from Galaxiidae (Whitley, 1957).

Lake (1971) reported of *T. unicolor* that: "They rarely exceed 350 g in weight but are good eating". A weight of as much as 350 g must be exceptional, as the heaviest fish ever obtained by us weighed 245 g. We agree that they are good eating.

To return to the main topic of discussion: it has already been made clear that part of the richness of species in northern Australia and New Guinea can be explained by repeated colonizations across the Torres Strait land bridge; indeed, it does not seem possible to us to explain it in any other way.

It may reasonably be assumed that the Torres Strait has also played a rôle in earlier history and has made possible the evolution of new species in each country, no longer easily recognizable as closely related. This leads to speculation about the origin of the whole group. Although the exact relationships of the Therapontidae are unknown, it is generally agreed that they belong to a group of families that is mainly marine. The simplest explanation for the present-day distribution and diversity of species would be repeated colonizations of freshwater by marine or semi-marine forms. Especially the existence of several semi-marine species, equally at home in sea as in freshwater, makes it easy to visualize how this could have occurred. On the other hand it is less easy to understand how such colonists could have evolved into the pure freshwater species they are now.

We are unable to take the discussion much beyond this point. It is true that in general morphology *T. argenteus* and *T. cancellatus* are closest to the freshwater species, but apart from the near-certainty that the supposed marine or semi-marine ancestor of the freshwater species has undergone considerable change itself, if it has survived at all in its original habitat, it is impossible to say whether the freshwater species have all been derived from the same species or from several species. In addition, whereas the Australo-Papuan species might possibly be a monophyletic group, *T. plumbeus* from Luzon and *T. micracanthus* from Celebes would almost certainly have originated from independent colonizations. The great diversity of the freshwater species of Australia and New Guinea proves that they form a group of some antiquity and we believe that at the present level of knowledge further attempts to define their exact relationships would lead to meaningless speculation.

7. Key to the Therapontidae known from New Guinea

In the introduction we have criticized the identification keys published by previous authors. Now, criticizing the work of others is one thing, but improving on their work another. Only the user will be able to judge in how far we have been successful; we can only hope that this judgement will be mild.

As in our opinion the only function of a key is to make identification as easy as possible, one must not look for a "natural system" in the key. Although it is logical that morphologically similar ("closely related") species usually key out near each other, this need not necessarily be so. It will also be obvious that, as our material of most species was limited, the range of individual variation may be wider than indicated.

To give a general idea of where, on present evidence, what species may be found, we have also provided a short geographical key. It should be noted that although from rivers of southern New Guinea seven species are known, at present no more than four species have been recorded from any one locality. This maximum of four is found at Morehead: *T. lorentzi, T. lacustris, T. affinis* and *T. raymondi*. Lake Murray has *T. lorentzi, T. lacustris* and *T. affinis*; whether these really occur together, or there is ecological segregation, is not known. From the Lorentz River also three species are known, but they have not been obtained at the same localities.

The ways we have counted and measured are standard ones that do not require much explanation. It should be mentioned, however, that in the transverse scale counts we have included above the lateral line the oblique rows of full-sized scales and the one above them which is shaped like half a scale, but excluded the small scales, often irregularly arranged, which form the basal sheath of the dorsal fin. In counting the gill-rakers on the outer (= first) branchial arch, we have included short and rudimentary ones such as appear near the lower end of the hypobranchial. Measurements like eye in snout and head in standard length were taken with dividers from the symphysis of the upper jaw backwards; it should be realized that fishes are three-dimensional so that the snout-length as measured is a little more than the snout-length shown on a plate, which of necessity is two-dimensional.

Some authors give measurements and proportions in thousands of standard length and even then use decimals, which means that the degree of accuracy claimed goes to tenthousands of the standard length. In our opinion any claim to accuracy of that kind in small soft-bodied fishes is unrealistic and therefore we have refrained from presenting that kind of measurements.

Geographical key to the freshwater species

Northern New Guinea (north of the central ranges).
Sermowai River: *T. obtusifrons.*
Ramu and Sepik basins: *T. transmontanus.*
Southern New Guinea (south of the central ranges).
Lake Jamoer: *T. jamoerensis.*
Rivers and lakes from Mimika to Fly and Bamu basins: *T. lorentzi, T. lacustris, T. habbemai, T. fuliginosus, T. roemeri, T. affinis, T. raymondi.*
Lake Kutubu: *T. adamsoni.*
Purari River: *T. fuliginosus.*
Laloki River and its tributaries: *T. trimaculatus.*

Key to the Therapontidae known from New Guinea

1a. Teeth, or at least some teeth in outer series in both jaws flattened with several (usually three) cusps or lobes, or basally flattened with conical tips and with "bumps" or lobes on each side below tip 2
b. Teeth in outer series of both jaws simple, conical; the tips may be sharp or blunt [1]) 4
2a. 45-51 series of scales between origin of lateral line and hypural joint counted below the lateral line; body depth 2.3-2.7 in standard length; distance from basis of last dorsal ray to middle of hypural joint shorter than or subequal to postorbital part of head; teeth in outer series of both jaws more or less flattened, lancet-shaped to truncate, often with several cusps or lobes (fig. 1b); teeth in outer row in lower jaw conspicuously larger than those in the second row; body plain, light brown to silvery; freshwater . . . . . . *Therapon lorentzi*
b. 63-94 series of scales between origin of lateral line and hypural joint counted below the lateral line; body depth 2.6-4.0 in standard length; distance from basis of last dorsal ray to middle of hypural joint always longer than postorbital part of head; teeth in outer row in lower jaw not much larger than those in subsequent rows; body with 4-6 longitudinal bands; marine 3

1) As small specimens of *T. quadrilineatus* may have more or less simple teeth, check description under 3b. *T. quadrilineatus* can be distinguished from all other species by its higher number of gill-rakers. Only *T. puta* comes near it in this character but is easily separable by the large spines on the bend of the preoperculum.

3a. 80-94 series of scales between origin of lateral line and hypural joint counted below the lateral line; body depth 3.2-4.0 in standard length; all teeth flattened and tricuspid, each jaw with five rows, close together (fig. 1a); gill-rakers on outer branchial arch rather short, 22-24 (6 or 7 + 1 + 15 or 16) . . . . *Helotes sexlineatus*

b. 63-75 series of scales between origin of lateral line and hypural joint counted below the lateral line; body depth 2.6-3.2 in standard length; teeth in outer series in both jaws either lancet-shaped, or basally flattened with conical tips, or tricuspid, the lateral cusps developed to a greater or lesser extent (fig. 1c), in the upper jaw three, in the lower jaw two rows of teeth, more or less regularly arranged; gill-rakers on outer branchial arch long and slender, 34-39 (11 to 15 + 1 + 20 to 23) . . . . *Therapon quadrilineatus*

4a. Lower opercular spine long, much more developed than upper opercular spine, much longer than broad and about half an eye's diameter in length (fig. 2); dorsal fin deeply notched, the last spine much longer than the penultimate one; a large black blotch on the spinous dorsal fin; marine 5

b. Lower opercular spine short, not much larger than upper opercular spine, basally flat and not much longer than broad, much less than half an eye's diameter in length; dorsal fin not deeply notched, the last spine at most a little longer than the one preceding it; no black blotch on the spinous dorsal fin; marine and freshwater 7

5a. Scales moderately large, less than 55 series between origin of lateral line and hypural joint counted below the lateral line . *Therapon theraps*

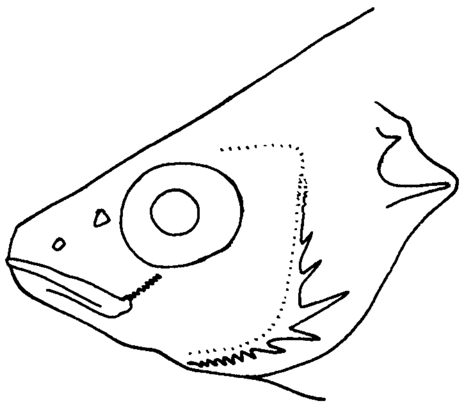

Fig. 2. Head of *Therapon puta*, showing the large lower opercular spine (which it has in common with several marine species) and the large spines on the bend of the preoperculum (which are unique to this species).

b. Scales small, over 70 series between origin of lateral line and hypural joint counted below the lateral line 6

6a. Body slender, its depth 3.1-3.7 in standard length; body with two to four longitudinal bands which are straight, not or scarcely curved upwards anteriorly; spines on bend of preoperculum very large, almost or quite as large as lower opercular spine (fig. 2); vomer and palatines edentulous . . . . *Therapon puta*

b. Body less slender, its depth 2.7-3.0 in standard length; body with three longitudinal bands which are curved upwards anteriorly; spines at bend of preoperculum much smaller than lower opercular spine; vomer and palatines with teeth . . . . *Therapon jarbua*

7a. Caudal fin with on each lobe a conspicuous oblique black blotch or bar; body with dark spots on a pale dusky background which sometimes shows indistinct broad and short vertical bars; semi-marine . . . . *Therapon caudavittatus*

b. Caudal fin without a conspicuous black blotch on each lobe, although there may be some grey or dusky spotting or a blackish edge to the lower lobe, or dark spots near its base; body not spotted . . . 8

8a. Body with five distinct black vertical bars, continued to about two-thirds down the sides, on a plain silvery background; caudal fin hyaline (in life yellowish) with usually some dusky or blackish spotting and with a blackish lower edge along the lower lobe; 41-47 series of scales between origin of lateral line and hypural joint counted below the lateral line . . . . *Therapon affinis*

b. Body plain, variegated, with longitudinal bands or with short vertical bars in association with other markings; caudal fin plain: hyaline, dusky or blackish, with or without one or more dark spots near its base; 45-67 series of scales between origin of lateral line and hypural joint counted below the lateral line 9

9a. Gill-rakers on outer branchial arch 4 to 10 + 1 + 14 to 18; marine and freshwater 10

b. Gill-rakers on outer branchial arch 4 to 7 + 1 + 8 to 12; freshwater 13

10a. D XII. 12½ to 14½, A III. 9½, gill-rakers on outer branchial arch 4 to 10 + 1 + 14 to 17; body plain, dark; freshwater . . . 11

b. D XII. 10½, A III. 8½ (according to literature also 9½); gill-rakers on outer branchial arch 7 to 10 + 1 + 15 to 18; body pale with dark longitudinal bands which may be indistinct or missing in large specimens; semi-marine 12

11a. 55-62 series of scales between origin of lateral line and hypural joint counted below the lateral line; 9 or 10 series of scales transverse above the lateral line . . . . *Therapon roemeri*

b. 50-52 (in Australian material 44-53) series of scales between origin of lateral line and hypural joint counted below the lateral line; 7 or 8 series of scales transverse above the lateral line . . . *Therapon fuliginosus*

12a. Mouth inferior, the upper jaw clearly protruding over the lower jaw; snout rather long, pointed or with a "chopped off" appearance of upper jaw at symphysis; eye 1.3-2.1 in snout; nostrils close together, the anterior one much closer to eye than to tip of snout; semi-marine . . . . *Therapon cancellatus*

b. Mouth low, far below the eye, but almost terminal; snout rather short, sharp or bluntly pointed; eye 1.0-1.6 in snout; nostrils well-separated, the anterior one about midway between eye and tip of snout; semi-marine . . . . *Therapon argenteus*

13a. Supracleithrum invisible, covered by scales; 58-67 series of scales between origin of lateral line and hypural joint counted below the lateral line 14

b. Supracleithrum exposed (covered with skin but not with scales); 45-65 series of scales between origin of lateral line and hypural joint counted below the lateral line 15

14a. Eye large, 3.0 in head . . . . *Therapon jamoerensis*

b. Eye moderate, 3.4-4.4 in head . . . . . . *Therapon lacustris*

15a. 60-65 series of scales between origin of lateral line and hypural joint counted below the lateral line; D XII. 14½, A III. 10½ or 11½; body with a variegated pattern of whitish or light yellowish spots on a brown background (large specimens, as yet unknown, may possibly be plain, or turn plain blackish in preservation) . . . *Therapon raymondi*

b. 45-59 series of scales between origin of lateral line and hypural joint counted below the lateral line; D XI to XIII. 10½ to 13½, A III. 9½ to 11½; body with longitudinal dark bands on a light background (in one species vertical bars may be present as well), in larger specimens the bands become faint and eventually disappear, such specimens are plain brown, varying from light to rather dark 16

16a. Longest dorsal spine equal to snout or only slightly longer, or shorter . . . . *Therapon adamsoni*

b. Longest dorsal spine equal or almost equal to snout with eye, or even longer 17

17a. Caudal peduncle long and slender, distance from basis of last dorsal ray to middle of hypural joint equal to postorbital part of head plus more than half an eye's diameter; body often with broad cross-bars in addition to longitudinal bands . . . . *Therapon transmontanus*

b. Caudal peduncle shorter, distance from basis of last dorsal ray to middle of hypural joint subequal or equal to postorbital part of head plus up to half an eye's diameter (in some specimens of *T. obtusifrons* only), or shorter; no cross-bars 18

18a. 54-59 series of scales between origin of lateral line and hypural joint counted below the lateral line . . . . . . *Therapon habbemai*

b. 45-51 series of scales between origin of lateral line and hypural joint counted below the lateral line 19

19a. Body with four longitudinal bands, the lower half of the flanks silvery, plain; base of caudal fin with a central dark blotch . . . . *Therapon obtusifrons*

b. Body with seven longitudinal dark bands, continued well onto the lower half of the flanks; base of caudal fin with three dark blotches, vertically arranged . . . . *Therapon trimaculatus*

8. Genus **Helotes** Cuvier

Helotes Cuvier, 1829, Règne Animal, ed. 2, 2: 148 — type by monotypy *Helotes 6 lineatus* = *Terapon sexlineatus* Quoy & Gaimard.

Discussion. — The only species we retain in this genus is its type-species, *H. sexlineatus*, characterized by the combination of slender body, relatively small head, small scales, long opercular spine, no exposed supracleithrum, and especially the dentition, with five rows of teeth in the upper jaw, three in the lower jaw, all flattened and tricuspid.

We realize that most of the characters listed are also found, in varying combinations, in members of the genus *Therapon* as here defined, and it is debatable whether they are really sufficient to retain for this one species a separate genus. As, however, the species combines several somewhat aberrant characters, in addition to having a unique dentition, we consider the retention of *Helotes* justified. We have also taken into consideration the fact that *Helotes* has been recognized by practically all previous authors. We will admit readily that our retention of *Helotes* as a separate genus is a concession to established classification, rather than that it stems from any deep conviction.

9. Genus **Therapon** Cuvier

Terapon Cuvier, 1816, Règne Animal, 2: 295 — based on two species: *Holocentrus servus* Bloch (= *Sciaena jarbua* Forskål) and *H. quadrilineatus* Bloch; added with a query is *H. surinamensis*. Type by elimination, *Holocentrus servus* Bloch (cf. Cuvier, 1829b: 146, who transferred *H. quadrilineatus* to *Pelates*). The name has been generally emended to *Therapon* by Cuvier himself and later authors, see Discussion below [1]).

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1) The year of publication appearing on the title-pages of all four volumes of the first edition of Cuvier's Règne Animal is 1817. There appears to be no doubt, however, that the work was published in 1816 (cf. Roux, 1976).

Pelates Cuvier, 1829, Règne Animal, éd. 2, 2: 148 — type by monotypy *Pelates quinquelineatus* Cuvier (= *Holocentrus quadrilineatus* Bloch).

Mesopristes Bleeker, 1845, Nat. Geneesk. Arch. Neêrl. Indië, 2: 523 — nomen nudum (*Mesopristes macracanthus* nom. nud.).

Autisthes De Vis, 1884, Proc. Linn. Soc. N. S. W., 9: 398 — type by monotypy *Autisthes argenteus* De Vis (= *Therapon puta* Cuvier).

Hephaestus De Vis, 1884, Proc. Linn. Soc. N. S. W., 9: 399 — type by monotypy *Hephaestus Tulliensis* De Vis (= *Therapon fuliginosus* Macleay).

Eutherapon Fowler, 1904, J. Acad. Nat. Sc. Philad., (2) 12: 527 — type by original designation *Therapon theraps* Cuvier.

Leiopotherapon Fowler, 1931, U. S. Nat. Mus. Bull., 100 (11): 328, 353 — type by original designation *Datnia plumbea* Kner.

Bidyanus Whitley, 1943, Austr. Zool., 10: 182 — type by original designation *Acerina* (*Cernua*) *bidyana* Mitchell.

Papuservus Whitley, 1943, Austr. Zool., 10: 182 — type by original designation *Therapon trimaculatus* Macleay.

Amniataba Whitley, 1943, Austr. Zool., 10: 183 — type by original designation *Therapon percoides* Günther.

Pelsartia Whitley, 1943, Austr. Zool., 10: 183 — type by original designation *Therapon humeralis* Ogilby.

Amphitherapon Whitley, 1943, Austr. Zool., 10: 183 — type by original designation *Datnia ? caudavittata* Richardson.

Scortum Whitley, 1943, Austr. Zool., 10: 183 — type by original designation *Therapon parviceps* Macleay.

Madigania Whitley, 1945, Trans. Roy. Soc. S. Austr., 69: 10 — type by original designation *Therapon unicolor* Günther.

Pingalla Whitley, 1955, Proc. R. Zool. Soc. N. S. W., 1953/54: 45 — type by original designation *Pingalla gilberti* Whitley.

Discussion. — Although in the original description the spelling of the generic name was *Terapon,* this was evidently a misprint, for Cuvier (1829a, 1829b) himself emended it to *Therapon.* The emendation was accepted by a majority of later authors, including Ogilby & McCulloch (1916), Weber & de Beaufort (1931), Trewavas (1940), etc. No purpose of any value would be served by a pedantic insistence on the use of the original spelling.

The genera *Pelates* and *Helotes* are generally cited as first described in Histoire Naturelle des Poissons, vol. III, but on present evidence the description in Règne Animal, nouv. éd., vol. II, has priority. The first-mentioned work was published in April 1829 (Sherborn, 1925), the second in the period January-March 1829, as established by Fowler (1907: 264), and probably in March 1829 (Boeseman, 1962). It is true that in the Règne Animal the

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Cuvier (1829b) is rather confused: he lists on different pages with separate descriptions a *Therapon quadrilineatus* and a *Pelates quadrilineatus*; also a *Pelates sexlineatus* and a *Helotes sexlineatus,* all as far as we can see ostensibly different species, and all marked as "nob."; later authors have regarded these all as the same (cf. Weber & de Beaufort, 1931: 161). Perhaps, therefore, we are not quite right in stating that Cuvier removed *H. quadrilineatus* Bloch to *Pelates.* Anyway, *H. servus* is nowadays generally accepted as the type species.

headings above the generic descriptions are in French only, but in the footnotes, where the species contained in each genus are listed, the new generic names appear in Latin. The matter of the priority is of some importance as the nomenclature used in the two publications differs in some cases.

Whitley (1943: 181) included *Homodemus* De Vis (1884: 395) as another synonym of *Therapon*; its type-species is *Homodemus cavifrons* De Vis, which Whitley identified with *Therapon fuliginosus* Macleay. In the description given by De Vis we read: "Teeth on vomer, palatines and jaws.... Pre-operculum entire...", and D XI. 16, A III. 13. Even allowing for the fact that De Vis's descriptions are known to be often rather inaccurate, we are unable to recognize *Therapon fuliginosus* in this description. At our request Mr. McKay made a search for the type material of *Homodemus cavifrons* in the collection of the Queensland Museum, but was unable to locate it.

The generic name *Mesopristes* Bleeker has to be discussed as, since Whitley (1943), it has become accepted widely in Australian ichthyological literature. The name as first published is a nomen nudum; all that Bleeker (1845: 523) has to say is: "...voorts, hoezeer zeldzaam, *Mesopristes macracanthus* nob. en *Heterodon zonatus* nob., twee nog onbeschreven geslachten, voor welke de Inlanders noch Chinezen hier een' naam hebben;...". It is worth observing that the quoted remark appears in the text under the heading "Sciaenoieden", whereas a few pages later several members of the genus *Therapon* are listed under the heading "Percoieden", hence there is not even a suggestion that *Mesopristes* would be close to *Therapon*.

The next time we meet the name *Mesopristes* is in Bleeker (1873: 372, 383) and again in Bleeker (1876a: 267), under the genus *Therapon*, as follows:

"Subgen. *Datnia* CV. (1829) = *Mesopristes* Blkr.

Dentes maxillis pluriseriati conici indivisi. Spec. typ. *Datnia argentea* CV".

Thus, on these occasions *Mesopristes* was published in the synonymy, and as such comes under article 11d of the International Code (Stoll et al., 1961), as emended by the XVIthe International Congress of Zoology, Washington, 1963: "A name first published as a synonym is not thereby made available unless prior to 1961 it has been treated as an available name with its original date and authorship, and either adopted as the name of a taxon or used as a senior homonym".

Under the rule here quoted, *Mesopristes* was not validated by Fowler (1918: 36), who used it as a replacement name for *Datnia*, arguing that: "This genus has been described under *Datnia* Cuvier by Day, but as Cuvier's type is *Coius datnia* B. Hamilton by tautonomy, *Datnia* merges with the sparoids". As Fowler definitely used *Mesopristes* Bleeker, 1845, and made no mention of *Mesopristes* Bleeker, 1876, and as *Mesopristes* Bleeker, 1845, being a nomen nudum, can under no circumstances be validated, Fowler's use of the name has no influence on the invalid name *Mesopristes* Bleeker, 1845, and cannot be construed as a validation under the Code of *Mesopristes* Bleeker, 1876. Whitley's (1943) use of *Mesopristes* is also based on Bleeker's name of 1845 and therefore does not constitute a validation of *Mesopristes* Bleeker, 1873 or of *Mesopristes* Bleeker, 1876, either. Our conclusion is that to those who want to subdivide *Therapon*, the name *Mesopristes* Bleeker is not available.

Therapon lorentzi (Weber) (figs. 1, 3)

Helotes Lorentzi Weber, 1910, Notes Leyden Mus., 32: 236 — Lorentz-Fluss.

Helotes Lorentzi; Weber, 1913, Nova Guinea, 9: 586, fig. 36 (Lorentz-Fluss bei der Regen-Insel).

Helotes lorentzi; Fowler, 1928, Mem. B. P. Bishop Mus., 10: 212 (Lorentz River); Weber & de Beaufort, 1931, Fish. Indo-Austr. Arch., 6: 167, fig. 31, 32B (Lorentz River near Regen-Island, Noord River, Upper Digul River); Fowler, 1934, Mem. B. P. Bishop Mus., 11: 417 (Regen Island, Noord River, Upper Digul River); Kailola, 1975, D. A. S. F. Res. Bull., 16: 98 (Lake Murray; Tiperrse Creek, 2½ miles from Morehead; Wotol Creek, Kiunga).

Terapon trimaculatus; Whitley, 1938, Rec. Austr. Mus., 20: 228 (Upper Fly River).

Pingalla lorentzi; Whitley, 1955, Proc. R. Zool. Soc. N. S. W., 1953/54: 45 (southern New Guinea rivers); Munro, 1958, Papua New Guinea Agricult. J., 10: 169 (Digul R.; Lorentz R.); Munro, 1964, Papua New Guinea Agricult. J. 16: 147 (Southern New Guinea); Munro, 1967, Fish. New Guinea: 320 in key (rivers of South West New Guinea); Munro, 1972, Encycl. Papua New Guinea: 423 (Lorentz-Digul-Fly basins).

Material. — One specimen, 20 September 1909, Regeneiland, collected by H. A. Lorentz (syntype, ZMA no. 112447), standard length 154 mm. One specimen (♀), 1 October 1909, Regeneiland by H. A. Lorentz (syntype, ZMA no. 112446), standard length 162 mm. Two specimens, 24 August 1959, Digoel River near Tanah Merah, collected by W. Vervoort (RMNH no. 25390), standard length 50, 53 mm. One specimen, 7 April 1972, Lake Murray, collected by P. Bourne (DPI no. FO 3737), standard length 67 mm. Two specimens, 26 August 1973, Tiperrse Creek, 2½ miles from Morehead station, collected by B. Malawa (AMS no. I. 19127—002), standard length 52, 57 mm. Two specimens, 25 September 1973, Wotol Creek, Kiunga, collected by J. Koaia and J. Timothy (DPI no. FO 3804), standard length 44, 54 mm. One specimen, date unknown, 30 miles above d'Albertis Junction, Fly River, collected by Stuart Campbell (AMS no. IA 7222), standard length 47 mm.

Description. — D XIII. or XIV. 11½ to 13½, A III. 8½ (IV. 8½ in one specimen, DPI no. FO 3737), P 14 or 15, V 1.5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 19-22 (6 to 9 + 1 + 11 to 13), branchiostegals 6, scales below lateral line 45-51, above lateral line 49-51, transverse 7/1/13 or 14.

A plain species with a small mouth, an exposed but inconspicuous supracleithrum with teeth along its posterior margin, and a dentition with at least some teeth flattened and more or less tricuspid, as indicated in the key and further described below. Head 2.7-3.4 in standard length; body depth 2.3-2.7 in standard length; snout bluntly pointed; anterior profile from tip of snout to dorsal origin almost straight; eye of moderate size, in the small specimens 3.0-3.6 in head, 0.9-1.1 in snout and 0.9-1.3 in interorbital, in the two large specimens 4.6-4.7 in head, 1.7 in snout, and 1.8 in interorbital; nostrils widely separated, the anterior one mid-way between tip of snout and eye (small specimens) or nearer tip of snout (large specimens), level with lower half of eye, the posterior one higher, in front of middle of eye and closer to eye than to anterior nostril; mouth small, entirely below level of eye; when the mouth is closed, the maxillary reaches to a vertical through the posterior nostril; lips scarcely fleshy; teeth in both jaws well-developed, each jaw with an outer row of rather large and more or less depressible teeth, some sixteen on each side, followed by three irregular rows or a narrow band of much smaller teeth, broadest near the symphysis and narrowing to a single row sideways; teeth in the outer row flattened and somewhat curved, their tips lanceolate in small specimens, but becoming three-cusped (a small tip on each side below the main one) in the larger specimens; all teeth conspicuously brown-tipped; no teeth on tongue, vomer or palatines; lower edge of preorbital more or less straight with about ten strong flat spines covered with skin; preoperculum strongly serrated along its whole free border, with ca. 19-24 spines, those on the bend a little larger than the others; operculum ending in two flat spines, which do not protrude beyond the border of the soft operculum; postcleithral process with a free posterior margin carrying from five (smallest specimen) to ten (largest specimen) teeth; supracleithrum covered with skin but not with scales, its posterior border with three to five teeth.

Body scaled, except for the chin and the snout to the nape; scales ctenoid, in regular rows. Lateral line complete, its arch following the outline of the back, its posterior fourth almost straight, with 49-50 + 3 pore-bearing scales.

Dorsal fin with thirteen or fourteen spines; the spines increase in length from the first to the fifth, which is half the length of the head (or equal to snout and two-thirds of eye, or to postorbital part of head and one-third of eye); the sixth is equal to the fifth and from there on there is a regular decrease in length to the last spine, which is about three-fifths of the longest spine and slightly to distinctly shorter than the penultimate spine. The soft dorsal has eleven to thirteen rays, the last one of which is split to its base, it is rounded-truncate in outline, the second, third and fourth rays longest, but a little shorter than the longest dorsal spines; the last ray is little more than half the length of the longest rays. Base of soft dorsal half length of base of spiny dorsal. Basal sheath well-developed over the whole length of the fin. Individual counts of the specimens examined are: D XIII. 11½, XIII. 12½ (four specimens), XIII. 13½ (two specimens), XIV. 12½, XIV. 13½.

Anal fin with three spines (in one specimen four spines) and eight rays, the last one of which is split to its base. Of the spines, the first is the smallest, about half the length of the second and largest spine, whereas the third spine is distinctly shorter (10-20%) than the second and usually thinner (in one specimen it is almost as thick). The soft anal is rounded-truncate in outline, with the first ray longest, equal in length to the longest dorsal rays but less than the longest anal spine and over twice the length of the last anal ray. There is a well-developed basal sheath.

Pectorals with rounded outline, with 14 or 15 rays, of which the first two and also usually the last one (rarely the last two) are simple, the others divided; the fifth ray is longest, 1.5-1.9 in head, a trifle longer than snout with eye.

Ventrals scarcely pointed, with one strong spine and five rays; the spine equals the postorbital part of the head; the spine is about three-fifths of the length of the first ray, which is the longest of the rays and has a short filament; all five rays divided; when pressed against the body the ventrals reach or almost reach the anus in small specimens, but reach only about three-quarters of the distance from their insertion to the anus in large specimens.

Caudal peduncle short; distance from base of last dorsal ray to middle of hypural joint slightly to distinctly shorter than postorbital part of head. Caudal fin truncate, slightly emarginate, with rounded lobes; it has fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colour in a preserved condition dull brown, the scales with paler centres, and darker along the edges; belly and lower part of the head paler; snout dusky; fins light brown without clear markings.

Distribution. — Apparently widely distributed in southern New Guinea, where now known from the Lorentz, Digoel, Morehead and Fly River basins.

Discussion. — In general we are of the opinion that when a species is not definitely misplaced in the genus in which it has been described and to which it is still assigned in the bulk of the literature, it should be left there. *Helotes lorentzi* was by its describer placed in *Helotes*, and apart from Whitley's (1955) attempt — not followed by many other ichthyologists — to split it off in a genus *Pingalla*, has remained there.

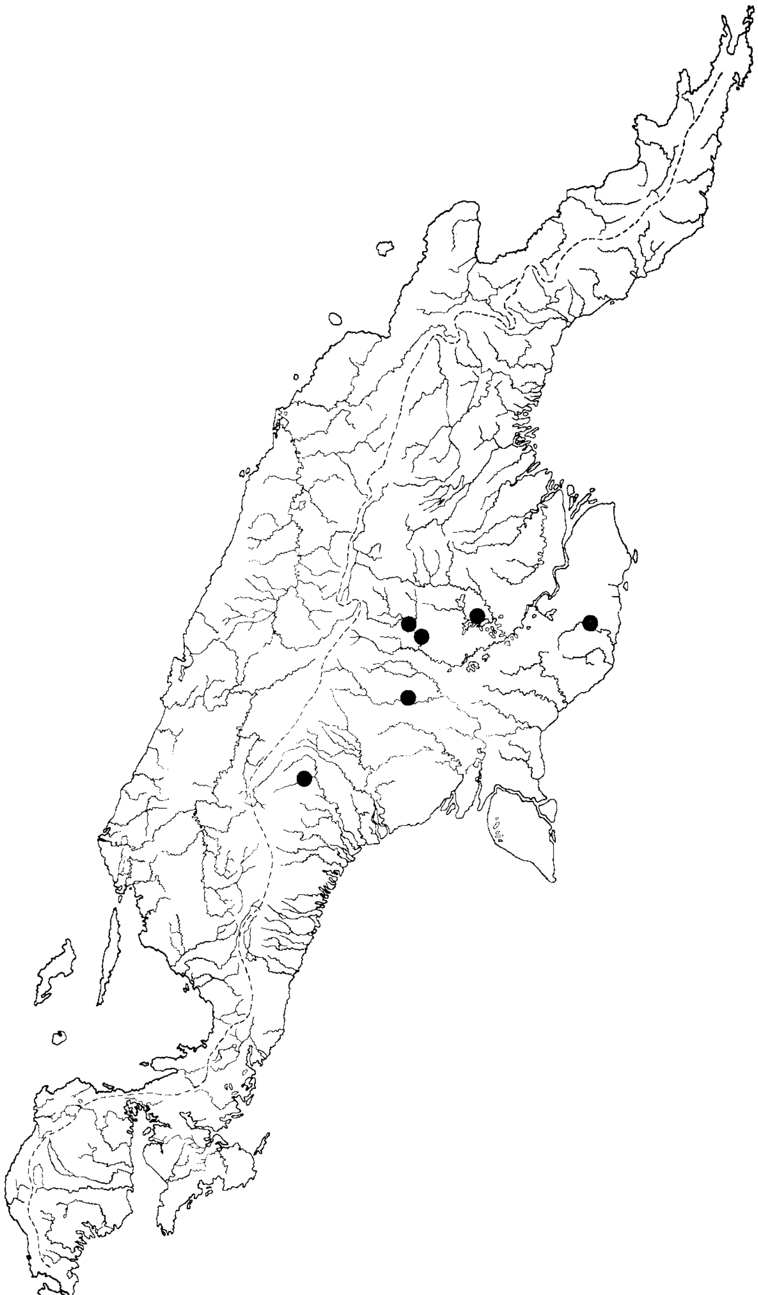

Fig. 3. The distribution of *Therapon lorentzi*.

The reasons why, after much hesitation, we have decided to transfer *H. lorentzi* to *Therapon* are the following: when Weber (1910) described the species, he did not mention his reasons for placing it in *Helotes*, neither did he do so in his next paper three years later (Weber, 1913). Only much later did Weber & de Beaufort (1931) produce a key and a generic diagnosis from which the differences between the three genera recognized by them, *Therapon, Pelates* and *Helotes*, can be distilled. Obviously the classification adhered to by these authors means that they believed *H. lorentzi* to be more closely related to *H. sexlineatus* than to any of the species placed by them in the genera *Therapon* and *Pelates*. On a previous page we have already discussed the merits of the various characters used for specific and generic discrimination. In the short discussion under *Helotes* we have indicated a number of characters of *H. sexlineatus*, and it is instructive to note that in all these characters but one, *H. lorentzi* differs from *H. sexlineatus* and agrees with other freshwater fishes of the genus *Therapon*: it has a deeper body, larger head, larger scales, no long opercular spine, an exposed supracleithrum, a plain body. The dentition is at most intermediate between that of *Helotes* and *Therapon*: the outer row of teeth is more or less flattened and tricuspid, but not nearly so completely as in *H. sexlineatus*; many teeth, even in the outer row, are simple, as are most of those farther back (see description of dentition in the key). Especially when considering *T. quadrilineatus*, which has simple but basally flattened teeth, it is evident that even in its dentition *H. lorentzi* is closer to other species of *Therapon* than to *H. sexlineatus*. We would add that it requires little imagination to suggest the possibility that dentition is a fairly plastic adaptation to a way of feeding rather than that it has much phylogenetic significance.

As far as Weber & de Beaufort's (1931) key characters are concerned: of some of them we can make nothing, others are applicable to *H. sexlineatus* only and not to *T. lorentzi*. The description of *Helotes* in their key runs as follows: "Teeth in jaws pluriseriate, brown, the outer series enlarged, flattened, lanceolate, trilobate or tricuspidate. Head small; gape of mouth small, square. D. XII-XIII, 10-13. Gillmembranes united, their posterior border free from isthmus". Here it is evident that the characters of dentition have been adapted to include *T. lorentzi*, but the small head applies to *H. sexlineatus* only; a small square mouth as opposed to a moderate oblique gape in the genera *Therapon* and *Pelates*, suggests differences that we are unable to find. The character of the gill-membranes has been discussed in chapter 4.

The Australian species *Pingalla gilberti* Whitley (1955), that unfortunately we did not have an opportunity to examine, is evidently closely related. The differential characters given by Whitley are: Posterior dorsal spines

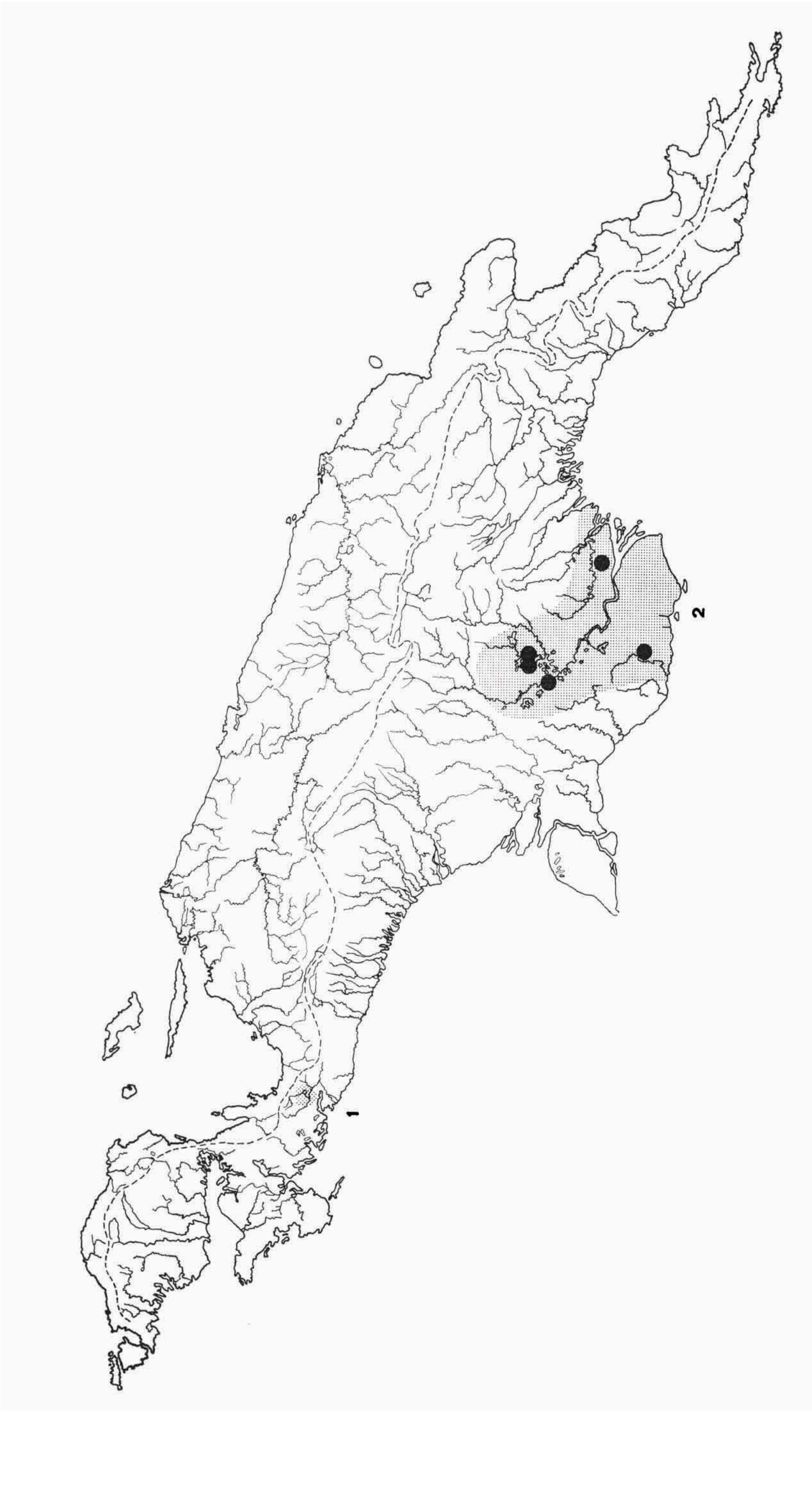

Fig. 4. The distribution of *Therapon jamoerensis* (1) and *T. lacustris* (2).

subequal, D XIII or XIV. 13, L. Lat. 52 (*lorentzi*); last dorsal spine longer than penultimate, D XII. 12, L. Lat. 44 (*gilberti*). However, in our material of *T. lorentzi* we found scales 45-51, and D XIII or XIV. 11 to 13, so that some of the differences mentioned by Whitley are subjected to individual variation. We only mention this to suggest that the two forms are even closer than Whitley thought.

Therapon jamoerensis Mees (fig. 4)

Therapon jamoerensis Mees, 1971, Zool. Meded., 45: 214 — Lake Jamoer, western New Guinea.

Description. — See Mees (1971). The main characters of this species, several of which appear in the key, are the large eyes, a comparatively deep body, plain coloration and no exposed supracleithrum.

Distribution. — On present evidence confined to Lake Jamoer (Jamoer Meer), in the narrow neck of the Vogelkop in western New Guinea. It is perhaps worth pointing out that the drainage of this lake is to the south, through the Waoedoe and Omba Rivers (cf. Boeseman, 1963: fig. 6). The complicated geography of the region is not always correctly indicated on maps; for example, the Times Atlas (1958) does not actually show Lake Jamoer with an outlet at all, but has a river, under the names Oerama and Wama, draped around it in such a way that the only drainage possible would be to the Geelvink Bay.

Therapon lacustris species nova (figs. 4, 5)

Material. — One specimen, August 1957, Balimo area, Western District, Papua, collector unknown (DPI no. FO 418), standard length 63 mm. One specimen, 8 May 1967, Pangoa, Lake Murray, Western District, Papua, collected by M. Rapson (RMNH no. 27575), standard length 110 mm. Two specimens, same data (AMS no. I. 19136—001), standard length 76, 106 mm. Two specimens, November 1967, Balimo area, collector unknown (AMS no. I. 19139—001), standard length 63, 78 mm. One specimen, 4 August 1970, Balimo Lagoon, collected by B. Malawa (holotype, AMS no. I. 19135—001), total length 168, standard length 136 mm. Three specimens, same data (AMS no. I. 19135—002), standard length 69, 82, 92 mm. One specimen, 4 August 1970, Balimo Lagoon, collected by L. F. Reynolds (AMS no. I. 19138—001), standard length 79 mm. One specimen, same data (RMNH no. 27465), standard length 84 mm. One specimen, 5 August 1970, Balimo Lagoon, collected by L. F. Reynolds (DPI no. FO 1320), standard length 136 mm. One specimen, August 1970, Balimo Lagoon, collected by L. F. Reynolds (RMNH no. 27466), standard length 144 mm. Four specimens, 27 August 1973, swamp one mile from Morehead Station, Western District, Papua, collected by B. Malawa (DPI no. FO 3733), standard length 72, 74, 79, 81 mm. One specimen, 16 October 1973, swamp one mile from Boboa, Lake Murray, collected by J. Koaia and J. Timothy (AMS no. I. 19140—001), standard length 66 mm. Two specimens, no date, Balimo Lagoon, collector unknown (RMNH no. 27576 and AMS no. I. 19137—001), standard length 78, 90 mm. One specimen, 27 November 1975, lagoons along mainstream of the Fly River near Boset, collected by T. R. Roberts (USNM no. 216417), standard length 83 mm. One specimen, 3-4 December 1975, Lake Murray near Boboa, collected by T. R. Roberts (USNM no. 216416), standard length 97 mm.

Description. — D XIII. 10½, rarely 11½, A III. 8½, rarely 9½, P 14-15, V 1.5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 16-20 (4 to 7 + 1 + 10 to 12), branchiostegals 6, scales below lateral line 58-67, above lateral line 66-74, transverse 9 to 11/1/20 to 22.

A plain-coloured and deep-bodied species with a small mouth and fine strong teeth, and a concealed supracleithrum; very close to *T. jamoerensis*, from which it differs conspicuously by its smaller eyes. Head 2.6-3.5 in standard length, depth of body 2.4-2.7 in standard length; snout bluntly pointed; anterior profile from tip of snout to first dorsal spine almost straight; eye of moderate size, 3.4-4.4 in head, 0.9-1.2 in snout and 0.9-1.3 in interorbital; nostrils well-separated, the anterior one midway between tip of snout and eye or very little closer to tip of snout, in line with the lower edge of the pupil when the mouth is closed; posterior nostril in line with middle of eye, and usually slightly nearer to eye than to anterior nostril; mouth rather small, below level of eye; when the mouth is closed, the maxillary just reaches to a vertical through anterior border of eye; lips moderately fleshy; dentition well-developed: upper jaw with an outer row of 9 to 13 strong conical fixed teeth on each side, larger near the symphysis; behind this there is a second row of smaller teeth, followed by two irregular rows of still smaller teeth; there is a similar dentition in the lower jaw though there are more (about 16) teeth on each side of the outer row; all teeth are colourless, but with tips ranging from pale yellow through orange to dark brown; no teeth on tongue, vomer or palatines; lower edge of preorbital straight to slightly curved, with eight to ten strong teeth, which are covered with thick pigmented skin in larger specimens, but readily apparent in smaller specimens; preoperculum serrated along its entire free border, with 22 to 30 colourless serrae which are strong and sharp, scarcely thicker at the bend; the operculum ends in two flat spines which do not extend beyond the border of the soft operculum; posterior border of postcleithral process free, with 6 to 10 serrae; supracleithrum not externally visible.

Body scaled, except for the chin and the snout to the nape; scales rather small, ctenoid, in regular rows. Lateral line complete, its arch following the outline of the back, the posterior fourth almost straight, with 55-62 + 3 or 4 pore-bearing scales.

Dorsal fin with thirteen spines, the first of which is very short; the following spines increase in length to the sixth which is a trifle longer than the fifth and is clearly longer than snout with eye in all specimens. From

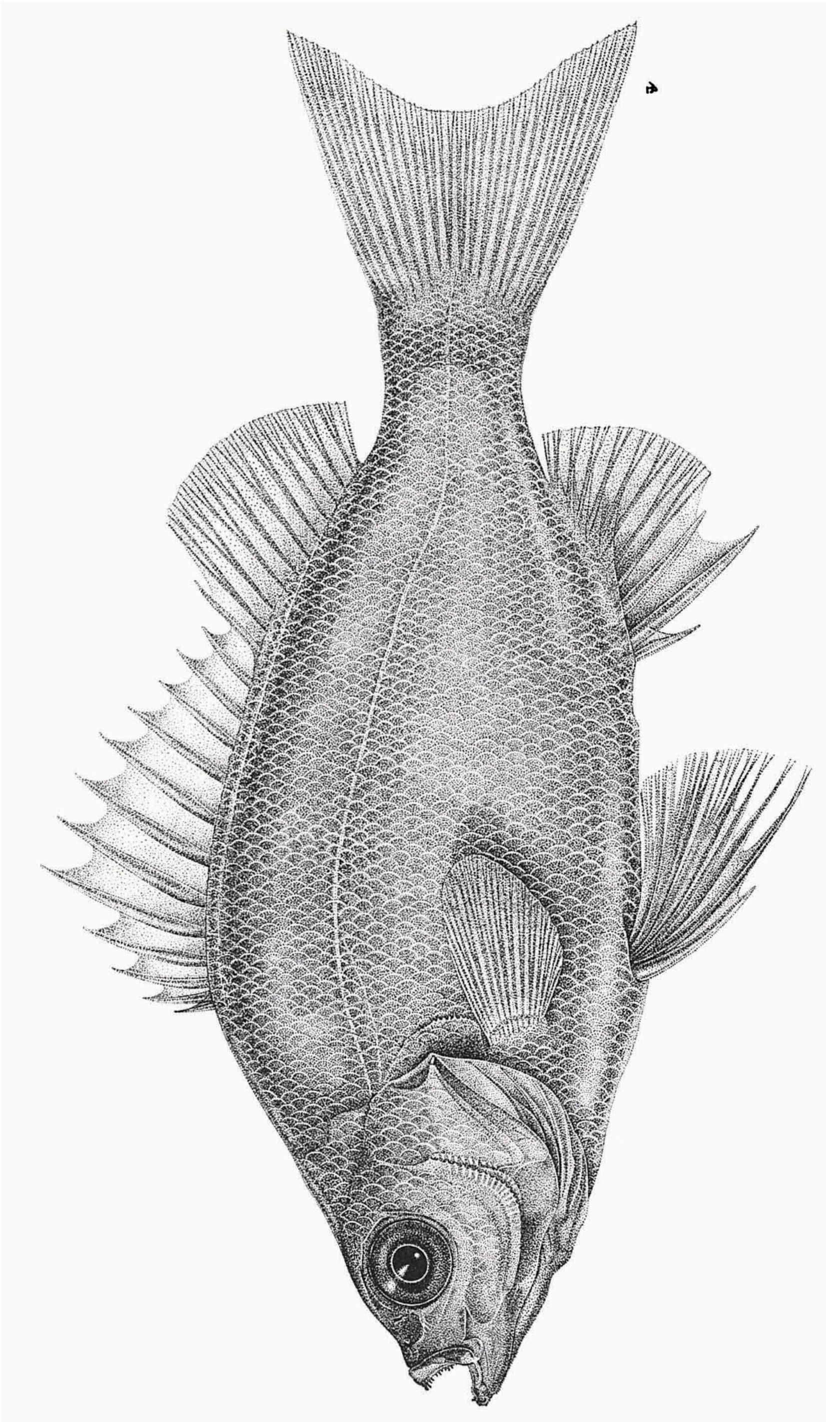

Fig. 5. *Therapon lacustris* (RMNH no. 27575, s. l. 110 mm).

the sixth the spines decrease regularly in length to the twelfth or penultimate spine, which varies from one-half to five-ninths of the length of the longest spine and tends to be a little shorter and weaker than the last (or thirteenth) spine, which is subequal to the eleventh (in the largest specimen there is scarcely any difference in length between the twelfth and thirteenth spines, although the latter is thicker). The soft dorsal fin has ten rays (eleven in one specimen), the last one of which is split to its base; the first three or four rays are of almost equal length, the subsequent rays diminish in size to the last, which is no more than half the length of the longest rays; the longest rays attain about four-fifths of the length of the longest dorsal spine. Base of soft dorsal half or less than half the length of the base of the spinous dorsal. The whole dorsal fin, except the last few rays of its soft part, has a well-developed basal scaly sheath.

Anal fin with three spines and eight rays (nine in one specimen), the last one of which is divided to its base. Of the spines the first one is the smallest: it is only slightly thinner than the second spine in small specimens, but much thinner in larger specimens and not quite or only just half its length. The second spine is the largest, it is subequal to the longest dorsal spine but a little thicker. It equals or is a little longer than snout with eye. The third spine is almost as thick as the second, but a little shorter. The soft anal fin is truncate, the anterior rays being twice the length of the last one, equal in length to the longest dorsal rays and equal to or a little shorter than the second anal spine. A basal sheath of small scales is well-developed, except on the bases of the last two or three rays, where it is much reduced.

Pectorals rounded-lanceolate in outline, with fourteen or fifteen rays, of which the first two and often the last one or two are simple, the others divided; the fourth and fifth rays are longest, 1.3-1.7 in head, or equal to postorbital part of head plus half an eye's diameter.

Ventrals pointed, with one strong spine and five rays; the spine approximately equals the postorbital part of the head; the spine is about three-fifths of the length of the first ray, which is the longest of the rays; all five rays divided; when pressed against the body the ventrals reach to or even a little beyond the anus in the smaller specimens, but fall short of the anus in the larger specimens.

The caudal peduncle is rather short; distance from base of last dorsal ray to middle of hypural joint less than postorbital part of head in all but the largest specimen, where it equals the postorbital part of the head. Caudal fin shallowly forked, with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colour in a preserved condition uniform yellowish brown to brown, dorsally darker, especially the upper half of the head and the area from nape to dorsal origin, which are almost blackish; the ventral surface, from chin to base of caudal fin creamy white or pinkish. Fins overall of the same brown colour as the body, but tips of membrane between the dorsal spines dark, and last dorsal and anal rays hyaline; pectorals paler than body; posterior margin of caudal fin dark brown. There is a complete absence of markings.

Distribution and habitat. — All specimens come from lakes and swampy areas and not from running water. In this kind of habitat the species may be assumed to be generally distributed in the delta region of the Fly River and adjoining rivers.

Discussion. — This species is very close to *T. jamoerensis*, of which eventually it may have to be regarded as a subspecies. As mentioned in the description, the main difference between the two species is that *T. jamoerensis* has conspicuously larger eyes; the silvery shine on the flanks, giving *T. jamoerensis* such a smooth appearance, is also absent in our specimens of *T. lacustris*.

The similarity between *T. jamoerensis* and *T. lacustris* extends also to their preferred habitat (as far as is known at present), both species being found in lakes and lagoons.

It deserves mention that the five known specimens of *T. jamoerensis* show the following counts of dorsal spines: XII (one), XIII (three) and XIV (one). In our 23 specimens of *T. lacustris*, on the other hand, there does not occur a single deviation from the number XIII, indicating that in this character it is much less variable. This is especially remarkable as the specimens of *T. jamoerensis* were taken in one locality, and its distribution appears to be confined to one lake, whereas the material of *T. lacustris* is from several localities, and the species is much more widely distributed.

Therapon habbemai Weber (figs. 6, 8)

Therapon Habbemai Weber, 1910, Notes Leyden Mus., 32: 234 — Lorentz-Fluss.

Therapon Habbemai; Weber, 1913, Nova Guinea, 9: 583, fig. 33, 34 (Lorentz-Fluss, bei Alkmaar).

Therapon habbemai; Regan, 1914, Trans. Zool. Soc. Lond., 20: 276 (Mimika River); Weber & de Beaufort, 1931, Fish. Indo-Austr. Arch., 6: 155-157 (Lorentz River, Mimika River); Trewavas, 1940, Ann. Mag. Nat. Hist, (11) 6: 286 (Lorentz and Mimika Rivers); Mees, 1971, Zool. Meded., 45: 213-214 (no locality).

Therapon trimaculatus; (pt.) Fowler, 1928, Mem. B. P. Bishop Mus., 10: 212 (bibliography).

Terapon micracanthus; (pt.) Fowler, 1931, U. S. Nat. Mus. Bull., 100 (11): 342 (Lorentz River, Mimika River); (pt.) Fowler, 1934, Mem. B. P. Bishop Mus., 11: 416 (Lorentz and Mimika Rivers).

Terapon habbemai; Whitley, 1948, Austr. Zool., 11: 280 (southern rivers of Dutch New Guinea).

Therapon micracanthus; (pt.) Munro, 1958, Papua New Guinea Agricult. J., 10: 170 (Lorentz R., Mimika R.).

Amphitherapon habbemai; Munro, 1964, Papua New Guinea Agricult. J., 16: 147 (Southern New Guinea); Munro, 1967, Fish. New Guinea: 321 (south west New Guinea).

Amphitherapon habbenami; Munro, 1972, Encycl. Papua New Guinea: 423 (along the Mimika coast to the Lorentz basin).

Therapon sp.; Kailola, 1975, D. A. S. F. Res. Bull., 16: 99 (5 miles east of Nomad; Tabubil, Ok Tedi; Rumginae, Ok Mart); Boyden, Brown, Drucker & Tuft, 1975, Ok Tedi Environmental Study: 26, 27 (Tabubil, Ok Tedi).

Material. — Seven specimens, August-September 1907, tributary of Lorentz River near Alkmaar, collected by H. A. Lorentz (syntypes, ZMA no. 112456), standard length 74, 79, 84, 84, 110, 119 and 130 mm. One specimen, 12 October 1973, creek five miles east of Nomad, Western District, Papua, collected by J. Koaia and J. Timothy (AMS no. I. 19129—001), standard length 95 mm. One specimen, 8 July 1974, Tabubil, Ok Tedi, collected by C. R. Boyden & Co. (RMNH no. 27529), standard length 92 mm. One specimen, 16-20 August 1974, Rumginae, Ok Mart, collected by C. R. Boyden & Co. (DPI no. F 4215—06), standard length 64 mm. One specimen, 5 November 1975, side channel of mainstream Ok Tedi, 1-2 miles above confluence with Ok Menga, collected by T. R. Roberts (USNM no. 216422), standard length 110 mm. Three specimens, 10-11 November 1975, small forest tributary of Palmer River just upstream from Wai Mingi, collected by T. R. Roberts (USNM no. 216420), standard length 17.4, 39, 55 mm. One specimen, 10-12 November 1975, Palmer River near Surprise Creek, collected by T. R. Roberts (USNM no. 216421), standard length 123 mm.

Aberrant specimen, 2 July 1959, Katem, Iwoer River, 180 m, collected by the Star Mountain Exp. (RMNH no. 27467), standard length ca. 147 mm.

Description. — D XII (once) or XIII. 11½ to 13½, A III. 10½ or 11½, P 15-17, V 1.5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 16-18 (4 to 6 + 1 + 10 or 11), branchiostegals 6, scales below lateral line 54-59, above lateral line 59-65, transverse 8 to 10/1/20 to 22.

A species with average proportions: supracleithrum exposed with a denticulated posterior border in small specimens, a smooth margin in the largest; body with six broad longitudinal bands which are moderately conspicuous in small specimens but are absent in larger individuals (see also Weber, 1913: 584). Head 2.8-3.2 in standard length; depth of body 2.5-2.7 in standard length; snout moderately blunt; anterior profile from tip of snout to dorsal origin almost straight in the smallest specimen, definitely convex between eye and first dorsal spine in the others; eye of moderate size, 3.7-5.1 in head, 1.2-1.8 in snout, 1.1-1.2 in interorbital; nostrils well separated, the anterior one closer to eye than to tip of snout, on a level with the lower edge of the pupil, the posterior one a little higher, on a level with middle of eye, and a little nearer to the eye than to the anterior nostril; mouth moderate, terminal,

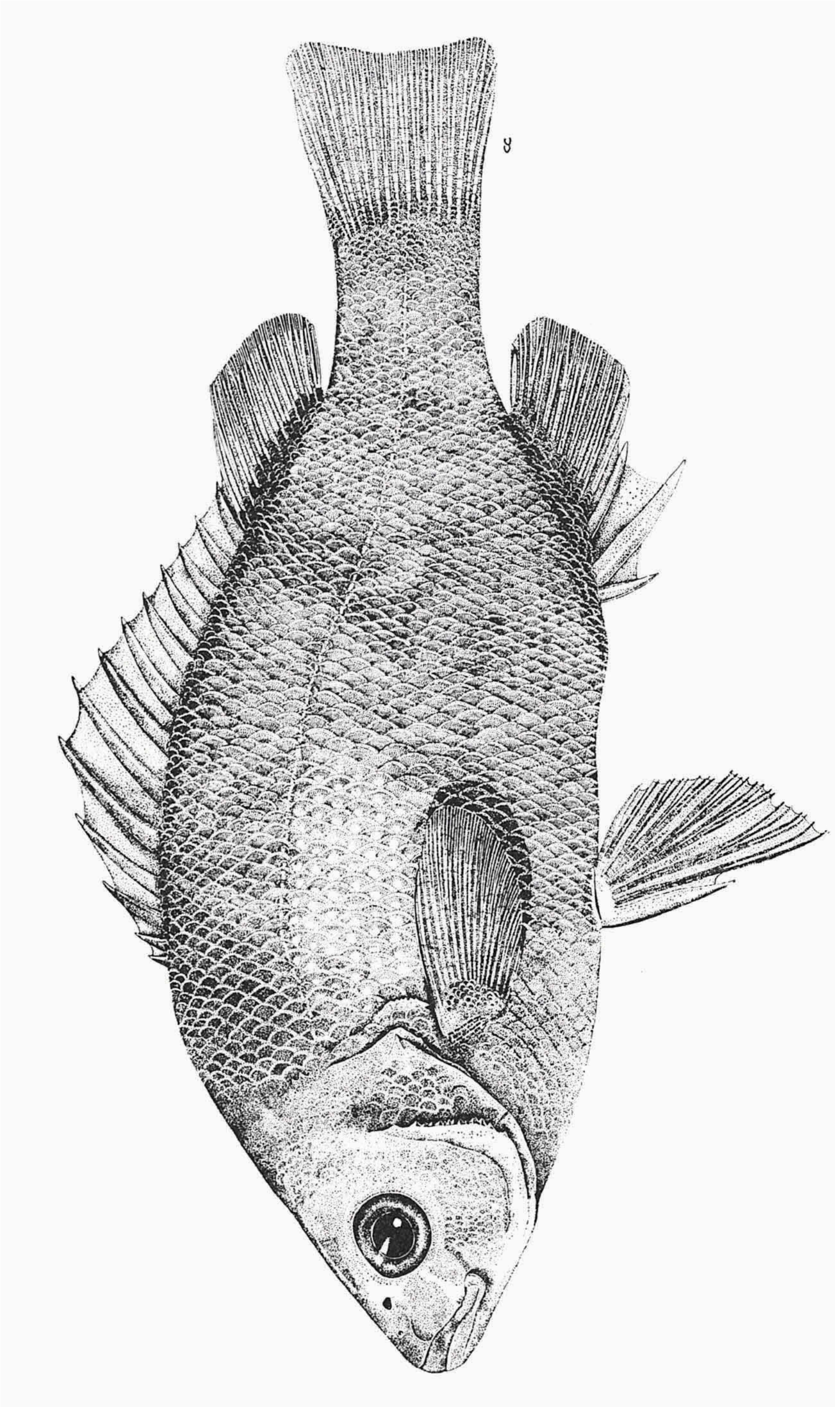

Fig. 6. *Therapon habbemai* (AMS no. I. 19129—001, s. l. 95 mm); the light central spots on the scales, indicated on part of the flank only, actually are found over the whole flank.

below level of eye, when closed the maxillary reaches to a vertical through the anterior border of the eye; lips fleshy; dentition well-developed, upper jaw with an outer row of strong conical teeth, 11 to 13 on each side, those near the symphysis largest; behind this there is an irregular patch or band of smaller teeth which, laterally, does not reach far backwards; in the lower jaw the dental arrangement is similar; the teeth are colourless, except for some of the larger ones, which have brown tips; no teeth on tongue, vomer or palatines; lower edge of preorbital straight or slightly convex, with some five strong teeth along the posterior half of its lower edge, which are, however, inconspicuous, being entirely covered by thick pigmented skin; preoperculum serrated along its whole free border, the serrae not enlarged or different at the bend, colourless; operculum ending in the usual two flat blunt spines, which do not protrude beyond the border of the soft operculum; posterior border of postcleithral process free, serrated, with four to seven teeth; free posterior margin of supracleithrum with three to five teeth in all except the largest specimen, in which it is smooth.

Body scaled, except for the chin and the snout to the nape; scales ctenoid, in regular rows. Lateral line more or less complete, its arch following the curve of the back, becoming straight on the caudal peduncle. A characteristic of our material of this species is that on the anterior part of the lateral line the pores are indistinct; for this reason we could not make a satisfactory count.

Dorsal fin with twelve (in only one specimen: USNM no. 216422) or thirteen spines, the first one of which is very short; the following spines increase in length to the fifth, which is equal to the postorbital part of the head and distinctly shorter than snout with eye; the sixth spine is equal in length to the fifth, and from there onwards the spines decrease regularly in length to the twelfth or penultimate spine, which is about two-thirds of the length of the fifth spine and equal in length to the last (thirteenth) spine. The soft dorsal fin has eleven or twelve rays, the last one of which is divided to its base; the fin is convex in outline with the third and fourth rays longest and the last ray about half the length of the longest ray; the longest rays are equal in length to the longest spines. The whole dorsal fin with a well-developed and high basal scaly sheath.

Anal fin with three spines and ten or eleven rays, the last one of which is divided to its base. Of the spines, the first one is the smallest, it is much thinner than the second spine and scarcely more than half its length. The second spine is the largest, it is thicker than the longest dorsal spine, but a little shorter. The third spine is distinctly thinner and shorter than the second spine. The soft anal fin is placed opposite the soft dorsal fin, has the same convex outline and its longest rays have the same length as the longest dorsal rays; its last ray is about half the length of its longest rays and these are slightly longer than the second anal spine. A basal sheath of small scales is well-developed.

Pectorals broadly-rounded in outline, with sixteen or seventeen rays of which the first one or two and the last one or two are simple, the others divided; the fifth and sixth rays are longest, 1.6 in head.

Ventrals with one spine and five rays; the spine is a little shorter than the postorbital part of the head; the spine is half or slightly more than half the length of the first and longest ray, which ends in a short filament; all five rays divided; when pressed against the body the ventrals reach to or just beyond the anus.

The caudal peduncle is of moderate length; distance from base of last dorsal ray to middle of hypural joint equal to postorbital part of head. Caudal fin truncate with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colours in a preserved condition: dorsally dark brown; the ventral surface from chin to ventral base creamy white, pigmentless; sides of head and of body with five or six broad longitudinal bands on a pale brown background, the brown bands wider than the pale bands with which they alternate, coalescent on the caudal peduncle. Dorsal, anal and caudal fins brown, distally more or less hyaline, pectorals hyaline, ventrals blackish. The pattern of bands is present in all syntypical specimens examined, but it is faint in the largest specimen (130 mm s.l.) and scarcely perceivable in the second largest specimen (s.l. 119 mm). The larger specimens from the more eastern localities are without any trace of bands; when fresh they had each scale on the sides with a central light spot as indicated in fig. 6.

Distribution and habitat. — Probably ranging throughout south-western New Guinea from the Mimika to the Fly River, but at present only known from the basins of the Mimika, Lorentz (or Noord), Digoel and Fly Rivers. The map illustrates well that this is a species of the headwaters; it has never been found in the lower courses of the great rivers. Boyden et al. (1975: 26, 27) found it the most common fish at Tabubil, Ok Tedi.

Discussion. — In the original description of this species no mention was made of the postcleithral process and the supracleithrum, but subsequently Weber & de Beaufort (1931: 155-156) stated: "Coracoid not dentate, suprascapular bone concealed below skin and scales". However, in six out of seven syntypes examined by us, postcleithral process as well as supracleithrum have exposed and serrated posterior margins; the seventh and largest specimen is similar, except that the posterior border of the supracleithrum is smooth, not denticulate. Weber & de Beaufort (1931: 143) and Munro (1967: 320) used the supposedly concealed supracleithrum as a key character, which means that *T. habbemai* cannot be identified with their keys.

Fowler (1928) was the first to express doubt about the validity of *T. habbemai*; under *T. trimaculatus* he wrote: "*Therapon habbemai* is said to have 54 to 56 scales in the lateral line (compared with 46 to 50 along below and 47 to 54 along above). Likely not distinct". A few years later Fowler (1931, 1934) went even further and synonymised both *T. trimaculatus* and *T. habbemai* with *T. micracanthus* (the latter a Celebesian species, not at all closely related to these New Guinea forms, cf. Mees, 1971: 219). Munro (1958) originally followed Fowler in this classification, but subsequently he restored *T. trimaculatus* as well as *T. habbemai* to validity, even placing them in different genera under the names *Papuservus trimaculatus* and *Amphitherapon habbemai* (Munro, 1967: 321). A short explanation of this change of stand was given by Munro in a footnote on the page just referred to, in which is said of *A. habbemai*: "Wrongly placed as a synonym of *micracanthus*.... Tentatively placed in *Amphitherapon* but has affinities with *Madagania adamsoni* and *Archerichthys suavis* (Whitley) from Cape York". Finally Mees (1971: 214) aired "a strong suspicion that *T. habbemai* does not differ from *T. trimaculatus*", but lacking material of the latter was unable to arrive at a definite conclusion.

It is evident that Munro's change of opinion was based on the supposed difference in the supracleithrum, hence was based on incorrect observation. Nevertheless, *T. habbemai* and *T. trimaculatus* are not identical, for the difference in numbers of scales (55-59 rows below lateral line in the former, 45-48, according to literature up to 50 rows in the latter) is convincing, and is confirmed by the material studied by us.

The relation between general size and relative size of the eye is well-illustrated by these specimens (table 4):

TABLE 4

s. l. (mm.)	eye in head	eye in snout
74	4.0	1.3
79	3.7	1.3
84	3.9	1.3
84	4.0	1.3
110	4.3	1.4
119	4.3	1.4
130	5.1	1.8

The specimen listed as aberrant (RMNH no. 27467) has not been included in the description given above. It differs from the other material mainly by having two dorsal spines less. Measurements and counts of this fish are: standard length ca. 147 mm (difficult to measure exactly as the specimen is strongly bent), D XI. 13½, A III. 10½, P 16 (ii.13.i), V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 17 (5 + 1 + 11), branchiostegals 6, scales below lateral line 54, above lateral line 58, transverse 7/1/22. The scale count, especially above the lateral line, is rather low but is unlikely to be outside the normal range of variation of *T. habbemai*. The supracleithrum has a smooth posterior border like the specimen of *T. habbemai* which is closest to it in size. The Iwoer River where this specimen was captured is a tributary of the Digoel River. With only a single specimen at hand it is impossible to decide whether it represents a separate, slightly differentiated local population, or just an extreme variant of *T. habbemai*. A colour description taken from this specimen when it was fresh reads: entirely dark grey-green dorsally, sides of head on operculae somewhat mottled, scales with dark edges, fins light red, body ventrally paler.

Therapon adamsoni Trewavas (figs. 7, 8)

Therapon adamsoni Trewavas, 1940, Ann. Mag. Nat. Hist., (11) 6: 284 — Lake Kutubu.

Terapon adamsoni; Whitley, 1948, Austr. Zool., 11: 280 (Lake Kutubu).

Therapon adamsoni; Munro, 1958, Papua New Guinea Agricult. J., 10: 170 (Lake Kutubu); Mees, 1971, Zool. Meded., 45: 213 (Lake Kutubu); Kailola, 1975, D. A. S. F. Res. Bull., 16: 100 (Lake Kutubu).

Madigania adamsoni; Munro, 1964, Papua New Guinea Agricult. J., 16: 174 (Lake Kutubu).

Madagania adamsoni; Munro, 1967, Fish. New Guinea: 324 (Lake Kutubu); Munro, 1972, Encycl. Papua New Guinea: 423 (Lake Kutubu).

Material. — Three specimens, undated (= October 1936), Lake Kutubu, collected by C. J. Adamson (paratypes, BM no. 1940.3.11: 1-5), standard length 85, 108, 134 mm[1]). Fourteen specimens, 27 September 1961, Lake Kutubu, collected by F. S. Fox (DPI no. FO 042), standard length 67-174 mm.

Description. — D XII. or XIII. 10½ to 12½, A III. 9½ or 10½, P 15 or 16, V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 15-19 (4 to 6 + 1 + 10 to 12), branchiostegals 6, scales below lateral line 46-55, above lateral line 54-57, transverse 8/1/20 or 21.

The main characters by which this species may be recognized are the relatively short and weak fins, in particular the spines, and an exposed supracleithrum of which, however, the free posterior margin is not serrated but smooth, occasionally with one or two blunt spines in smaller specimens;

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1) Trewavas gave the name of the collector as J. C. Adamson; evidently this should be C. J. Adamson, and the expedition during which *T. adamsoni* was collected explored Lake Kutubu in the second half of October 1936 (cf. Champion, 1937).

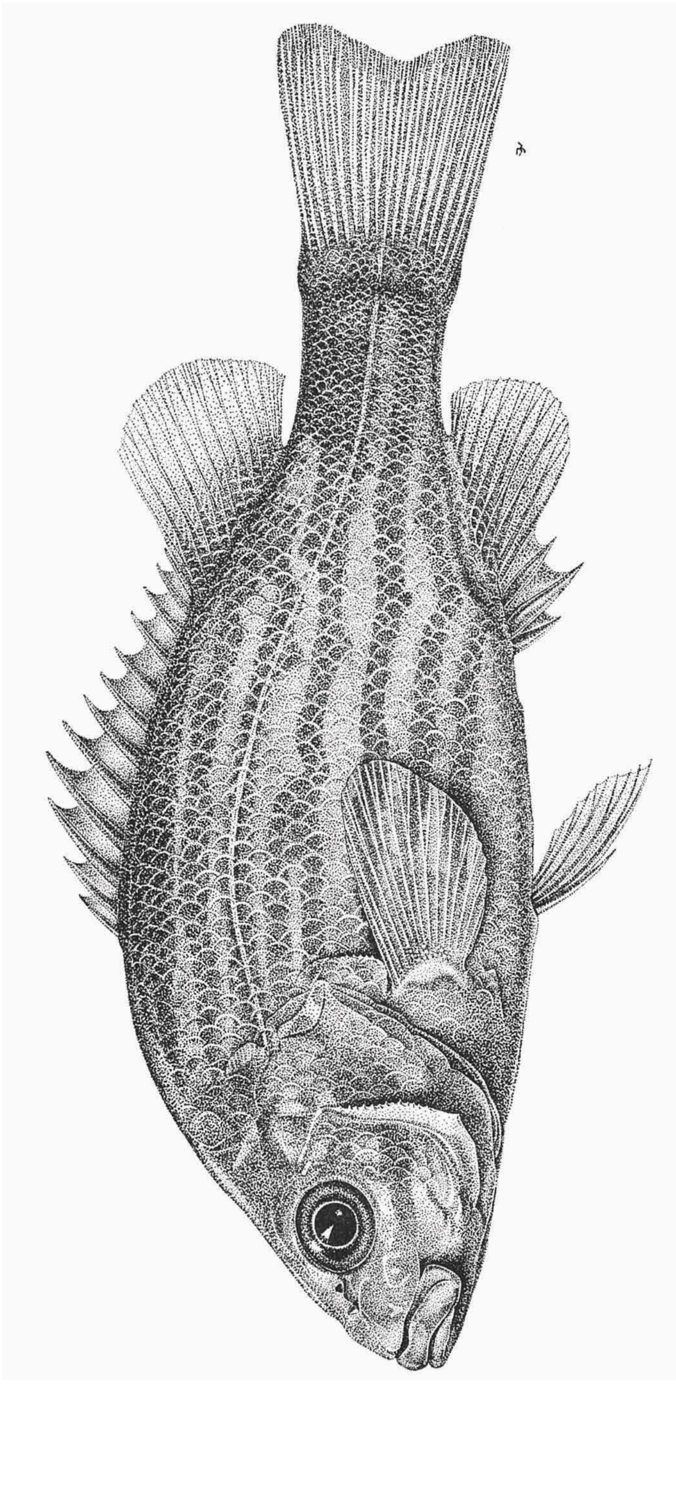

Fig. 7. *Therapon adamsoni* (from sample BM no. 1940.3.11 : 1-5, s. l. 85 mm).

small specimens have longitudinal stripes, which in larger individuals become less distinct. Head 2.7-3.0 in standard length; depth of body 2.7-3.1 in standard length; snout blunt, anteriorly rounded; profile of head from tip of snout to nape almost straight, with a suggestion of concavity above the eyes, the outline from the nape to the dorsal origin convex; eye comparatively small, 3.9-5.4 in head, 1.3-1.7 in snout and 1.2-1.5 in interorbital; nostrils close together, the anterior one about two-thirds of an eye's diameter in front of middle of eye, a little closer to eye than to tip of snout, the posterior one a little higher and slightly closer to eye than to anterior nostril; mouth moderate, below the level of the eye; when the mouth is closed, the maxillary reaches a vertical through the anterior border of the eye; lips fleshy; teeth small but strong, upper jaw with an outer row of conical canine-like teeth, ten to twelve on each side, followed by a narrow band of smaller teeth which is widest at the symphysis (about four rows, but their implantation is too irregular to be referred to as rows); dentition of the lower jaw similar; teeth colourless with brownish-yellow tips; no teeth on tongue, vomer or palatines; lower edge of preorbital very slightly convex, smooth, the bony edge covered with thick skin and without teeth or serrations; preoperculum distinctly serrated along its posterior border, with 16-18 small teeth, but scarcely along its ventral border; operculum ending in the usual two flat spines, which do not protrude beyond the border of the soft operculum; postcleithral process with a free posterior border which carries from two to six small spines; supracleithrum covered with skin but not with scales, its free posterior margin smooth, without teeth.

Body scaled, except for the chin and the snout to the nape; scales ctenoid, in regular rows. Lateral line complete, its arch following the outline of the back, its posterior two-sevenths practically straight, with 50-57 + 4 or 5 pore-bearing scales.

Dorsal fin with twelve or thirteen spines, the first one of which is very short, the following spines increase in length to the fifth which is longest, it equals in length the distance from tip of snout to posterior nostril or anterior border of the eye in large specimens, and is as long as snout plus one-third of an eye's diameter in smaller specimens; from the fifth onwards the spines decrease in length to the penultimate one, which is about three-fifths of the length of the longest spine and a trifle shorter than the last spine. The soft dorsal has ten to twelve rays, the last one of which is split to its base, it is rounded-truncate in outline, with the third and fourth rays longest, conspicuously (about one-third) longer than the longest dorsal spines. Base of soft dorsal half or just over half length of base of spiny dorsal. Basal sheath practically absent, but there are rows of scales on the basal portions of the membranes between the soft rays. Individual counts of the three BM specimens are XII. 10½, XII. 12½ and XIII. 11½.

Anal fin with three spines and nine or ten rays, the last one of which is split to its base. Of the spines, the first one is the smallest, about half the length of the second and largest spine, whereas the third spine is only a little shorter and thinner than the second. The soft anal is similar in outline to the soft dorsal, with the second and third rays longest, a little longer than the longest dorsal rays and one-and-a-half times the length of the longest anal spine. There is no clear basal sheath, but there are rows of small scales on the basal portions of the membranes between the soft rays, as in the dorsal fin.

Pectorals with rounded outline, with fifteen rays of which the first two and usually also the last one are simple, the others divided; the fourth and fifth rays are longest, equal to snout with eye, and a little longer than postorbital part of head; from the fifth the rays diminish rapidly in size to the last one which is less than one-third of the longest ray.

Ventrals pointed, with one spine and five divided rays; the spine equals the snout in the smallest specimen and is much shorter than the snout in the largest; it measures 1.5-1.8 times in the postorbital part of the head; the spine is a little over half to three-fifths of the length of the first and longest ray; when pressed against the body, the ventrals do not nearly reach the anus.

The caudal peduncle is of moderate length; distance from base of last dorsal ray to middle of hypural joint equal to postorbital part of head. Caudal fin shallowly forked, its tips rounded, with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colours in a preserved condition: the general impression is of light to dark earth brown. The ventral surface of the body, below a line connecting the gape, the highest point of the pectoral base and the first anal spine, is lightly pigmented, brownish cream. The sides of the body have a pattern of dark and light longitudinal bands, about seven of each, the dark and the light bands of equal width (1½ to 2 scales wide); the bands above the lateral line are curved, following the outline of the back; those below the lateral line are almost straight. In small specimens the bands are distinct, becoming faint with increasing size; they are usually absent in larger specimens, in which the upper two-thirds of the body is mottled with brown spots. Still larger individuals, such as were not available to us, have a plain body coloration (Munro, 1964). Whitley's (1948) unqualified statement that *T. adamsoni* is plain-coloured is an error.

Distribution and habitat. — This species is exclusively known from, and perhaps confined to Lake Kutubu, the surface of which is ca. 750 m above sea level. This habitat is different from that of related species, which inhabit rivers. For more information and a map of the area, see Schodde & Hitchcock (1968).

Discussion. — *T. adamsoni* is close to both *T. habbemai* and *T. trimaculatus*. The relative smoothness of the posterior border of the supracleithrum seems to be a matter of individual variation; those specimens possessing blunt spines on the supracleithrum in our material are 67, 85, 90, 100 and 114 mm in standard length, although equally small specimens have a smooth supracleithrum. As we have mentioned on a previous page, in the related *T. habbemai* the smoothness of the supracleithrum appears also to be a matter of size. The number of scales of *T. adamsoni* is lower than in *T. habbemai* but higher than in *T. trimaculatus*, in line with its intermediate geographical position.

However, in its short fins this species deviates from both the other species mentioned and it may also be significant that it inhabits a lake, whereas both other species have been found in rivers. In its high number of vertebrae it stands apart (table 3). Anyway, *T. adamsoni* is sufficiently well-differentiated from all other forms to be treated as a separate species.

Therapon trimaculatus Macleay (fig. 8)

Therapon trimaculatus Macleay, 1883, Proc. Linn. Soc. N. S. W., 8: 258 — Goldie River.

Terapon trimaculatus; Jordan & Seale, 1906, Bull. Bur. Fish., 25: 266 (Goldie River, New Guinea); McCulloch, 1929, Austr. Mus. Mem., 5: 163 (Queensland?, New Guinea).

Therapon trimaculatus; Ogilby & McCulloch, 1916, Mem. Qd. Mus., 5: 120, pl. XIII fig. 1 (Goldie River, New Guinea; York Peninsula, Queensland: this locality is uncertain and requires verification); McCulloch & Whitley, 1925, Mem. Qd. Mus., 8: 153 (? York Peninsula); (pt.) Fowler, 1928, Mem. B. P. Bishop Mus., 10: 212 (Goldie River; York Peninsula, Queensland?); Weber & de Beaufort, 1931, Fish. Indo-Austr. Arch., 5: 157 (New Guinea (Goldie River); York Peninsula, Queensland: this locality is uncertain and requires verification); Mees, 1971, Zool. Meded., 45: 214 (no locality); Kailola, 1975, D. A. S. F. Res. Bull., 16: 102 (Laloki River, Brown River bridge).

Terapon micracanthus; (pt.) Fowler, 1931, U. S. Nat. Mus. Bull., 100 (11): 342 (Goldie River, British New Guinea); Fowler, 1934, Mem. B. P. Bishop Mus., 11: 416 (Goldie River, New Guinea).

Papuservus trimaculatus; Whitley, 1943, Austr. Zool. 10: 182 (New Guinea and North Queensland); Whitley, 1956, Proc. R. Zool. Soc. N. S. W., 1954/55: 41 (Australia); Whitley, 1960, Nat. Freshw. Fish. Austr.: 77 (Queensland?, Papua); Munro, 1964, Papua New Guinea Agricult. J., 16: 144, 147 (Tropical Australia, Southern New Guinea); Whitley, 1964, Proc. Linn. Soc. N. S. W., 89: 43 (no locality = Australia); Munro, 1967, Fish. New Guinea: 323 (southern rivers of New Guinea, extending to Cape York Peninsula); Lake, 1971, Freshw. Fish. Riv. Austr.: 34 (Australia: Gulf of Carpentaria drainage); Munro, 1972, Encycl. Papua New Guinea: 423 (Lorentz-Digul-Fly basins with... Australia); Tyler, 1972, in Walker (ed.), Bridge and Barrier: 240 (Australia and New Guinea); Berra, Moore & Reynolds, 1975, Copeia: 320, 324 (Laloki River, Brown River, Goldie River).

Papuservus micracanthus; Munro, 1958, Papua New Guinea Agricult. J., 10: 170 (New Guinea).

Material. — Two specimens, no data (DPI no. FO 329), standard length 82, 89 mm. One specimen, 10 June 1970, lower Laloki River, Central Papua, collected by A. Murray (AMS no. I. 19132-001), standard length 99 mm. Four specimens, 8 September 1972, Laloki River, collected by G. McShane (DPI no. FO 3710), standard length 25, 30, 51, 71 mm. Three specimens, same data (RMNH no. 27429), standard length 32, 55, 62 mm.

Description. — D XIII. 11½ to 13½ [1]), A III. 10½ or 11½, P 15 or 16, V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 17-19 (5 or 6 + 1 + 11 or 12), branchiostegals 6, scales below lateral line 45-48, above lateral line 49-53, transverse 7 or 8/1/18 or 19.

This species is morphologically very close to *T. habbemai*, but differs by its slightly larger scales and different colour pattern: there are seven longitudinal dark streaks on the body and these are narrower than their pale background, whereas in *T. habbemai* the bands are broader than their pale background; colour pattern said to be indistinct or absent in large specimens (not examined by us); supracleithrum exposed and denticulate. Head 2.85-3.0 in standard length; depth of body 2.45-2.6 in standard length; snout pointed; anterior profile from tip of snout to dorsal origin almost straight; eye of moderate size, 3.1-3.8 in head, 0.8-1.2 in snout and 0.9-1.2 in interorbital [2]); nostrils well-separated, the anterior one a little closer to eye than to tip of snout, on a level with the middle of the eye, the posterior one a little higher and closer to eye than to anterior nostril; mouth of moderate size, its anterior part just reaching a horizontal line through the lower border of the eye; the maxillary touches a vertical line through the anterior border of the eye; lips somewhat fleshy; dentition well-developed: upper jaw with an outer row of conical, fixed teeth, 10-13 on each side, those near the symphysis largest; the outer row is followed by a less regular second row of smaller teeth and behind this there is a little-developed third row; dentition of lower jaw similar, but the outer row has 13-18 teeth on each side; all teeth are colourless or, the larger ones, with pale yellowish tips; no teeth on tongue, vomer or palatines; lower edge of preorbital slightly convex,

[1]) In a material of 28 specimens, Berra et al. (1975: 324) found that D XII occurs.

[2]) The relatively larger size of the eye, compared with *T. habbemai* is almost certainly due to the small size of the specimens. Evidently the relative size of the eye decreases somewhat with increase of overall size. In the sample of *T. trimaculatus* it is also the smallest specimen which has relatively the largest eyes. The same factor may also account for part of the difference from *T. adamsoni*, although that species appears to have somewhat smaller eyes.

with five to seven strong teeth, partly concealed by thick skin; preoperculum serrated along its whole free border, the serrae or teeth not notably enlarged or different at the bend, colourless; the operculum ends in two flat blunt spines, which do not extend beyond the border of the soft operculum; posterior border of postcleithral process free, with four of five teeth; supracleithrum covered with skin but not with scales, its posterior border with five or six teeth.

Body scaled, except for the chin and the snout to the nape; scales ctenoid, in regular rows. Lateral line complete, its arch following the outline of the back, its posterior fourth almost straight, with 50-51 pore-bearing scales (none clearly on the caudal fin).

Dorsal fin with thirteen spines; the spines increase in length from the first to the sixth, which is a little shorter than snout with eye and 1.75 in head; from the sixth onwards there is a regular decrease in length to the last spine, which is about two-thirds of the longest spine and a little shorter than the penultimate spine. The soft dorsal fin has eleven to thirteen rays, the last one of which is split to its base, it is rounded-truncate in outline, the third and fourth rays longest, a little longer than the longest dorsal spine; the last ray is about half the length of the longest rays. Base of soft dorsal half the length of the base of the spiny dorsal. Basal sheath of small scales well-developed over the whole length of the fin.

Anal fin with three spines and ten or eleven rays, the last one of which is split to its base. Of the spines the first one is the smallest, about three-fifths of the length of the second and largest spine. The second spine is shorter but thicker than the longest dorsal spine, it is equal to snout and one-third to half an eye's diameter, and about 2.2 in head. The third spine is almost as thick as the second spine and only a little shorter. The soft anal fin is rounded-truncate in outline, with the third and fourth rays longest, equal in length to the longest dorsal rays and double the length of the last anal ray. There is a well-developed basal sheath of small scales.

Pectorals rounded-lanceolate in outline, with fifteen or sixteen rays, of which the first two and sometimes the last one or two are simple, the others divided; the fifth ray is the longest, 1.5-1.6 in head, a trifle longer than snout with eye and almost equal to head without snout.

Ventrals pointed, with one strong spine and five rays; the spine approximately equals the postorbital part of the head; the spine is about three-fifths of the length of the first ray, which is the longest of the rays and has only a suggestion of a filament; all five rays divided; when pressed against the body, the ventrals reach to a little distance beyond the anus.

The caudal peduncle is of moderate length; distance from base of last

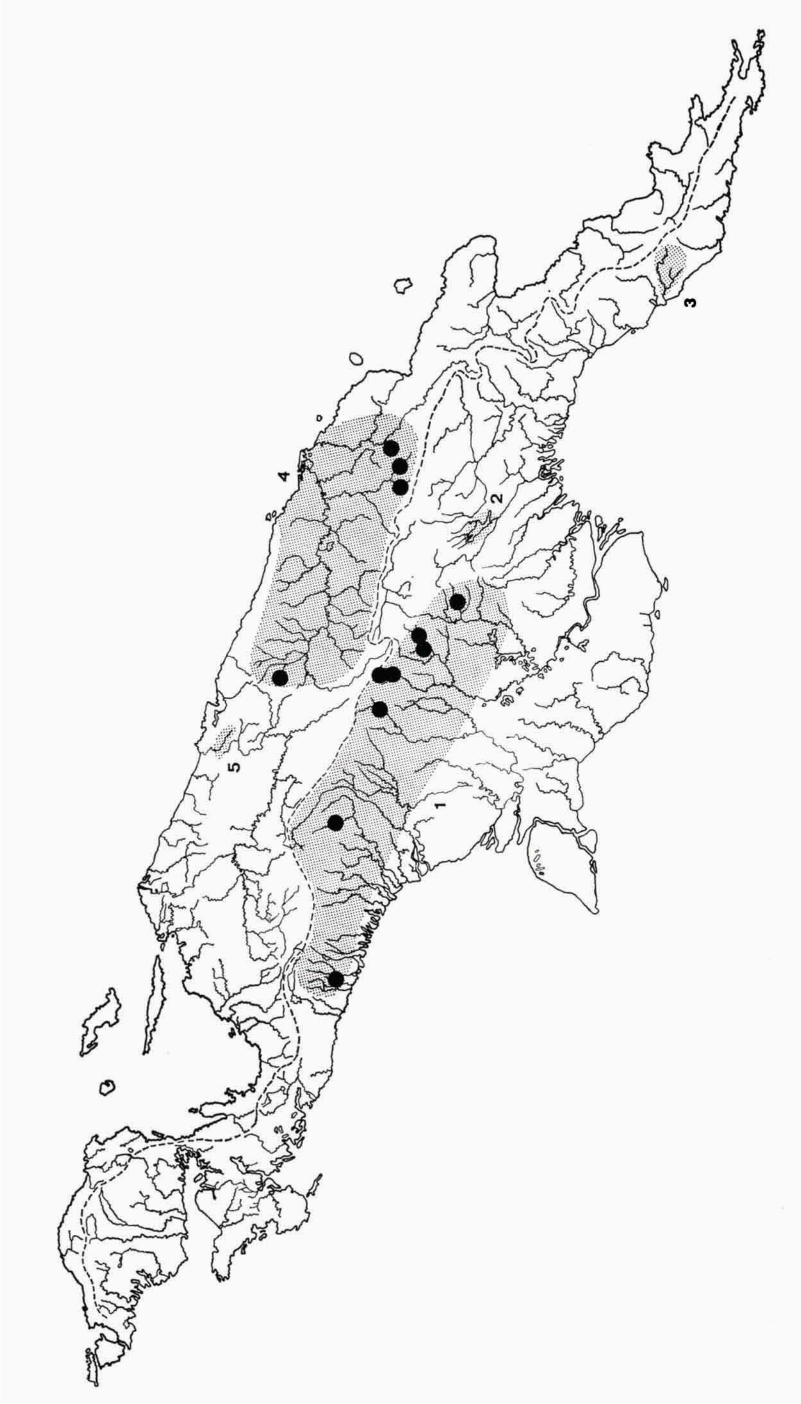

Fig. 8. The distribution of *Therapon habbemai* (1), *T. adamsoni* (2), *T. trimaculatus* (3), *T. transmontanus* (4), and *T. obtusifrons* (5).

dorsal ray to middle of hypural joint equal to postorbital part of head. The caudal fin is slightly emarginate, with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colours in a preserved condition: upper half light brown, lower half cream colour, with along the sides seven or eight longitudinal dark brown bands, which are narrower than the cream bands separating them; fins hyaline to slightly dusky, the caudal fin with near its base three dark brown spots, vertically arranged.

Distribution and habitat. — On present evidence confined to the Laloki River with its tributaries the Goldie and Brown Rivers, in the neighbourhood of Port Moresby. Records from outside this range, published from time to time, are erroneous (see discussion). For a description of the Laloki River as a habitat we refer to Berra, Moore & Reynolds (1975).

Discussion. — Whitley (1938) recorded *T. trimaculatus* from the Upper Fly River. The specimen on which this record was based is lodged in the Australian Museum, where PK examined it and found it to be referable to *T. lorentzi*. The doubtful record from Australia has been discussed on a previous page.

Therapon transmontanus species nova (figs. 8, 9)

Terapon sp. juv.; Whitley, 1956, Rec. Austr. Mus., 24: 27 (Jimmi River).
Therapon sp.; Kailola, 1975, D. A. S. F. Res. Bull., 16: 99 (material listed below).

Material. — Three specimens, July 1954, Jimmi River, 33 miles NE of Mount Hagen airstrip, 1200 ft., collected by E. Troughton and N. Camps (AMS no. IB 3350-2), standard length 13½, 15, 25 mm. Two specimens, 15 December 1970, Utigantz River (Ioka Creek is probably another name), a tributary of the Ramu River, at Aiome, ca. 1600 m, collected by G. West and K. McDonald (holotype, the larger specimen, RMNH no. 27426, the other specimen RMNH no. 27427), total length 80, 121, standard length 64, 98 mm. Two specimens, same data (AMS no. I. 17149-001), total length 76½, 110, standard length 62, 87½ mm. One specimen, 15 August 1972, Yasi River, Amanab, ca. 1525 m, collected by J. Koaia (AMS no. I. 19128-001), standard length 94 mm. Two specimens, August-September 1974, Trauna River, a tributary of the Baiyer River, ca. 1200 m, collected by G. George (DPI no. F. 4282-01), standard length 80, 81 mm.

Description. — D XI. or XII. 10½ or 11½, A III. 10½ or 11½ (IV. 10½ in one specimen, the smaller one of sample DPI no. F 4282-01), P 14 to 16, V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 13-16 (4 or 5 + 1 + 8 to 10), branchiostegals 6, scales below lateral line 46-58, above lateral line 48-68, transverse 9 to 11/1/15 to 17.

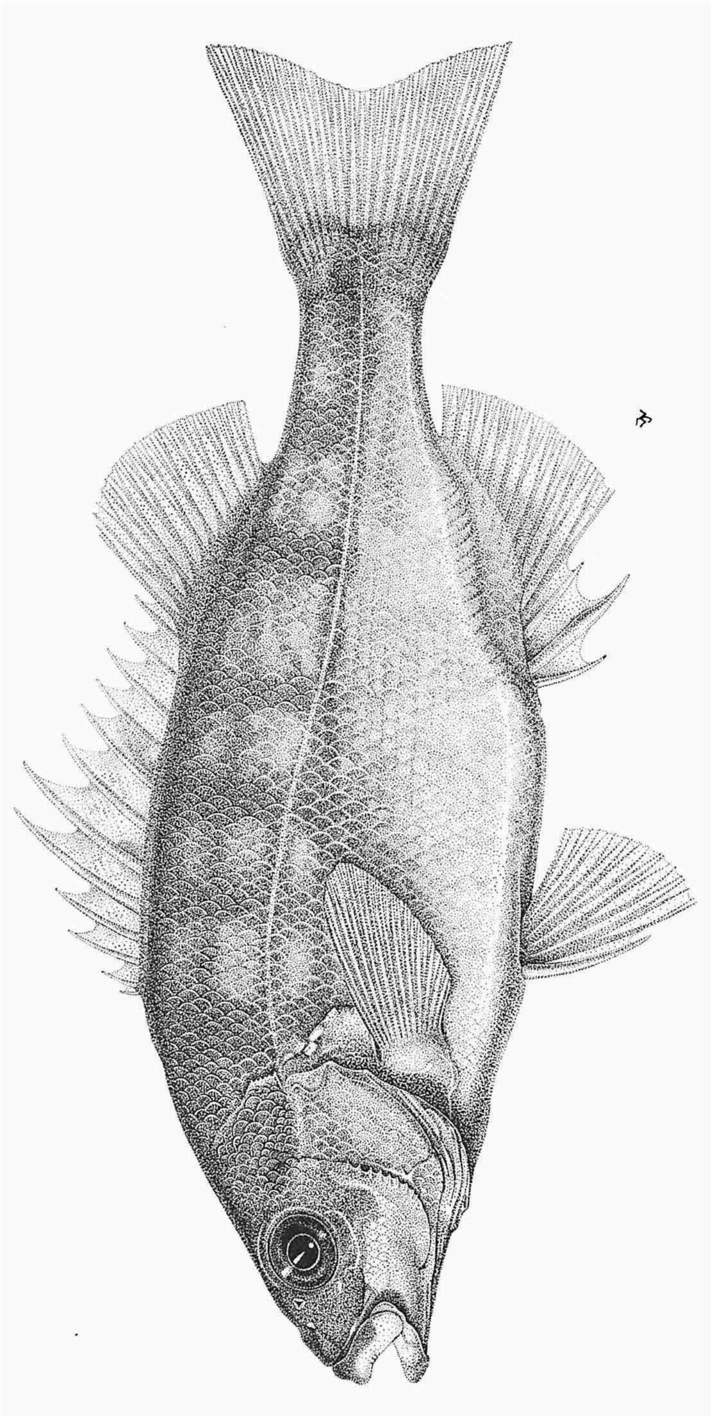

Fig. 9. *Therapon transmontanus* (RMNH no. 27426, s. l. 98 mm).

A moderately slender species with a small head and a long caudal peduncle; the colour-pattern of longitudinal bands as well as cross-bars is highly diagnostic in typical specimens. Head 3.2-3.5 in standard length; body depth 2.7-3.6 in standard length; snout short and rounded; anterior profile from tip of snout to dorsal origin almost straight, slightly curved before the dorsal fin; eye of moderate size, 3.7-4.3 in head, 1.0-1.5 in snout and 1.1-1.3 in interorbital; nostrils posterior in position and fairly close together, the anterior one nearer to eye than to tip of snout and on a level with the middle of the eye, the posterior one a little higher and midway between eye and anterior nostril; mouth moderate, terminal, well below the level of the eye, when the mouth is closed the maxillary reaches to or just past a vertical through the anterior border of the eye; lips fleshy; upper jaw with an outer row of strong conical teeth, five to nine on each side, those near the symphysis larger; the outer row is followed by a second, shorter row of similar teeth, about six on each side, and a small third row of only four or five teeth; the dentition of the lower jaw is similar, except that there are slightly more teeth (eight to eleven) on each side of the outer row; all teeth are colourless, the tips of the larger ones yellowish to greenish grey, none dark brown; no teeth on tongue, vomer or palatines; lower edge of preorbital convex, with five to seven inconspicuous blunt spines, concealed in skin; preoperculum serrated along its whole free border, with 15-22 teeth, those on the lower edge smaller and partly concealed in skin; operculum ending in two flat spines which do not extend beyond the border of the soft operculum; free posterior border of postcleithral process with four to six teeth; supracleithrum covered with skin but not with scales, its posterior margin denticulate with five to eight teeth.

Body scaled, except for chin and snout to nape; the scales ctenoid, in regular rows. Lateral line complete, anteriorly following the curve of the back, its posterior third practically straight, with 49-57 + 2 or 3 pore-bearing scales.

Dorsal fin with eleven or twelve spines; the spines increasing in length from the very short first to the sixth, which is longest, a fraction longer than the fifth and one-third to half an eye's diameter longer than the post-orbital part of the head, or equal to snout and eye in the smallest specimen, equal to snout and two-thirds of an eye's diameter in the largest specimen, or 1.7-2.0 in head; from the sixth onwards, the spines decrease regularly in length to the penultimate spine, which is about three-fifths of the length of the longest spine and equal in length to, or a fraction shorter than the last spine. The soft dorsal fin has ten or eleven rays, the last one of which is split to its base; it is rounded-truncate in outline, with the second and third rays longest, varying from about equal in length to distinctly longer than the longest dorsal spines and about two-and-a-half times the length of the last ray; base of soft dorsal fin twice or a little more in spiny dorsal base. A low basal sheath of no more than one row of scales extends along the spiny dorsal base, this increases to a height of five rows of small scales on the anterior part of the soft dorsal and decreases again to a depth of only one or two scales on its posterior part.

Anal fin with three (in one specimen four) spines and ten or eleven rays, the last one of which is split to its base. The first spine is smallest, it is much thinner than the second spine and about three-fifths of its length; the second spine is largest, it is thicker but a little shorter than the longest dorsal spine; the third spine is as thick as the second, but one-fifth shorter. The soft anal fin is rounded-truncate in outline, with the second and third rays longest, equal in length to the longest dorsal rays and 1.3-1.4 times the longest anal spine. There is a well-developed basal sheath of small scales.

Pectorals rounded-lanceolate with fourteen to sixteen rays of which the first two and often also the last one or two are simple, the others divided; the fifth ray is longest, 1.4 to 1.8 in head.

Ventrals pointed, with one strong spine and five divided rays; the spine is about three-fifths the length of the first, longest ray and 2.3-2.7 in head; when pressed against the body, the ventrals do not reach the anus except in one small specimen in which they just reach the anus.

The caudal peduncle is long and slender; distance from base of last dorsal ray to middle of hypural joint equal to postorbital part of head plus more than half an eye's diameter, almost equal to head without snout. Caudal fin deeply emarginate, with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colours in a preserved condition: ground colour pale yellowish brown (flanks in life a rich gold); upper part of the head, including part of the upper lip, the whole snout and nape, the subocular shelf and the upper halves of preoperculum and operculum blackish brown; on the body four blackish-brown somewhat irregular longitudinal bands; the first one from the nape along the base of the dorsal fin to below the soft dorsal; the second from the side of the nape, midway between dorsal profile and lateral line, backwards to below the soft dorsal fin and from there onwards over the dorsal surface of the caudal peduncle; the third and least distinct one from the posterior border of the orbit over the side of the head and along the lateral line, following its curve, to somewhat behind the middle of the spiny dorsal fin; the fourth is faintly marked on the operculum and wide, distinctive and straight on the body, from just above the postcleithrum to the hypural joint where it widens to a large terminal spot; in its anterior part this band is below the lateral line, but from below the soft dorsal fin to the hypural joint it contains the straight part of the lateral line.

In addition, the Ramu River specimens and the one largest Jimmi River specimen (the two others from this locality have insufficiently developed pigmentation) have six broad but not well-defined cross-bars on the body, which begin dorsally, and become vague and eventually vanish on the flanks a little below the fourth longitudinal band. The first of these bars originates just in front of the dorsal fin and goes down to the postcleithrum; the second begins between the fourth and the sixth dorsal spines; the third between the seventh and ninth dorsal spines; the fourth between the tenth and twelfth dorsal spines; the fifth between the fourth and the eighth soft dorsal rays, and the sixth and least distinct one on the caudal peduncle. Dorsal and caudal fins light brown, pectoral, ventral and anal fins hyaline; on the base of the caudal fin is a large central spot (the termination of the fourth longitudinal band), and above and below it are four or five small dark brown spots; a series of spots forms a band across the base of the soft dorsal fin.

Distribution and habitat. — *T. transmontanus* is apparently widely distributed in north-eastern New Guinea, north of the central mountain range. Our records are from the Sepik and Ramu River systems.

The Utigantz River where the type specimens were collected is a tributary of the Ramu River, approximately 130 miles from its mouth; one of the collectors, Mr. G. West, took the following notes of the locality: air temperature 30°C; water temperature 25.8°C; turbidity: quite clear; pH 8.0; average stream width 25 ft; average depth 18 inches with some pools up to 8 ft deep; bottom sandy with occasional rocky sections. Of special interest seems to us the vertical distribution: although the specimens from the Jimmi River come from an elevation of only 1200 ft, about 360 m, the other material was collected at elevations of from 1200 to 1600 m, higher than any other species of *Therapon* has ever been found. This is evidently a species of clear running water, and as such it may avoid the lowlands and the lower courses of the great rivers.

Discussion. — This species shows a lot of unexplained variation. In the first place there is the peculiar difference in colour-pattern, with some specimens having distinctive vertical bars, which are entirely lacking in others. In all other species, differences in pattern can be correlated with size, more in particular longitudinal bands which are present in small specimens may become less distinctive and ultimately disappear altogether with growth. The strange thing in the present species is that the difference is not due to differences in size, as specimens with cross-bars have been available in the size-range (standard length) of 25-98 mm, and specimens without cross-bars of 80-94 mm. It cannot be a matter of geographical variation either as the Jimmi River (specimen with cross-bars) and the Trauna River (specimens without cross-bars) belong both to the basin of the Yuat River and are no more than 50 km apart.

Even less comprehensible to us is the enormous variation in numbers of scales. From a few species of fishes it is known that their number of scales increases with growth; this was shown convincingly for *Oxyeleotris fimbriatus* (Weber), in which Koumans (1949) found a variation from as few as 45 series of scales in the smallest specimen to 77 series in the largest specimens, with a linear connection between length and scale-numbers. In the specimens of Therapontidae examined by us we have not found that scale-number is a function of size and in our material of *T. transmontanus* we found the following (table 5):

TABLE 5

locality	standard length (mm)	scales above lateral line
Jimmi	25	60
Ramu	62	54-56
Ramu	64	48-49
Trauna	80	63-68
Trauna	81	
Ramu	87½	54-56
Yasi	94	59
Ramu	98	53-55

Evidently, there is no relation at all between size and number of scales in this small series. The possibility of geographical variation cannot, however, be excluded. The Ramu River specimens show a variation of 48-56, which is not small but not excessive either (although, considering that it concerns only four specimens, collected at the same place, it is rather large); the specimens from the Jimmi, Trauna and Yasi Rivers, all belonging to the Sepik drainage, show a variation of 59-68 which also is acceptable, but only just. It is a pity that this difference in scale counts cannot be related to the difference between fishes with and without cross-bars, but the Jimmi River specimen spoils this. It should be noted that the closely related *T. obtusifrons* from the Sermowai River shows a low count, 48-53.

Therapon obtusifrons species nova (figs. 8, 10)

Therapon argenteus; Weber, 1913, Nova Guinea, 9: 582 (Oberlauf des Sermowai-Flüsses, Walckenaer-Bucht, Nord-Neu-Guinea).

Material. — Fourteen specimens, 26 April and 9 May 1911, Sermowai River and its tributary the Boearim, ca. 400 and 500 m, collected by K. Gjellerup (ZMA no. 112781), standard length 58-93 mm. One specimen has been removed from this lot and was re-registered (holotype, ZMA no. 114203), total length 117 mm, standard length 93 mm.

Note. The specimens from the two different dates and localities have been united to one lot, possibly by the collector himself; this makes it impossible to say from which locality the individual specimens came. Therefore the type-locality can best be defined as: upper course of Sermowai River, 400-500 m.

Description. — D XII. 10½ of 11½, A III. 9½ or 10½, P 15 or 16, V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 15-17 (5 or 6 + 1 + 9 or 10), branchiostegals 6, scales below lateral line 48-51, above lateral line 48-53, transverse 8 to 10/1/17 or 18.

This species is very close to *T. transmontanus*, but differs by its even blunter snout, higher dorsal profile, shorter caudal peduncle and perhaps somewhat different colour pattern. Head 3.0-3.4 in standard length; body depth 2.7-3.0 in standard length; snout short and blunt, rounded; anterior profile from tip of snout to dorsal origin almost straight or very slightly convex; eye of moderate size, 3.7-4.0 in head, 0.9-1.1 in snout and 0.9-1.2 in interorbital; nostrils well-separated, the anterior one a little nearer to eye than to tip of snout, a horizontal line from the anterior nostril passes through the lower edge of the pupil or a little higher; posterior nostril distinctly nearer to eye than to anterior nostril, in front of middle of eye; mouth terminal, inclining to inferior, well below the lower edge of the eye; maxilla reaching to or a little past front border of eye when the mouth is closed; lips rather thick; upper jaw with an outer series of strong conical teeth, 6 to 10 on each side, those near the symphysis larger; the outer row is followed by a second row of much smaller teeth, and in the larger specimens there are a few small teeth behind the second row, not enough and of insufficient regularity to be called a third row; the dentition of the lower jaw is similar, but the number of teeth in the outer row tends to be slightly larger (eight to twelve on each side), all teeth are colourless, with more or less distinct light brown tips; no teeth on tongue, vomer or palatines; lower edge of preorbital slightly curved, just covering the upper part of the maxilla when the mouth is closed, and with six or seven fairly large spines along the posterior half of its lower edge: these spines are not very conspicuous as they are concealed by thick skin; preoperculum serrated with 12-16 rather strong spines along its posterior border and some less developed spines, encased in skin, along its lower border; operculum ending in two flat spines of which the lower one is much the better developed, not extending beyond the border of the soft operculum; posterior border of postcleithral process free, with two to four teeth; supracleithrum covered with pigmented skin, but its posterior border free and provided with from five to ten teeth.

Body scaled, except for chin and snout to nape; the scales ctenoid, in regular rows, distinctly smaller on the belly. Lateral line complete, its arch a little less elevated than the outline of the back, with 48-54 + 2 or 3 pore-bearing scales.

Dorsal fin with twelve spines; the spines increase in length from the first to the sixth, which is equal to the postorbital part of the head in the larger specimens, but up to postorbital part of head plus half an eye's diameter in the smaller specimens, or slightly less than snout with eye in the larger specimens and distinctly longer than snout and eye in the smaller ones, or 1.75-2.1 in head; the seventh spine is equal in length to the sixth, and from there onwards there is a regular decrease in length to the penultimate spine, which is of the same length or a trifle shorter than the last spine and about two-thirds of the longest spine. The soft dorsal fin has ten or eleven rays, the last one of which is split to its base; it is more or less truncate in outline, with the second, third and fourth rays longest, equal in length to the longest dorsal spines; the last ray is about half the length of the longest rays; base of soft dorsal fin about twice (1.9-2.2) in spiny dorsal base. Basal sheath of small scales developed along the whole length of the fin.

Anal fin with three spines and nine or ten rays, the last one of which is split to its base. The first spine is smallest, almost or fully two-thirds of the length of the second and largest spine and much thinner, whereas the third spine is only a little shorter (5-10%) than the second and a little thinner, especially distally. The soft anal fin is truncate in outline, with the second ray longest, distinctly longer (up to ca. 20%) than the longest dorsal rays, about 25% longer than the longest anal spine and over twice the length of the last anal ray. The basal sheath of small scales is very well-developed.

Pectorals rounded-lanceolate in outline, with 15 or 16 rays of which the first two and in some specimens also the last one are simple, the others divided; the fifth ray is the longest, 1.4-1.6 in head, a little shorter than head without snout and much longer than snout with eye.

Ventrals pointed with one strong spine and five divided rays; the spine is just a trifle less in length than the postorbital part of the head; the spine is about three-fifths of the length of the first and longest ray, which has a very short filament, giving the closed fin a pointed appearance; when pressed against the body, the ventrals reach the anus except in one specimen (the largest) in which they fall just short of it.

The caudal peduncle is rather long; distance from base of last dorsal

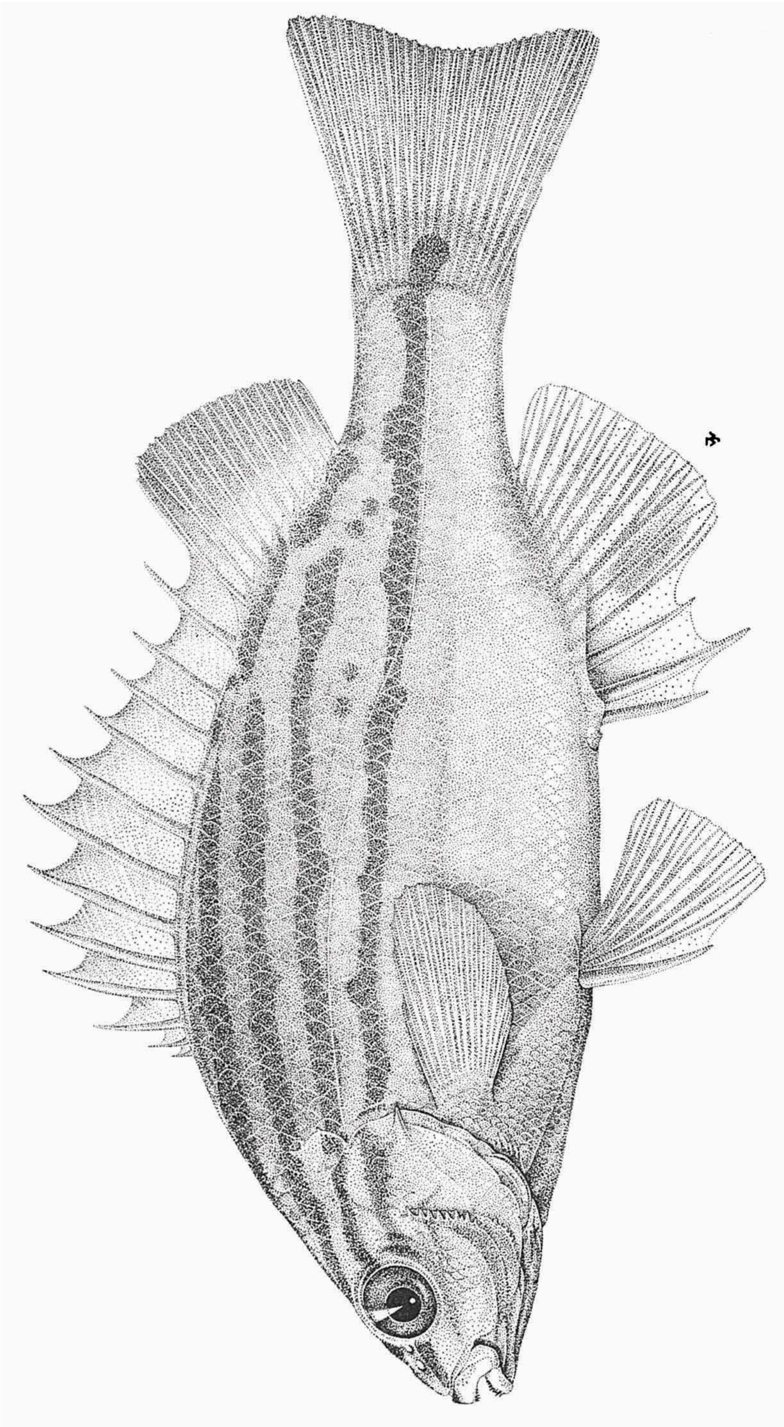

Fig. 10. *Therapon obtusifrons* (from sample ZMA no. 112781, s. l. 62 mm).

ray to middle of hypural joint equal to postorbital part of head plus about one-third of an eye's diameter. Caudal fin deeply emarginate, with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, besides several short and rudimentary ones.

Colours in a preserved condition pale brown, white below, with four distinct, slightly irregular dark brown longitudinal bands; the first one from the tip of the snout over the nape and just below the spinous dorsal backwards, where it may merge with the second band below the posterior part of the spinous dorsal or below the anterior part of the soft dorsal fin, or may continue to below the end of the soft dorsal fin; the second band from the posterior part of the upper margin of the eye backwards, following the dorsal outline, usually to below the soft dorsal fin, where it may merge with the first band as described above; the third band passes from a little above the middle of the posterior border of the eye to below the end of the spinous dorsal fin where it ends in a few dots, the narrow posterior part of the body leaving no room for it between the second and the fourth bands, which are usually continued farther backwards; the fourth band from the middle or a little below the middle of the posterior border of the eye practically straight (not curved) backwards over the flanks and the sides of the caudal peduncle on to the basis of the caudal fin where it ends abruptly; this band is broadest in its posterior part, on the sides of the caudal peduncle; in addition there is a band connecting the tip of the snout with the middle of the anterior border of the eye: this band can be seen as the beginning of the third or of the fourth band, or of both; some specimens also have, faintly indicated, a fifth body band, leading from below the orbit straight backwards. As already indicated, there is some individual variation in the shape of the bands; also, in the smaller specimens the bands are very distinct, notwithstanding sixty-five years of preservation, but the three largest specimens (standard length 79, 85 and 93 mm) differ by having them much less clear and there is every reason to assume that in still larger specimens they would disappear altogether, as happens in other members of the genus, assuming, of course, that *T. obtusifrons* does grow to a much larger size, for which there is no evidence. On purpose we have figured one of the smaller specimens, in which the colour-pattern is pronounced. The fins are mostly hyaline, the dorsal dusky towards the tips of spines and rays; the caudal fin is pale dusky, darker towards the tips of the rays, especially those of the central rays which have almost blackish-dusky tips.

Distribution and habitat. — On present evidence this species is confined to the upper course of the Sermowai River and its tributary the Boearim, ca. 400 and 500 m. Sachse (1912), in his report on the expedition during which the material was collected, recorded that the upper and lower courses of the Sermowai River are separated by a waterfall of about 50 m height and it is of special interest that the fishes were all taken upstream from this formidable barrier. Unfortunately Sachse did not further describe this waterfall.

Discussion. — As already mentioned, *T. obtusifrons* appears to be closely related to *T. transmontanus*. Only further collecting can learn whether it is confined to the upper course of the Sermowai river, or is widely distributed in the western half of northern New Guinea, where it would replace *T. transmontanus* which inhabits the eastern half of northern New Guinea.

For the reason given above, the figured specimen of *T. obtusifrons* is a small one. The higher body, longer fins and larger head of the figured specimen, compared with the illustrated specimen of *T. transmontanus*, are partly functions of size.

Therapon fuliginosus Macleay (fig. 11)

Therapon fuliginosus Macleay, 1883, Proc. Linn. Soc. N. S. W., 8: 201 — Upper Burdekin, at or near Charters Towers, Queensland.

Therapon fuliginosus; Kailola, 1975, D. A. S. F. Res. Bull., 16: 100 (3 miles from Rumginae, Ok Mart River; Fly River at Kiunga); Boyden, Brown, Drucker & Tuft, 1975, Ok Tedi Environmental Study: 27 (Kiunga).

Material. — Three specimens, 3 October 1973, 3 miles from Rumginae village, Ok Mart, western Papua, collected by J. Koaia and J. Timothy (AMS no. I. 19131—001 and RMNH no. 27577), standard length 112-118 mm [1]).

Description. — D XII. 12½ or 13½, A III. 9½, P 15-17, V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 23-26 (7 to 10 + 1 + 15 or 16), branchiostegals 6, scales below lateral line 50-52, above lateral line 54-56, transverse 8/1/17 or 18.

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[1]) In November 1974, Mr. A. K. Haines collected specimens of a species of *Therapon* in the Purari River at Kone and at the Bevan Rapids. This material was not yet available when we prepared the main text of our paper, but one of us (PK) has since had an opportunity to examine two of the specimens (22/23 November 1974, Kone, standard length 118 and 171.5 mm), which she found to be referable to *T. fuliginosus*. A few counts and measurements of these specimens are: D XII.13½, A III.9½, P 17 (ii.14.i), V I.5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 9 + 1 + 17 and 10 + 1 + 17, scales below lateral line 48-50, above lateral line 53, 55, transverse 8/1/18 and 8/1/17, eye 4.0 and 4.5 in head, 1.4 and 1.6 in snout, 1.0 and 1.2 in interorbital (where the measurements differ those of the smaller specimen have been listed first). Some of the counts (scales and gill-rakers) slightly expand the ranges of variation, based on very few specimens, given in the main text and in table 1.

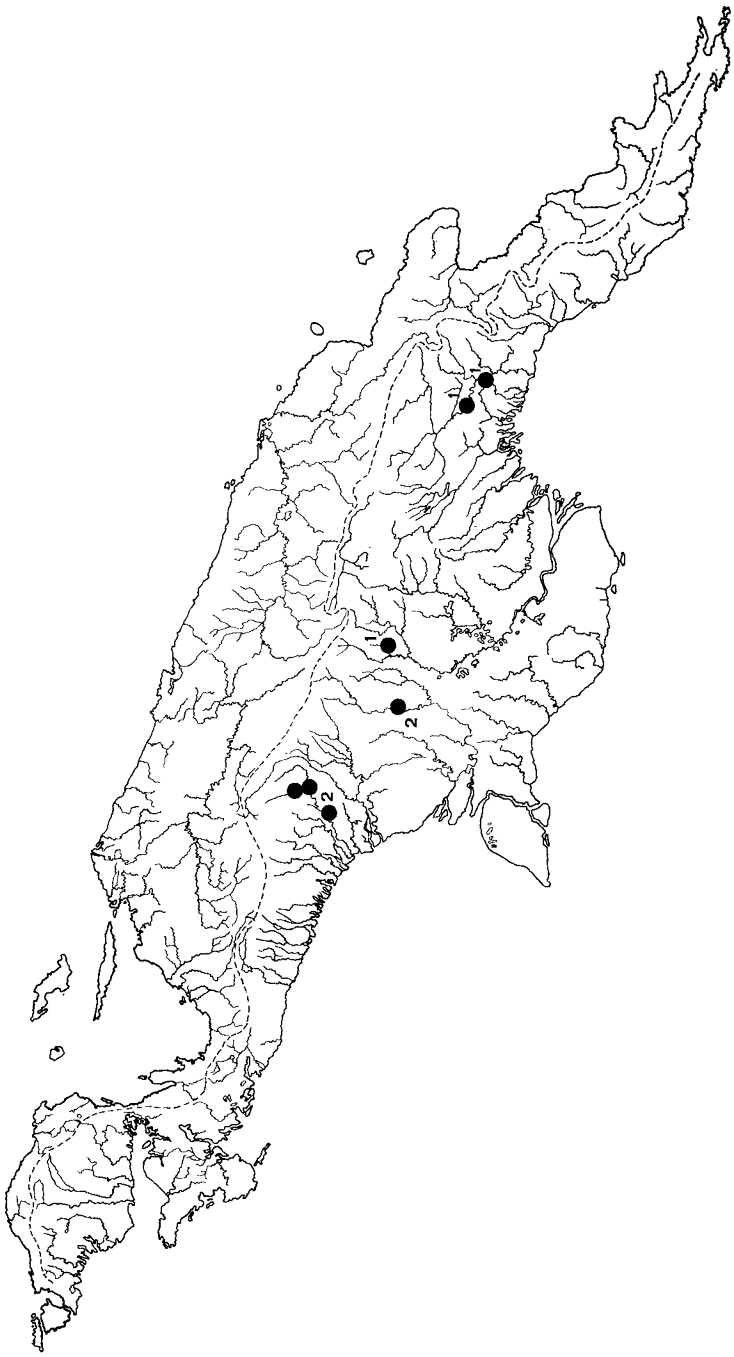

Fig. 11. The distribution of *Therapon fuliginosus* (1) and *T. roemeri* (2).

As we identify these specimens with the well-known Australian species *T. fuliginosus*, we consider it unnecessary to provide a full description and confine us to stating that they appear to differ from *T. fuliginosus* in two characters: the larger eyes and the greater distance separating the anterior and posterior nostrils. Both these characters will be further discussed below. The sheath of scales along the base of the dorsal fin gives an impression of being broader and less regularly arranged than in Australian *T. fuliginosus*, but that is at most a doubtful difference. In their plain dark brown colour these fishes agree with preserved *T. fuliginosus*.

Distribution and habitat. — The Ok Mart where these fishes were captured runs at about three knots, although it is faster over shallower parts. The water is clear, the river bed and banks consist of sand and gravel. Creeks running into the Ok Mart at Rumginae are deep and fast. The river is subject to sudden flooding, one example near the date of capture being a rise of twelve feet overnight. The Fly River at Kiunga is a much larger river, but also turbid with widely fluctuating levels (Boyden et al., 1975: 27).

Discussion. — These specimens are so close to three specimens of *T. fuliginosus* from the Daintree River, Queensland (RMNH no. 26397) that we consider it inadvisable to separate them. They are merely distinguished by having the nostrils rather farther apart and by their larger eyes, as table 6 shows.

TABLE 6

locality	standard length (mm)	eye diameter in head	eye diameter in snout	eye diameter in bony interorbital
Daintree River	92	4.0	1.5	1.3
" "	134	4.7	1.7	1.6
" "	148	4.6	1.8	1.6
Ok Mart	112	3.7	1.3	1.0
"	113	4.0	1.4	1.0
"	118	4.1	1.5	1.2

More material of both populations would be needed to show whether the difference is constant; the fact that one specimen from Ok Mart has distinctly larger eyes than the others, indicates that there is a considerable individual variation, even among specimens of the same general size.

The distance between the anterior and posterior nostrils was previously used by Mees (1971) in the *T. fuliginosus* group of forms, to separate *T. bancrofti* from *T. fuliginosus*, the nostrils of the former being well-separated, those of the latter close together. Material received later, however, made him remark that there is some variation and that: "Only examination of additional material could reveal if this character is always ... reliable ... A further comparative study of the species *T. fuliginosus* and *T. bancrofti* on the basis of more material ... remains to be done" (Mees, 1971: 207). Thus, doubt was thrown on the validity of the nostril-character and on the validity of *T. bancrofti* (as a species different from *T. fuliginosus*) as well. For the moment it seems much preferable to include the New Guinea population in a widely ranging species *T. fuliginosus*, than to use the very slight differences here discussed as an excuse for nomenclatural separation.

It is interesting to note that our New Guinea specimens were collected in clear running water and that the species has not been found in lagoons and in the lower courses of the great rivers. In Australia also, members of the *T. fuliginosus* group are almost confined to clear and permanently running water.

Therapon roemeri Weber (figs. 1, 11)

Therapon Römeri Weber, 1910, Notes Leyden Mus., 32: 233 — Lorentz-Fluss.
Therapon Römeri; Weber, 1913, Nova Guinea, 9: 584, fig. 35 (Lorentz-Fluss bei „Van Weelskamp", Lorentz-Fluss bei Sabang, Lorentz-Fluss bei der Regeninsel.

Therapon fuliginosus; (pt.) Fowler, 1928, Mem. B. P. Bishop Mus., 10: 212 (Lorentz River at Van Weelskamp, Sabang and Regeninsel).
Terapon fuliginosus; (pt.) Fowler, 1931, U. S. Nat. Mus. Bull., 100 (11): 352 (Lorentz River at Van Weelskamp, Sabang and Regeninsel).
Pelates römeri; Weber & de Beaufort, 1931, Fish. Indo-Austr. Arch., 4: 163 (New Guinea (Lorentz River)); Hardenberg, 1941, Treubia 18: 227 (Tanah Merah, Digoel River).
Pelates romeri; Fowler, 1934, Mem. B. P. Bishop Mus., 11: 416 (distribution); Munro, 1958, Papua New Guinea Agricult. J., 10: 169 (Lorentz R., Digul R.); (pt.) Munro, 1964, Papua New Guinea Agricult. J., 16: 147 (Southern New Guinea); Munro, 1967, Fish. New Guinea: 320 (south West New Guinea); Munro, 1972, Encycl. Papua New Guinea: 423 (Lorentz and Fly-Digul basins).
Therapon roemeri; Mees, 1971, Zool. Meded., 45: 212 (Lorentz River and Digoel River at Tanah Merah).

Material. — One specimen, 29 May 1907, Van Weel's Kamp, Lorentz River, collected by H. A. Lorentz (syntype, ZMA, coll. no. 43), standard length 304 mm. One specimen, 30 September 1909, Regeneiland, collected by H. A. Lorentz (syntype, ZMA, coll. no. 287), standard length 272 mm. Two specimens, 25 September 1912, Bivakeiland, collected by H. A. Lorentz (ZMA no. 104738), standard length 100, 118 mm. One specimen, 13 April 1955, Tanah Merah, collected by M. Boeseman (RMNH no. 24941), standard length 123 mm. Two specimens, 14-17 April 1955, Tanah Merah, collected by M. Boeseman (RMNH no. 24936), standard length 117, 143 mm. One specimen, 11 September 1959, Tanah Merah, collected by W. Vervoort (RMNH no. 25909), standard length 88 mm.

Description. — This same material was discussed by Mees (1971), who noted that *T. roemeri* is very close to *T. fuliginosus*, but differs by its slightly smaller scales, 55-62 rows below lateral line, against 44-53 in *T. fuliginosus*; also the dorsal fin appeared to average one ray more, 12½ to 14½, against 11½ to 13½.

Distribution. — South-western New Guinea, where at present only known from the Lorentz River (several localities) and the Digoel River at Tanah Merah. It is a safe assumption that the species is much more widely distributed in south-western New Guinea.

Therapon affinis species nova (figs. 12, 13)

Therapon sp.; Kailola, 1975, D. A. S. F. Res. Bull., 16: 98-99 (various localities, same material as listed below).

Material. — Two specimens, 7 September 1973, half mile downstream from Morehead Station, collected by B. Malawa (AMS no. I. 19133—001), standard length 76, 91 mm. Two specimens, 27 September 1973, Kiunga swamp, Kiunga, collected by J. Koaia and J. Timothy (the larger specimen AMS no. I. 19134—001, the other RMNH no. 27579), standard length 136, 141 mm. One specimen, 7 October 1973, Senamre village downstream from Rumginae, Ok Mart, collected by J. Koaia and J. Timothy (RMNH no. 27580), standard length 95 mm. Three specimens, 18 October 1973, Lake Murray, Western District, Papua, collected by J. Koaia and J. Timothy (holotype, the largest specimen, AMS no. I. 19132—001, the others DPI no. FO 3803 and RMNH no. 27578), total length 105, 115, 120, standard length 84, 92, 94 mm. Two specimens, 27 November 1975, lagoon along mainstream of Fly River near Boset, collected by T. R. Roberts (USNM no. 216418), standard length 41, 101 mm. Three specimens, 3-4 December 1975, Lake Murray near Boboa, collected by T. R. Roberts (USNM no 216419), standard length 33, 59, 84 mm. There are 24 other specimens of this species in the reference collection of the D. P. I. at Kanudi, all from the same localities as the above, except for one from swamps at Maderi plantation on the lower Fly River; for an enumeration, see Kailola (1975: 98-99).

Description. — D XIII. 9½ or 10½, A III. 8½ or 9½, P 14 (rarely 13 or 15), V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 18-20 (6 or 7 + 1 + 11 to 13), branchiostegals 6, scales below lateral line 41-47, above lateral line 44-52, transverse 6 or 7/1/15 or 16.

A deep-bodied species with large scales, a rather small pointed head and a highly diagnostic colour pattern of vertical black bars on a silvery background. Head 2.9-3.5 in standard length; body depth 2.5-2.8 in standard length; snout sharp but rounded at tip; anterior profile from tip of snout to dorsal origin steep and almost straight; eye rather large, 2.9-3.6 in head, 0.95-1.2 in snout and 0.8-1.2 in interorbital; nostrils well-separated, the anterior one distinctly nearer to tip of snout than to eye and level with the lower edge of the pupil or the lower border of the eye, the posterior one

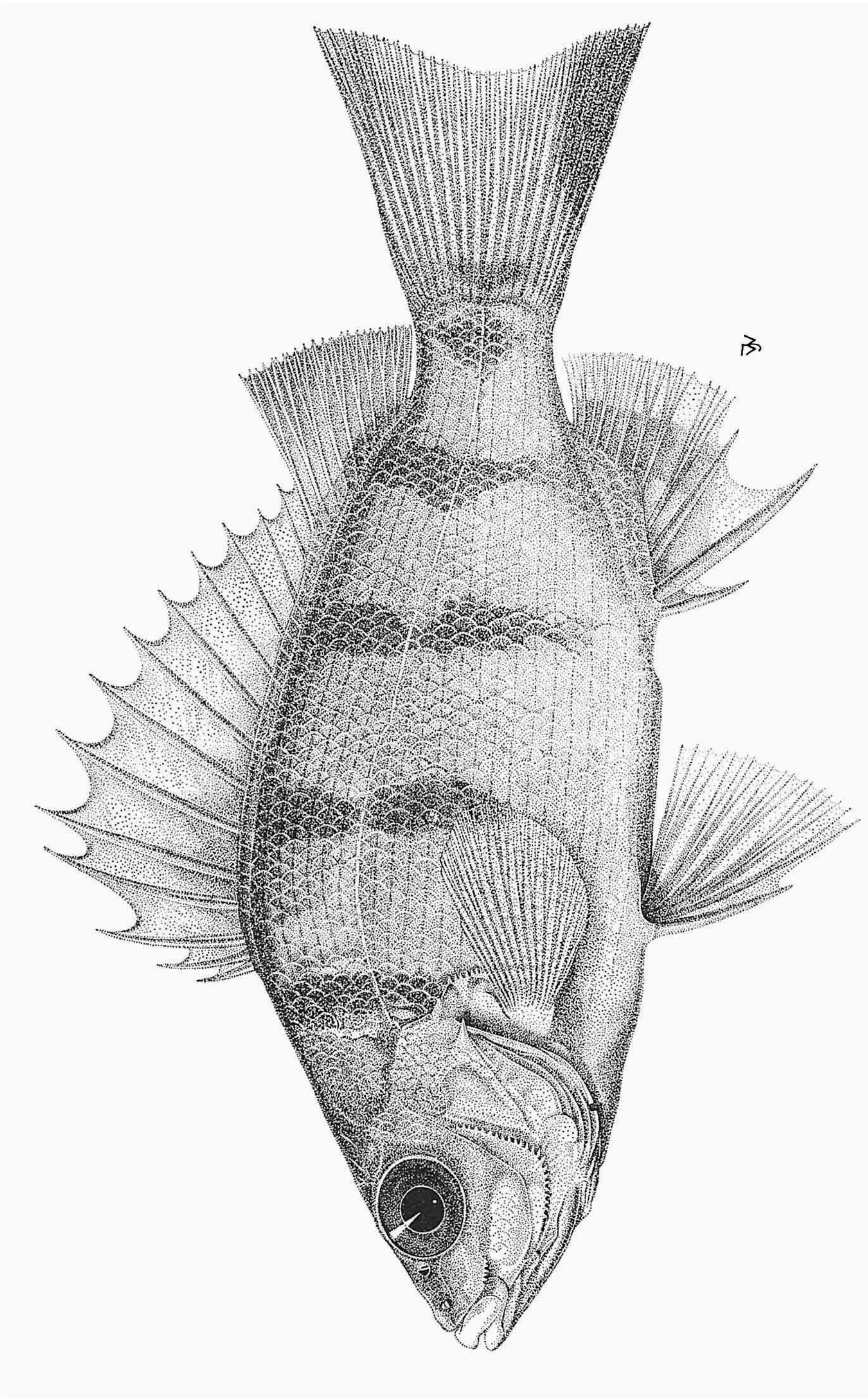

Fig. 12. *Therapon affinis* (RMNH no. 27578, s. 1. 92 mm).

much nearer to eye than to anterior nostril and in line with the middle of the pupil; mouth small to moderate, terminal, well below level of eye; when the mouth is closed, the maxillary reaches to below the posterior nostril or the anterior border of the eye; lips moderately fleshy, becoming thicker in larger specimens; dentition well-developed, upper jaw with an outer row of conical teeth, 16 to 20 on each side, those near the symphysis larger; the outer row is followed by four rows of smaller teeth, the rows becoming more irregular distally; the dentition of the lower jaw is similar, except that there are 20 to 26 teeth on each side of the outer row; all teeth are colourless or pale yellow with brown tips, darker on teeth in outer rows; no teeth on tongue, vomer or palatines; lower edge of preorbital straight to curved posteriorly, with seven to ten strong teeth, mostly concealed by skin in larger specimens; preoperculum serrated along its whole free border, with 16 (one specimen) or 21-27 teeth, the teeth at the angle slightly stronger and broader and those of the lower edge smaller and partly hidden in skin; operculum ending in two flat spines, the lower one of which is strong and reaches almost to the border of the soft operculum; free posterior margin of postcleithral process with four to six teeth; supracleithrum concealed, not externally visible.

Body scaled, except for chin and snout to nape; the scales ctenoid in regular rows. Lateral line complete, following the curve of the back, on the caudal peduncle straight, with 43-46 + 3 pored scales.

Dorsal fin with thirteen spines; the spines increase in length from the first to the fifth, which is longest, being very little longer than the fourth and the sixth spines and equal to postorbital part of head plus three-quarters to all of eye-diameter, or 1.45-1.55 in head; the spines decrease regularly in length from the fifth to the last two, which are subequal, and are half to three-fifths the length of the longest spine. The soft dorsal fin has nine or ten rays, the last one of which is split to its base; the soft dorsal is truncate in outline; the rays decrease in length from the first and second which are subequal, and three-quarters to four-fifths the length of the longest dorsal spine; the last dorsal ray one-third to half the length of the longest ray; base of soft dorsal fin more than twice (up to 2.5) in spinous dorsal base. A low scaly basal sheath extends along the whole dorsal base, but is reduced on the posterior part of the soft fin.

Anal fin with three spines and eight or nine soft rays, the last one of which is split to its base. The first spine is the smallest, being half the length of the second and largest, which is a little longer than the third spine. The second anal spine is thicker but shorter than the longest (fifth) dorsal spine and equals the postorbital part of the head plus half an eye's diameter.

The soft anal fin is truncate in outline, with the first ray longest, a little longer than the first and second dorsal rays, two or three times longer than the last anal ray, and subequal to the longest anal spine. A scaly basal sheath extends most of the way along the fin.

Pectorals rounded-lanceolate, with thirteen to fifteen, usually fourteen rays of which the first two and sometimes also the last one are simple, the others divided; the fifth ray is longest, 1.5-1.7 in head and more or less equal to snout plus eye.

Ventrals pointed, with one strong spine and five divided rays; the spine is a half to two-thirds the length of the first, longest ray and about 2.0 in head; when pressed against the body the ventrals reach to the anus in smaller specimens, fall short of it in the larger specimens.

The caudal peduncle is of moderate length; distance from base of last dorsal ray to middle of hypural joint equal to postorbital part of head or a little longer. Caudal fin emarginate, with fifteen (8 + 7) divided rays and a single well-developed simple ray on upper and lower edges, as well as several short and rudimentary ones.

Colours in a preserved condition: back, upper half of sides and most of the head light to dark brown, darkest on the back and on the dorsal surface of the head; lower part of head, breast and sides cream or silvery. The head shows a rather sharp boundary, running horizontally from the gape and below the orbit backwards, between the brownish and the lightly pigmented cream parts; on the flanks the change is gradual. Each body scale has a central dark stripe which gives an appearance of narrow longitudinal dark lines along the body, most conspicuous on the flanks below the lateral line, where the paler background makes these lines stand out more distinctly than higher on the body. The body is crossed by five vertical black or brownish black bars, three or four scales wide, which extend well down the sides. The first bar runs from the nape just in front of the first dorsal spine down to the pectoral base; the second from between the bases of the fifth to the seventh dorsal spines; the third from the bases of the tenth to the twelfth dorsal spines; the fourth from the fifth to the eighth dorsal rays, and the last one across the caudal peduncle. Fins mostly hyaline or dusky; membranes of the spinous dorsal tipped black, soft dorsal and anal fins with an obscure brownish band, caudal fin with a blackish base, a distinctive blackish lower edge, and usually some dusky spotting which may be arranged in vertical series. The closely related Australian *T. percoides* has in life all fins except the dorsal tinged with yellow, a colour disappearing soon after death, and it is likely that *T. affinis* has also yellow fins in life.

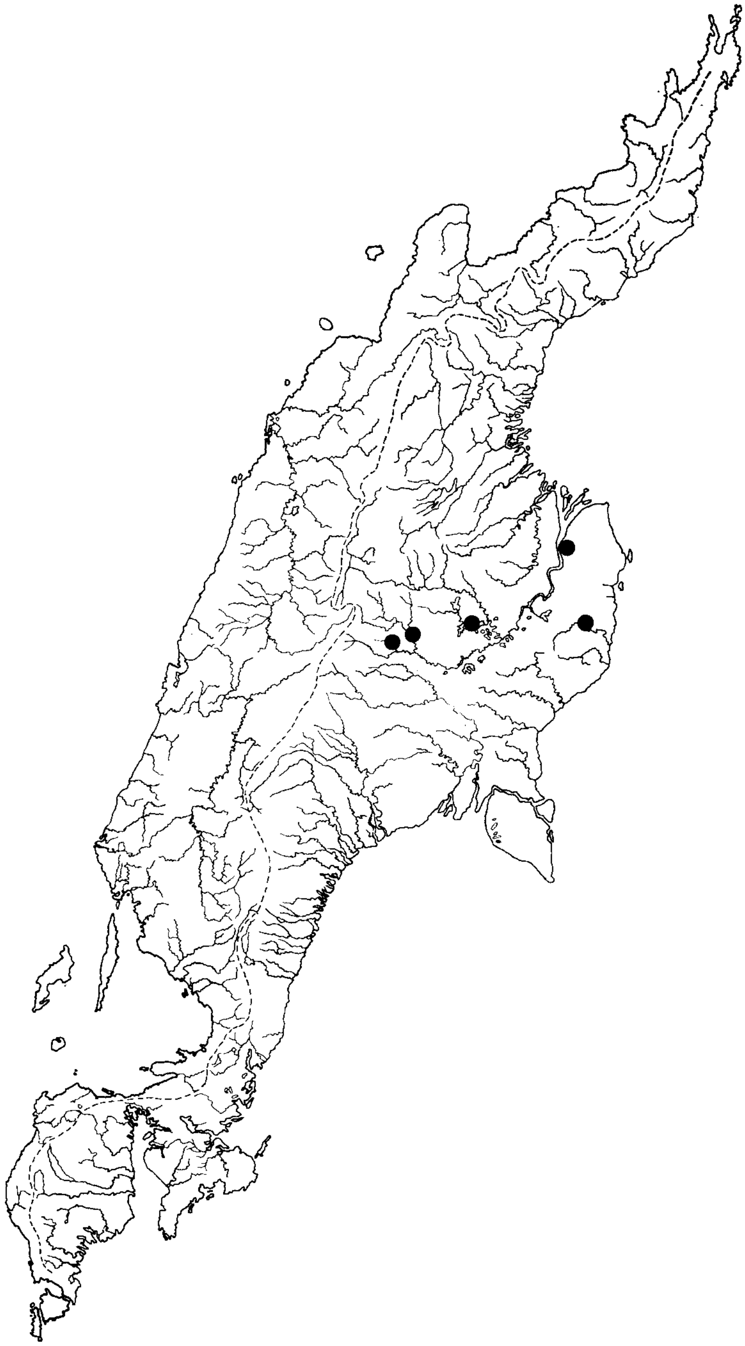

Fig. 13. The distribution of *Therapon affinis*.

Distribution and habitat. — *T. affinis* is at present known from the Fly River basin (several localities) and the Morehead River. Undoubtedly it is more widely distributed. It is equally at home in shallow and fast flowing rivers as in lakes and swampy backwaters.

Discussion. — *T. affinis* is very similar to *T. percoides*, a species with a wide distribution in tropical Australia, and that is why we have given it the name *T. affinis*. The temptation to describe it as a subspecies, under a trinomial, has been particularly strong in this case. The only difference between the two is the higher scale-count, both longitudinally and transversally, in the New Guinea form, and possibly a slightly higher number of gill-rakers. The difference is constant in the material examined by us. Whereas there is some individual variation in the longitudinal scale counts, all our specimens of *T. affinis* have at least six rows of scales above the lateral line, whereas 21 specimens of *T. percoides* from various localities in Western Australia and the Northern Territory have only five. This, in our opinion, is the easiest character to distinguish between the two. The colour-pattern, with the five black vertical bars and the blackish lower edge to the caudal fin may be said to be identical, and there is little doubt that *T. affinis* has only recently become differentiated from *T. percoides*, in the way suggested in chapter 6.

As far as can be judged from the fragmentary data at present available, *T. affinis* and *T. percoides* agree also in having a broad ecological tolerance, *T. affinis* has been recorded from both running and stagnant waters. *T. percoides* is next to *T. unicolor* the most widely distributed of the Australian freshwater therapons; we have found it in running waters, but also surviving well in small pools left in the beds of seasonal creeks and rivers, in rock-holes, etc.

We have hesitated to describe this species as new, because Nichols (1949) described from the Cape York Peninsula a subspecies *T. percoides yorkensis*. Unfortunately Nichols, in an extensive description (longer than that of *Archeria jamesonoides*, a new genus and species described in the same article!), failed to make any comparison with nominate *T. percoides*, a species not even mentioned in his description except in a concluding statement: "Whereas Ogilby and McCulloch ... are probably right that *percoides* shows minor population variations best disregarded in taxonomy, it will prove advantageous to recognize a few of the major geographic variations". We are left entirely uninformed as to what these "major geographic variations" consist of, but the number of scales (41 to 47, average 44) given in the description is definitely higher than that of *T. percoides* as mentioned in literature and as counted by us. In addition, the geographical position of the Cape York Peninsula made it appear not unlikely that it would have a population similar to the New Guinea one. Mr. Vari has informed us, however, that in spite of its description, *T. percoides yorkensis* does not differ significantly from material of *T. percoides* collected in other parts of Australia; he has also examined one of our specimens of *T. affinis* and agrees that it differs from *T. percoides*. In a later communication Mr. Vari (in litt., 20.V.1976) supplied more comprehensive notes, which we cite here: "I have checked my data and the specimens utilized by Nichols for the description of *T. percoides yorkensis* and I find that none of the specimens have a lateral line count higher than the 43 I noted as the highest observed in the species. The counts for the material (AMNH nos. 18535 (type), 18544 and 18545) show a range of 38 to 42 scales counted to the hypural joint with the type being one of the two specimens with the highest count. Evidently as you suspected Nichols also counted tubed lateral line scales beyond the hypural joint. However, it is also possible that it was a result of his lack of care in general".

Therapon raymondi species nova (fig. 14)

Therapon sp.; Kailola, 1975, D. A. S. F. Res. Bull., 16: 99 (same material as listed here).

Material. — One specimen, 26 August 1973, Tiperrse Creek, 2½ miles from Morehead Station, Western District, Papua, collected by B. Malawa (holotype, AMS no. I. 19127—001), total length 115, standard length 95 mm. One specimen, same data (RMNH no. 27581), total length 81, standard length 65 mm.

Description. — D XII. 14½, A III. 10½ or 11½, P 16-17, V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 18-19 (6 or 7 + 1 + 11), branchiostegals 6, scales below lateral line 60-65, above lateral line 71-73, transverse 10 or 11/1/23 to 25.

A deep-bodied species with small scales, a higher number of soft rays in the dorsal fin than all other species here dealt with except some specimens of *T. roemeri*, a peculiarly variegated body pattern of brown and cream, and an exposed posterior border to the supracleithrum which is, however, more or less smooth, not clearly denticulate. Head 2.8-2.9 in standard length, depth of body 2.3-2.6 in standard length; snout rather pointed; anterior profile from tip of snout to dorsal origin straight to slightly arched before dorsal fin; eye moderate, 3.5-4.0 in head, 1.0-1.2 in snout and 1.1-1.3 in interorbital; nostrils well-separated, the anterior one slightly closer to eye than to tip of snout, a little below a line through the centre of the pupil; posterior nostril a little above a line through the centre of the pupil and much

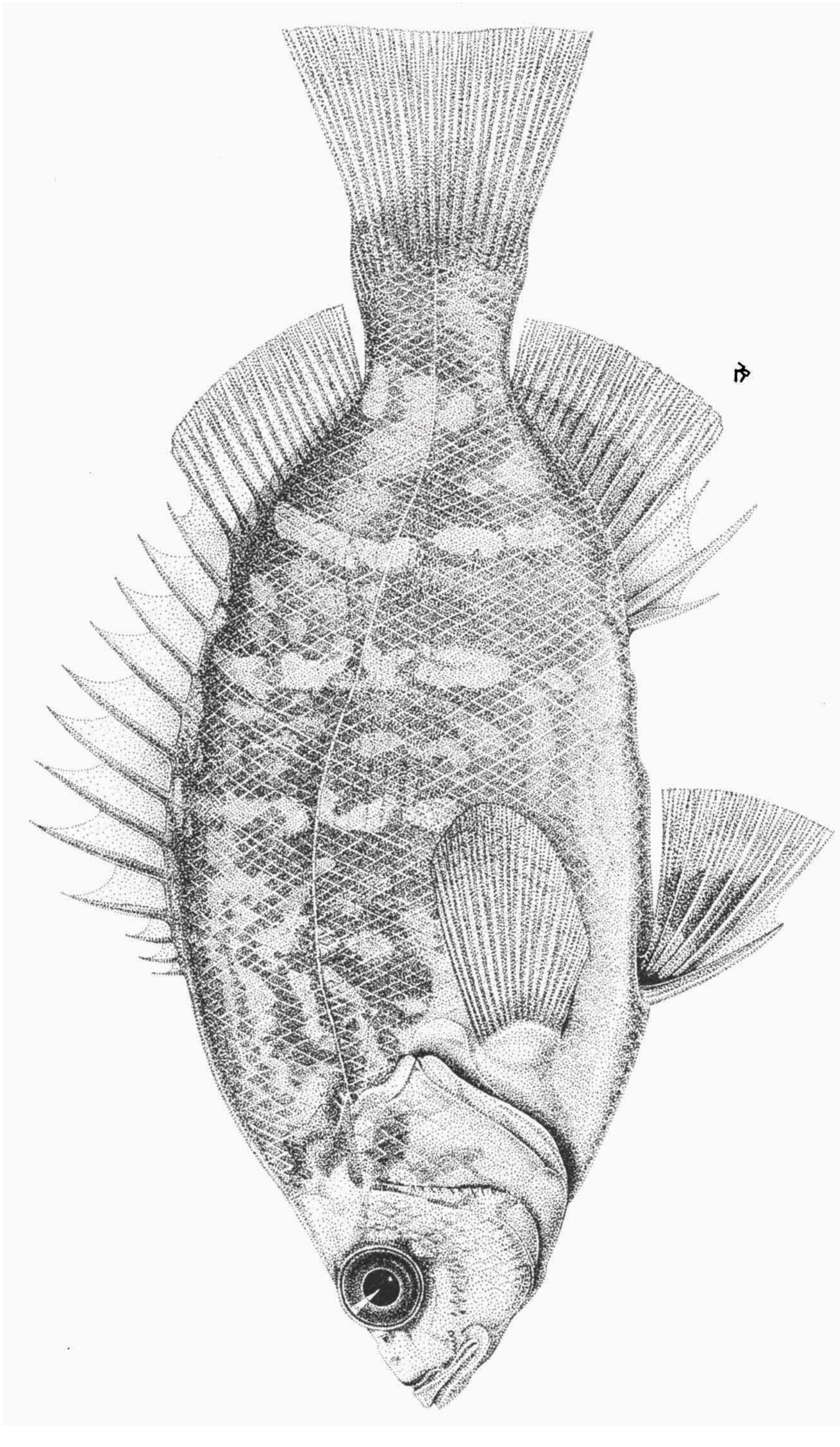

Fig. 14. *Therapon raymondi* (RMNH no. 27581, s. l. 65 mm).

closer to eye than to anterior nostril; mouth terminal, oblique, beginning on a level with the lower edge of the eye or slightly below it and reaching backwards to a vertical through the anterior edge of the pupil; lips thin but broad; dentition well-developed: upper jaw with an outer row of strong conical slightly curved teeth, 14 to 17 on each side, those near the symphysis largest; behind the outer row are a shorter second and an irregular third row of smaller teeth; teeth in lower jaw similarly arranged, but with only 12 to 14 teeth on each side of the outer row; the teeth are colourless, with tips ranging from pale yellow to dark brown; no teeth on tongue, vomer or palatines; lower edge of preorbital rounded, its anterior part smooth, its posterior part ending in five or six rather strong flat teeth, which are largely covered with skin and therefore not conspicuous; preoperculum serrated along its whole free border, with 20 to 26 colourless serrae which are best developed near the bend; the operculum ends in two flat spines which do not extend beyond the border of the soft operculum; posterior border of postcleithral process free, a little uneven without clear serrae (small specimen) or with 4 to 6 serrae (larger specimen); supracleithrum hidden by skin but not by scales, hence "exposed", its posterior border free and almost smooth.

Body scaled, except for the chin and the snout to the nape, with regular rows of small ctenoid scales. Lateral line complete, its arch following the outline of the back, with ca. 65 + 3 pore-bearing scales.

Dorsal fin with twelve spines which increase in length from the very short first to the sixth, which goes about 2.4 times in the head, or equals in length the snout and half an eye's diameter, or the postorbital part of the head less half an eye's diameter; the seventh spine is subequal to the sixth, and from there onwards the spines decrease regularly in length to the last one, which is three-quarters the length of the longest spine. The soft dorsal fin has fourteen rays, the last one of which is split to its base; it is rounded-truncate in outline with the third to the sixth rays longest, equal in length to the longest dorsal spines or a little longer, and one-and-a-half to almost twice the length of the last dorsal ray; base of the soft dorsal fin half the length of the base of the spinous dorsal. A scaly sheath covers the base of the whole fin, except for the last one or two rays.

Anal fin with three spines and ten or eleven rays, the last one of which is split to its base. The first spine is smallest, it is much thinner than the second spine and no more than three-fifths (in the smaller specimen) to three-quarters (in the larger specimen) of its length; the second spine is largest, it is equal to (in the smaller specimen) or three-quarters of (in the larger specimen) the length of the longest dorsal spine and in its basal part is clearly thicker; the third spine is longer than the first spine, and measures about four-fifths of the length of the second spine, it is not so thick as the second spine, but much less slender than the first. The soft anal fin is rounded-truncate in outline, with the second and third rays longest, a little longer than the longest dorsal rays, about 1.2 times the longest anal spine and almost twice the last anal ray. There is a well-developed sheath of small scales which covers the whole anal base, except for the last one or two rays.

Pectorals almost rounded in outline, with sixteen or seventeen rays, of which the first two and the last one are simple, all others divided; the fifth and sixth rays are longest, 1.7-1.8 in head.

Ventrals pointed with a strong spine and five divided rays; the spine is about three-fifths of the length of the first, longest ray and 2.5-2.6 in head; when pressed against the body the ventrals fall far short of the anus.

The caudal peduncle is rather short; distance from base of last dorsal ray to middle of hypural joint about one-third of an eye's diameter less than postorbital part of head, or equal to snout and half an eye's diameter, or 2.4-2.5 in head. The caudal fin is truncate with fifteen (8 + 7) divided rays and a single well-developed simple ray along upper and lower edges, besides several short and rudimentary ones.

Colours in a preserved condition mottled and variegated with dark brown and white, giving a suggestion of irregular dark lines along back and flanks, crossed by five of six broken white vertical bars; cheeks with crescentic dark lines; lower part of sides mottled with lighter brown. The fins are uniform pale brownish or greyish, somewhat darker towards the base, except for the ventral fins which have the membranes blackish.

Distribution and habitat. — The species is only known from its type-locality. No information of habitat has been received.

Discussion. — This species is markedly different from all other Therapontidae known from New Guinea, but is evidently closely related to *Leiopotherapon suavis* Whitley (1948), a nominal species only known from the Archer River (Nichols, 1949, under the name of *Archeria jamesonoides*, a synonym of *L. suavis* as suggested by Whitley, 1951, and confirmed by Vari, in litt., 19.II.1976; Brass, 1953: 190 and map on page 152) and its tributary the Coen River (type locality of *L. suavis*), in northern Queensland.

In one character Whitley's (1948) description of *L. suavis* is contradictory: he describes the species in the genus *Leiopotherapon*, a genus of which the sole character is the concealed supracleithrum, but in the description states: "Supracleithrum covered by scales, ending with few denticles", which suggests an exposed posterior margin to the supracleithrum. Mainly because of this contradiction it appeared necessary to re-examine the type of *L. suavis*. Fortunately a loan could be arranged, which enabled us also to make a comparison with *T. raymondi*.

Our measurements and counts of *L. suavis* do not differ much from Whitley's: total length 76, standard length 62 mm, head 2.8 in standard length, body depth 2.5 in standard length, eye 1.2 in snout, 4.0 in head, D XII. 14½, A III. 11½, P 16 (ii.14), V I. 5, C i.15.i (ignoring rudiments), gill-rakers on outer branchial arch 16 (5 + 1 + 10), branchiostegals 6, scales below lateral line 54, above lateral line 60, transverse 9/1/22, pore-bearing scales in lateral line ca. 57 + 3, when pressed against the body the ventrals reach the anus.

The supracleithrum was not correctly described by Whitley, and one gets an impression that when, in the sentence just quoted, he referred to the supracleithrum, he actually meant the postcleithral process. The postcleithrum is covered by scales, but with a free and denticulate posterior border, exactly as described by Whitley for the supracleithrum. The supracleithrum, on the other hand, is covered by skin but not by scales and its posterior margin is convex, entirely smooth. As it is covered by pigmented skin, Whitley must have overlooked it and that would explain why he placed the species without comment in *Leiopotherapon*.

The colour-pattern of *L. suavis* is much more distinctive than that of the available specimens of *T. raymondi*, but that is probably at least partly due to a difference in method of preservation. It is true that *T. raymondi* inclines to having the pale bands vertically arranged, *L. suavis* longitudinally, but Nichols (1949) recorded that his specimen had: "Pale blotches on sides which tend to fall into vertical series", which would also be a good description of *T. raymondi* and suggests that in colour and pattern there is not much difference between the two. *L. suavis* has also black ventral fins, like *T. raymondi*.

Thus, the differences between *L. suavis* and *T. raymondi* are reduced to two: the latter has smaller scales, and it has the free lower border of the preorbital with strong spines. In the type of *L. suavis*, the lower border of the preorbital is entirely smooth (a rather unusual condition in Therapontidae). Feeling uncertain about the value of the preorbital character, with only a single specimen of *L. suavis* available, we asked Mr. Vari to verify it in the type specimen of the synonym *Archeria jamesonoides*. Mr. Vari (in litt., 20.V.1976) replied: "Examination of the type shows two distinct serrae along the posterioventral edge of the lacrimal. However it is possible that as in other species these are reduced with age. My notes indicate that such was the condition in several other closely related species. Since the type of *T. suavis* is larger than that of *A. jamesonoides*, the difference may simply be part of an ontogenetic progression or individual variation". The value of the character appears therefore to be doubtful, although it is relevant to state that the specimens of *T. raymondi* (standard length 65 mm) and of *L. suavis* (standard length 62 mm) that we compared correspond closely in size.

Although in the preceding discussion we have used the binomen originally given to the species described by Whitley, it will be clear that even by the standards of those who believe in the use of the genus *Leiopotherapon* for species without exposed supracleithrum, *L. suavis* is misplaced, as the supracleithrum is not covered by scales. We do not propose a new binomen, as we are of the opinion that *L. suavis* is a synonym of *Therapon carbo* Ogilby & McCulloch. This identification will be discussed below.

Lake (1971: fig. 69) has under the name *Hephaestus carbo* a coloured illustration of a fish with a colour-pattern very similar to that of *T. raymondi* and *L. suavis*; he further notes: "When preserved this species goes almost black. When alive they are most colourful and attractive. The gold speckles sparkle and iridesce as they swim in the stream". If this is correct, little remains to distinguish between *L. suavis* and *T. carbo*, although the type-specimen of the former has in preservative most emphatically not turned black. Keeping in mind the differences in size, the description of *T. carbo* by Ogilby & McCulloch fits *L. suavis* rather well. It is also of interest to read that the mentioned authors state of *T. carbo*: "Preorbital entire".

To ascertain whether, as we suspected, *Leiopotherapon suavis* is the same as *Therapon carbo*, we borrowed a syntype of the latter (QM no. I 2445) and found good agreement in proportions and counts: total length 150, standard length 125 mm, head 3.2 in standard length, body depth 2.5 in standard length, eye 1.4 in snout, 4.6 in head, D XII. 14½, A III. 11½, P 16 (ii.14 or ii.13.i), V I. 5, C i.14.i (ignoring rudiments), gill-rakers on outer branchial arch 16 (4 + 1 + 11), branchiostegals 6, scales below lateral line 56, above lateral line ca. 60, transverse 9/1/22, pore-bearing scales in lateral line ca. 58 + 3; when pressed against the body the ventrals reach about 0.8 of the way to the anus.

The few differences, such as the somewhat smaller head, the smaller eyes and the shorter ventrals are obviously functions of size. The fact that the specimen has only 14 (7 + 7) divided caudal rays must be an individual aberration as 15 is universal in the Therapontidae. We conclude that *Leiopotherapon suavis* is nothing but the young of *Therapon carbo*.

We have named *T. raymondi* after Mr. Raymond Moore, a fisheries biologist who, in the course of an extensive study of the Barramundi, *Lates* *calcarifer* (Bloch), carried out and directed numerous collecting surveys of the rivers, creeks and swamps of western Papua. It was on one such survey that the specimens of this new species were obtained.

10. References

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11. GAZETTEER

1. Aiome, Utigantz River
2. d'Albertis Junction, confluence of Fly and Alice Rivers
3. Alkmaar, Lorentz River
4. Amanab, Yasi River
5. Baiyer River

6. Bevan Rapids, Purari River (7°17'S, 145°17'E)
7. Bivakeiland, Lorentz River
   Boboa, Lake Murray (7°00'S, 141°30'E)
   Boearim River, tributary of the Sermowai River
8. Boset, Fly River (7°18'S, 141°04'E)
9. Brown River
10. Balimo
11. Digoel River (also spelled Digul)
12. Fly River
13. Goldie River
    Ioka Creek: alternate name for the Utigantz River
14. Jimmi River (also spelled Jimi)
15. Katem, Iwoer River
16. Kiunga, Fly River
    Kone, Purari River (6°59'S, 144°55'E)
17. Lake Jamoer
18. Lake Kutubu
19. Lake Murray
20. Laloki River
21. Lorentz River
22. Maderi plantation
23. Mimika River
24. Morehead Station
25. Nomad
    Noord Rivier: alternate (old) name for Lorentz River
    Ok Mart, tributary of the Alice River, see Rumginae
    Ok Menga, tributary of the Ok Tedi
    Ok Tedi, tributary of the Alice River, see Tabubil
26. Palmer River
    Pangoa, Lake Murray
27. Purari River
28. Ramu River
29. Regeneiland, Lorentz River
30. Rumginae, Ok Mart
    Senamre village, Ok Mart, downstream from Rumginae
31. Sepik River
32. Sermowai River
    Surprise Creek, Palmer River
33. Tabubil, Ok Tedi

34. Tanah Merah, Digoel River
Tiperrse Creek, Morehead Station
Trauna River, tributary of the Baiyer River
Utigantz River, see Aiome
35. Van Weel's Kamp, Lorentz River
Wai Mingi, Palmer River
Wotol Creek, Kiunga
Yasi River, see Amanab

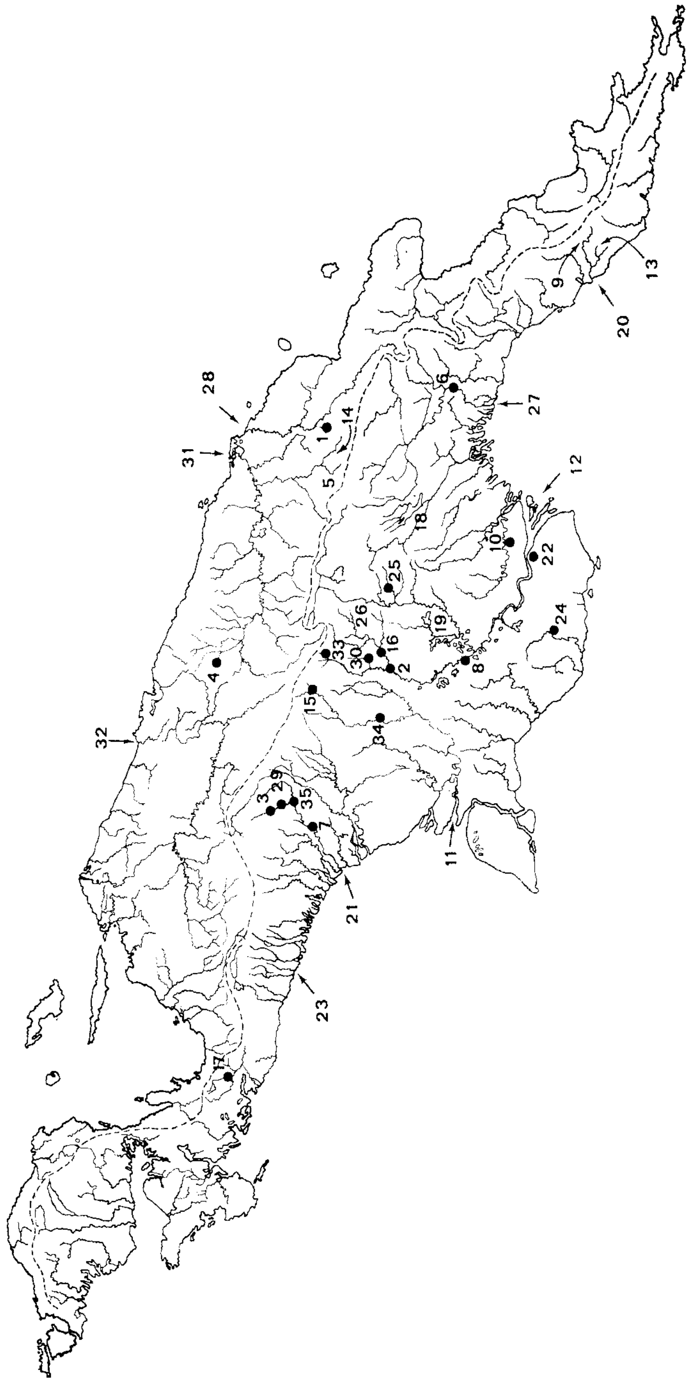

Fig. 15. Map showing localities listed in the gazetteer.