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Zoology. — “*On the fresh-water fish-fauna of New Guinea*”. By Prof. MAX WEBER.

(Communicated in the meeting of November 24, 1906).

In the year 1877 there appeared a “*Quatrième mémoire sur la faune ichthyologique de la Nouvelle-Guinée*”, written by P. J. BLEEKER and containing 341 species. These species are exclusively marine and brackish-water fishes and shew clearly, as might be expected, that the littoral fish-fauna of New Guinea belongs to the great Indo-Pacific fauna which extends from the East coast of Africa to the islands of the Western Pacific.

The same result is arrived at from the lists published by W. MACLEAY in 1876 and 1882, which treat of the fishes of the South coast of New Guinea and Torres Straits. But none of these lists accomplished what BLEEKER desired, namely, to give some insight into the nature of the fresh-water fish-fauna of New Guinea. The information which BLEEKER desired was partly supplied by certain communications, published by W. MACLEAY, E. P. RAMSAY, J. DOUGLAS OGILBY, A. PERUGIA and G. BOULENGER, about fishes caught in the Strickland, Goldie and Paumotu rivers, and in a number of rivulets all situated in the south-eastern part of the island. The number of fishes mentioned amount to about 30, but so long as the fish-fauna of German and Dutch New Guinea remained unknown, it was impossible to give a complete idea of the ichthyological fauna of this big island.

This was the more to be regretted inasmuch as fresh-water fishes are of very great assistance in solving zoo-geographical problems. In using them for this purpose we should however keep well in mind the following points.

If in regions, at present separated by the sea, identical or closely allied fresh-water forms are found, to which the sea affords an insurmountable barrier, one may freely draw the conclusion that these regions were formerly either directly or indirectly connected. Among the fresh-water fishes there are however whole categories which cannot be used as factors in such an argument or only with great caution. These are the migratory fishes and those that can live also in brackish water and indeed even in sea-water.

The so-called law of E. von MARTENS states that from the Poles to the Equator the number of brackish water animals increases. This is also true for fishes and especially for those of the Indo-Australian Archipelago, and in a very remarkable degree for those of the islands east of Borneo and Java. The great Sunda Islands

in consequence of their former connection with the continent of Asia possess a fish-fauna of which the most important elements, both as regards quality and quantity, had no chance of further distribution in an eastern direction. The rivers of the eastern islands of the Archipelago were therefore almost devoid of fishes, and offered a good place of abode for such forms as, though denizens of the sea or of brackish water, possessed sufficient capacity for accommodating themselves to a life in fresh-water. The competition of those Asiatic forms (Cyprinidae, Mastacembelidae, Ophiocephalidae, Labyrinthici etc.), originally better fitted for a fresh-water life, failing, everything was in favour of the immigrants from the sea. The river-fishes of Celebes favour this view, as also does all that we know about the fishes of Ternate, Ambon, Halmahera, etc.

We observe the same phenomenon in the fresh waters of Australia. These however contain also indigenous forms, partly very old, partly younger forms; the latter were obviously, at least in part, marine immigrants, which have accommodated themselves so entirely to a fresh-water life as to adopt the characters of fresh-water fishes.

The fauna of Australia enjoy at present a general and vivid interest — are there not even people who believe that the cradle of mankind stood there? A remarkable point of interest in the study of its fauna is the question how long Australia has been isolated from other parts of the globe. New Guinea plays a prominent rôle in answering this question.

It is therefore a welcome fact that the Dutch New Guinea Expedition of 1903 under the direction of Prof. A. WICHMANN has brought home, besides other treasures, a large collection of fishes from different lakes and many rivers and rivulets, giving us a good insight into the fresh-water fauna of the northern part of the island. It was of great help to me, while studying this collection, that I was able to make use of the fishes collected in the brackish water at the mouth of the Merauke river, by Dr. KOCH the medical man of the Royal Geographical Society's Expedition to South New Guinea. The results of this investigation will be published elsewhere, but some more general conclusions may be mentioned here.

When we reckon up all the fishes known up to the present date from the lakes, rivers, and rivulets of New Guinea, we find that their number amounts to more than 100 species, but only about 40 of these were found exclusively in fresh-water.

A careful examination shews further that the latter species, with a few exceptions, are either known from brackish or sea water at other places, or that their nearest relatives may be found in brac-

lish or sea water. New Guinea shews clearly the fact that immigration from the sea or from brackish water has played and perhaps still plays a predominant part in the populating of its rivers.

Let us now return to the point at issue: namely, that the marine fish-fauna of New Guinea forms part of the great Indo-Pacific fish-fauna and particularly of that of the Indo-Australian Archipelago. Keeping this in mind one might be inclined to draw the conclusion that there is not much to be learned from the fauna of the rivers of New Guinea concerning the history of this island. Such a conclusion however would be erroneous, for it is clear that the very fishes which are characteristic of the fresh-water of New Guinea belong:

1. to genera which outside New Guinea are known only from Australia (*Pseudomugil*, *Rhombatractus*, *Melanotaenia*, *Eumeda*);

2. or to genera nearly related to exclusively Australian genera. *Lambertia* for instance is nearly related to *Eumeda*; *Glossolepis* to *Rhombatractus* and the three new species of *Apogon* are closely allied to Australian ones. Finally the species of *Hemipimelodus* from New Guinea form a special group, distinct from those of the neighbouring Indian Archipelago. Everything that gives to the fresh-water fish-fauna of New Guinea a character different from that of the Indian Archipelago is at the same time characteristic of Australia. Twelve of its species belonging to the genera *Pseudomugil*, *Rhombatractus*, *Melanotaenia*, *Glossolepis*, belong to the family or subfamily of the *Melanotaenidae*, only known from Australia. I do not hesitate therefore to maintain that the river-fishes of New Guinea belong to two groups:

1. A fluvi-marine group, which is Indo-Australian or, if one prefers, Indo-Pacific and which may also be met with, for instance, in Ambon or Celebes. To this category belongs also *Rhiacichthys* (*Platyptera*) *novae-guineae* Blgr. discovered by Pratt in mountain rivers of the Owen Stanley Range four thousand feet high. Boulenger speaks of the discovery of a fish of the genus *Rhiacichthys* "so admirably adapted to life in mountain torrents" as highly interesting. He tells us that the closely allied *Rhiacichthys asper* C. V. is known from Bantam, Celebes and Luzon. This is likely to create the impression that *Rhiacichthys novae-guineae* does not belong to this category, but is a species whose nearest relative is confined to rivers in regions occupied by the Asiatic fauna. *Rhiacichthys asper* however, differing but little from *Rhiacichthys novae-guineae*, was also found by BLEEKER in Sumatra and, what is far more interesting, it occurs, according to Günther, also in Wanderer Bay on the island of Guadalcanar in the Solomon Islands — in "fresh-water". At all events it is thus found close to the sea. This

is also true for a specimen which I described from Ambon and still more so for a specimen that I caught near Balangnipa in the lower part of the Tangka, close to its mouth in the gulf of Boni. The water was here already brackish and ran slowly. *Rhiacichtys* has therefore a very wide distribution, it does not fear brackish water, and its presence in New Guinea loses therewith much of its importance.

2. The second group, the characteristic element, is Australian. This last group requires further explanation as to its origin. In the present state of things, now that New Guinea is separated from Australia by Torres Straits, these offer a barrier impassable to those fishes which I called characteristic. Some species of *Rhombattractus* and *Melanotaenia* may it is true, descend to the mouth of the river and be able to endure even slightly brackish water, but none of the 24 recorded species is known from the sea. The barrier can therefore not be bridged by the group of islands in the Torres Straits. They are too poorly supplied with fresh-water and far too strictly coral islands, even when we leave out of consideration the fact that they are separated from each other, from New Guinea and from Australia by broad tracts of sea with a high salt percentage and strong tidal currents. The simultaneous presence of these characteristic forms in New Guinea and in Australia cannot be explained otherwise than by the existence of a more solid and extensive connection in former ages. This connection must have been so far back in the past that, to take an instance, the representatives of the abovenamed *Melanotaeniidae* had time to separate themselves specifically. And this actually happened; for among the 12 species of *Melanotaeniidae* already known from New Guinea and among the 12 species described from tropical or sub-tropical Australia not one is common to the two regions, although the differences between some species are very small. On the other hand therefore it cannot have been so very long ago from a geological point of view that this connection between Australia and New Guinea existed. How long a time may have elapsed since that period is at present a matter of hypothesis. But if zoo-geographical and more particularly ichthyological experience may venture an opinion, I should seek the period of this connection not earlier than in the pliocene, and the breaking up of it in the pleistocene. Other zoological observations may perhaps be in favour of this supposition.

It will be a long time yet before the last word is spoken on this question. We may express the hope that the new expedition to Dutch Southern New Guinea under the guidance of Dr. H. A. LORENTZ, which intends to investigate especially its big rivers, will bring us further light.