

ON A COLLECTION OF FRESHWATER FISHES OF THE ISLAND OF BILLITON.

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In 1936 and 1937 Mr. F. J. KUIPER, to whom I wish to express my thanks here, presented the Zoological Museum of Amsterdam with several collections of freshwater fishes, made in different streams on the island of Billiton.

The only one, who has reported on fishes from that island is BLEEKER. In 1851 (2) he mentioned 10 marine species, in a paper issued the following year (3) he described 15 freshwater species, collected by Mr. C. DE GROOT. In 1857 (4) he recorded 43 marine and freshwater species and this number increased to 137 in a fourth paper (5). Two later papers in 1858 (6) and 1859 (7) did not add much to our knowledge of the ichthyology of Billiton.

The collections of Mr. KUIPER consist of 41 species. All species recorded by BLEEKER are present, with the exception of the following six: *Glyptosternum platypogon* BLKR., *Leiocassis poecilopterus* (C.V.), *Leiocassis micropogon* (BLKR.), *Ophiocephalus maruloides* BLKR., *Betta picta* (C.V.) and *Mastacembelus maculatus* C.V.

On the other hand, Mr. KUIPER collected the following 22 species, not yet known from Billiton: *Chaca chaca* (H.B.), *Clarias leiacanthus* BLKR., *Cryptopterus macrocephalus* (BLKR.), *Aoria nemurus* (C.V.), *Nemachilus kuiperi* n. sp., *Rasbora lateristriata* (BLKR.), *Rasbora pauciperforata* M. WEB. & DE BERT., *Rasbora dorsiocellata* DUNCKER, *Cyclocheilichthys apogon* (C.V.), *Puntius fasciatus* (BLKR.), *Osteochilus vittatus* (C.V.), *Osteochilus spilurus* (BLKR.), *Fluta alba* (ZIEUW), *Ophiocephalus melanosoma* BLKR., *Ophiocephalus striatus* BL., *Ophiocephalus bankanensis* BLKR., *Ophiocephalus lucius* C.V., *Polyacanthus hasselti* C.V., *Sphaerichthys osphromenoides* CAN., *Trichopodus trichopterus* (PALL.), *Tetodon* (*Crayracion*) *palembangensis* BLKR., and *Mastacembelus billitonensis* n. sp.

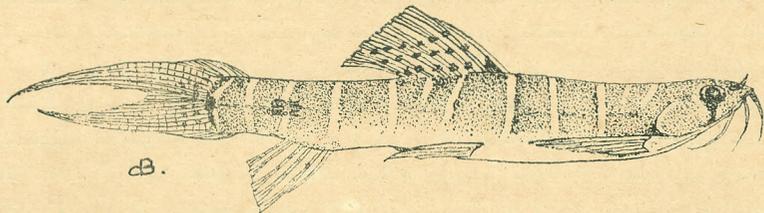
I. Systematic Part.

1. *Megalops cyprinoides* BROUSS.
One specimen 400 mm long.
2. *Chaca chaca* (H.B.).
One specimen, 210 mm long.

3. *Clarias leiacanthus* BLKR.
Three specimens, 190 - 320 mm.
4. *Clarias nieuhofi* C.V.
Five specimens, 233 - 630 mm.
5. *Clarias (batrachus)* BL. ?).
One young specimen, 60 mm long, possibly belongs to this species.
6. *Clarias (teysmanni)* BLKR. ?).
Ten specimens, 52 - 102 mm, probably belong to this species.
- 6a. *Clarias* spec. juv.
Seven specimens, 38 mm long, are too small to identify.
7. *Silurichthys phaiosoma* (BLKR.).
Thirteen specimens. Length 89 - 118 mm.
8. *Cryptopterus macrocephalus* (BLKR.).
Two specimens, 86 mm, differ from typical ones in having shorter maxillary barbels, which reach to anterior rays of anal. Colour brownish, with indications of darker longitudinal bands.
9. *Aoria nemurus* (C.V.).
Five specimens, 96 - 260 mm.
10. ***Nemachilus kuiperi*** n. sp. (Fig. 1).

D.1.8-9. A.i.5. P.9-10. V.i.7. Ll. circa 110. Ltr. $\frac{15}{15}$.

Height 5 - 6 in length, 6.5 - 8.4 in length with caudal. Head 4 - 4.6, 5.1 - 5.9 in length with caudal. Eye 4 - 4.9, with a free orbital margin, slightly more than interorbital space and 1.3 - 2.2 in snout. Nostrils close together, the posterior one an oval opening, the anterior one a tube. Mouth inferior, horse-shoe-shaped. Lips swollen and somewhat papillate. Three pair of barbels, one at corner of mouth, reaching on operculum, but not to gillopening, one pair



Nemachilus kuiperi, n. sp. ($\times 1\frac{2}{3}$).

of maxillary barbels reaching to hindborder of eye and one rostral pair, which is somewhat shorter than the maxillary one. Dorsal truncate, the first divided ray longest and equal to head; its origin about midway between snout and upper caudal rays, somewhat in advance of ventrals, which reach to anus. Anal truncate, the first divided ray longest, shorter than head. First divided ray of pectorals longest, as long as or somewhat shorter than head. Caudal very deeply forked, the lobes pointed, the upper lobe longer than the lower one. Scales cycloid, slightly larger posteriorly. Head naked above, opercular region

scaly. Body completely covered with scales. Lateral line complete. Immediately above and below the lateral line on the caudal peduncle a longitudinal row of 3-6 much thicker, elongate and pointed scales, pigmented with dark along their border and generally with a shining pearly white knob in their centre. In some specimens a few other scales, also immediately above and below the lateral line show a similar pearly knob. Colour of preserved specimens brown above, whitish below, and with 12 light, narrow, crossbars on the back, more or less bordered with dark brown. There is also a faint bar on top of head, connecting the hindborders of the eyes, and a light spot above the opercle. The bars on the back are not symmetrical, often being more developed on one side than on the other. A dark brown band immediately behind the last light bar at base of caudal, forming a still darker patch where it crosses the lateral line. A small dark spot above axil of pectoral. A dark brown band from eye downwards. Dorsal with a deep black patch at base between first and second ray and with three longitudinal rows of black spots. Anal hyaline or with two longitudinal rows of very faint spots. Base of caudal with two transverse rows of dark spots. Pectorals and ventrals hyaline.

Twenty-two specimens, 45 - 69 mm.

This handsome fish, which I dedicate to its collector, resembles in its coloring *N. sayoma* H.B. and still more the fish described and figured under that name by DAY (8, p. 619 and Pl. CLV, fig. 8), which according to HORA (13, p. 57) represents another species, which he called *N. dayi*. *N. kuiperi* differs however by its much more forked caudal, by the belly being scaly, by the dark markings below eye and on base of dorsal, and specially by the peculiar patches of pearly scales on the caudal peduncle. As far as I know, similar patches have never been described in species of *Nemachilus*. It seems improbable, that they represent secondary sexual characters, as they occur in all the 22 specimens examined, and it is hardly believable that these are all of the same sex. Moreover the secondary sexual characters which have been described in species of *Nemachilus* (HORA, 12; VLADYKOW, 16) are of a quite different nature.

N. kuiperi shows also some resemblance to *N. longipectoralis* POPTA, specially in the long pectoral and the deeply forked caudal, but the coloration is quite different and Miss POPTA would certainly have mentioned the patches of pearly scales if they had been present in her specimens.

11. *Rasbora cephalotaenia* (BLKR.).

Eight specimens, 60 - 83 mm.

12. *Rasbora einthoveni* (BLKR.).

Fifty-five specimens, 30 - 65 mm.

In small specimens, 30 - 33 mm long, the lateral line is still incompletely developed.

13. *Rasbora lateristriata* (BLKR.).

Twenty-eight specimens, 32 - 67 mm.

14. *Rasbora pauciperforata* M. WEB. & DE BERT.
Fifty-five specimens, 31 - 54 mm.
In some specimens there is a very pronounced dark band from head to caudal. In others this band is very faint, and sometimes there are traces of red in the light band above it.
15. *Rasbora dorsiocellata* DUNCKER.
Thirty-one specimens, 19 - 55 mm.
Small specimens are much more elongate than larger ones. Possibly this is a sexual difference.
- 15a. *Rasbora* spec. juv.
Three specimens, 29 - 33 mm.
16. *Cyclocheilichthys apogon* (C.V.).
Two specimens, 62 and 155 mm.
17. *Puntius binotatus* (C.V.).
Seventy-one specimens, 41 - 159 mm.
18. *Puntius lateristriga* (C.V.).
Two specimens, 58 and 115 mm.
19. *Puntius fasciatus* (BLKR.).
Seven specimens, 60 - 69 mm.
20. *Osteochilus vittatus* (C.V.).
Twelve specimens, 80 - 187 mm.
All specimens, the large ones as well as the small ones, have only one large pore on the snout. The longitudinal dark lateral band is very conspicuous, and is continued on the head as well as on the caudal.
21. *Osteochilus spilurus* (BLKR.).
Seven specimens, 31 - 85 mm.
22. *Fluta alba* (ZIEUW).
Two specimens, 600 and 800 mm.
23. *Hemirhamphodon phaiosoma* BLKR.
Two males, 76 and 80 mm, and two females, 68 and 69 mm.
Colour of preserved specimens yellowish. The males with two narrow crimson lines, running parallel to each other along sides of body and tail; the females with a faint pinkish lateral band, bordered above and below with dusky.
24. *Hemirhamphodon pogonognathus* BLKR.
One male, 78 mm and seven females, 53 - 70 mm.
25. *Ophiocephalus melanosoma* BLKR.
One specimen, 335 mm.
26. *Ophiocephalus striatus* BL.
Ten specimens, 90 - 290 mm.
27. *Ophiocephalus gachua* H.B.
Five specimens, 65 - 135 mm.
28. *Ophiocephalus bankanensis* BLKR.
Four specimens, 63 - 240 mm.

Reddish violet above, creamy below. A row of blotches, each consisting of a group of black spots, along the middle of the sides of the body. A similar blotch on opercle. A band, also consisting of black spots, from hindborder of eye obliquely downwards, ending on lower part of opercle. Upper part of head with scattered black spots. Similar but smaller spots on lips, on side and underside of head and body. Dorsal and anal light, dark towards the upper margin of the fins, and with rows of black spots. Caudal violet, with rows of black spots. Pectorals with transverse rows of black spots. Ventrals creamy, violet-brown towards their tip. In another specimen the spots, forming the blotches along the sides and on the opercle, and also those forming the band on the head, are diffuse. In smaller specimens the blotches are smaller and consist of smaller spots; the blotches are arranged in two alternating rows in the second half of the body: one above and one below the lateral line. The fins are much darker and the pectorals are black, with irregular white dots and stripes.

29. *Ophiocephalus lucius* C.V.

Seven specimens, 86 - 380 mm.

30. *Ophiocephalus micropeltes* C.V.

Twenty-six specimens, 40 - 78 mm.

These juvenile specimens have only about 70 scales in the lateral line, which is very low.

31. *Anabas testudineus* (BL.).

Five specimens, 74 - 80 mm.

32. *Polyacanthus hasselti* C.V.

Nine specimens, 82 - 111 mm.

Two specimens, 82 and 87 mm, from the same locality differ from the others in being of a sepia colour. Many scales of the body with a narrow dark hindborder, giving to the sides a reticular appearance. A diffuse dark blotch at base of soft dorsal. Moreover the lateral line is continuous, showing only a bend downwards at the point where the lateral line is generally interrupted. The interruption of the lateral line varies a good deal in this species. Sometimes the lateral line ends abruptly, and is continued a few scales lower, but often the continuity is only broken by one scale without tube.

33. *Sphaerichthys osphromenoides* CAN.

Two specimens, 30 and 34 mm.

34. *Betta anabatoides* BLKR.

Fourty-six specimens, 30 - 116 mm.

Among this material there are five specimens, 62 - 92 mm, in which the anal spines are weak, but this may be due to prolonged conservation in formaline. In five other specimens however, 62 - 116 mm, there is a distinct dorsal spine and this character would bring them in quite a different group of the genus *Betta*. I have long hesitated if I ought to create a new species for these specimens, but otherwise they agree so completely with the other

specimens in fin- and scale-counts as well as in the colour-markings, that I have come to the conclusion that the development of a dorsal spine may occur or not in the same species. Possibly the presence or absence of a dorsal spine may be a sexual character. It may be worth noticing that excepting one, the specimens with a dorsal spine are larger than those without.

As said above, all the specimens are alike in colour-markings and this is, I think, not without importance as their coloring differs from what I have seen in specimens of this species from other localities. In all, small and large, there is a double row of black spots, each spot on one scale, along the belly and above the anterior part of the anal fin. Besides, the young ones have distinct longitudinal bands, as HARDENBERG (10) also describes, and traces of these bands are sometimes visible in older specimens.

35. *Trichopodus trichopterus* (PALL.).
Fifteen specimens, 51 - 94 mm.
36. *Luciocephalus pulcher* (GRAY).
Six specimens, 52 - 134 mm.
37. *Nandus nebulosus* (GRAY).
Sixteen specimens, 58 - 137 mm.
38. *Pristolepis fasciatus* (BLKR.).
Two specimens, 62 and 94 mm.
39. *Pristolepis grooti* (BLKR.).
Thirty-seven specimens, 58 - 123 mm.
40. *Tetrodon (Crayracion) palembangensis* BLKR.
One specimen, 142 mm.
41. ***Mastacembelus billitonensis* n. sp.**
D.XXX.56-60. A.III.57-69. P.22. Ll.about 220.Ltr. (between D. and origin of A.) about 36.

Height at origin of anal 8.4 - 12 in total length. Head 6.2 - 7.9 in total length. Eye 12 - 15, situated in the anterior half of the head. Maxillary reaching to below nostrils. Head scaly, excepting above, the scales of the nape reaching anteriorly to above the hind margin of the preopercle. A distinct, flat, triangular preorbital spine. Preopercle without spines. The distance of the origin of the dorsal from the head is equal to the length of the head without snout. Dorsal spines slightly increasing in length posteriorly; the 29th spine much longer than the others and equal to twice the diameter of the eye. Last dorsal spine minute, hidden below the skin. Soft dorsal with a thick membrane, the rays therefore difficult to count, specially posteriorly. No notch between dorsal and caudal. Anal spines close together, at a short distance behind anus, which is situated halfway between tip of snout and tip of caudal. First and second anal spines minute, second as long as snout without proboscis. A very slight notch between anal and caudal. Caudal rounded. Pectorals rounded, more or less than three times in length of head. Lateral line conspicuous, interrupted at several places

of its course, running along upper part of sides on body, and on middle of sides of tail. Colour of preserved specimens light reddish brown. Sides of body and tail with dark brown or blackish transverse blotches, fusing or forming cloudy markings on the back, and tapering into narrow transverse bands towards the belly; sometimes bifurcating or anastomosing with the neighbouring bands. Similar but somewhat broader bands on the isthmus and on the lower side of the head. Upperside of head dark, with a more or less distinct light band from eye to above the extremity of the opercle or continued a little way along the back. Soft dorsal, anal and caudal with a white margin; the rest of the dorsal and anal transversely banded, the bands of the tail continued on the fins. In large specimens these bands have fused and the fins are uniform, blackish with a white margin. Pectorals white, with irregular dark vertical bands.

Three specimens, 236 - 338 mm.

Besides these specimens there are three specimens, 78 - 218 mm, in the collections of the Zoological Museum of Amsterdam, collected by Dr. KARNY in 1921 in the Wai Lima, Lampong District, Sumatra. They agree with the specimens from Billiton, but being smaller, the colour-markings are more distinct than in those from the typical locality.

This species is nearest to the Siamese *M. circumcinctus* HORA (11, p. 475) and *M. taeniagaster* FOWLER (9, p. 136), which is only a colour-variety of the former, but *M. billitonensis* differs in being more slender, with a longer tail and with more rays in the dorsal and anal, and in having the hind border of the preopercle smooth.

II. Ecological and Zoogeographical Part.

Billiton is a low island, most of it being below 100 m above sea-level and only a few hillranges attain greater height, up to 500 m. Torrential species are therefore not to be expected, and the species collected belong to those, which are merely found in ponds and rivers of the lowland. On my request Mr. KUIPER kept apart, as far as possible, the species collected in the lower-, middle, and upper course of the rivers and it may be of interest to publish the results of this attempt to an ecological classification of the freshwater fishes of this island.

The species exclusively found in the lower course of the rivers are *Megalops cyprinoides*, *Fluta alba* and *Anabas testudineus*. The first of these three is a marine species, entering estuaries, the second is known to occur in freshwater as well as in brackish water, and *Anabas testudineus*, the Climbing Perch, is a species with a wide ecological valence. From the other species, collected in the lower course, three have also been found in the middle course, viz. *Clarias nieuhofti*, *Trichopodus trichopterus* and *Luciocephalus pulcher*. One species, the common *Ophiocephalus striatus*, inhabits the whole river from lower to upper course.

The middle course yielded the greatest number of species. Exclusively in this part the following have been found: *Silurichthys phaiosoma*, *Aoria nemurus*,

Rasbora dorsiocellata, *Puntius lateristriga*, *Puntius fasciatus*, *Ophiocephalus bankanensis*, *Polyacanthus hasselti*, *Betta anabatooides*, *Nandus nebulosus*, *Pristolepis fasciatus* and *Pristolepis grooti*. In the middle and in the upper course the following species were caught: *Rasbora cephalotaenia*, *Rasbora einthoveni*, *Rasbora pauciperforata*, *Puntius binotatus* and *Ophiocephalus lucius*. Only two species seem to be restricted to the upper course of the rivers: *Rasbora lateristriata* and *Sphaerichthys osphromenoides*. The former is a species of a wide ecological and geographical range, the second seems to be rather rare everywhere and therefore it may well be a stenotopic species.

Now that, thanks to the investigations of Mr. KUIPER, our knowledge of the freshwater fauna of Billiton has made a good advance, it is of interest to consider it from a zoogeographical point of view.

As has been first pointed out by MAX WEBER (14), the freshwater fish fauna of West Borneo shows more affinity to that of East Sumatra than to East Borneo, the explanation being that during the pleistocene ice-age so much water was assembled in the polar regions in the form of ice, that the sea level in the tropics was considerably lowered. According to MOLENGRAAFF (14) the recession of the sea was such, that the present shallow Sunda Sea, now separating the Greater Sunda Islands, changed into dry land, and the rivers of East Sumatra and West Borneo continued their course on this Sundaland and united into a big stream, which probably discharged into the South China Sea.

In pleistocene times therefore the rivers of West Borneo and East Sumatra had a much longer course than now, and they were in communication with each other. Probably the conditions for the origin of new species were favorable and we may assume that the species now living in these rivers, but not occurring in those of West Sumatra and East Borneo, originated in the drainage system of the pleistocene Sundaland or invaded that area in those times. They belong to what I have called (1) a young pleistocene fauna in contrast to those, which are also found in West Sumatra or East Borneo, and which must belong to an older fauna.

Billiton and Banka must have risen out of the plains of the Sundaland as monadnocks and the water of their rivers must have mixed with those of the Sundaland.

During pleistocene times an intermingling of the freshwater fauna of Billiton with that of Sumatra, Banka, and Borneo must have been possible, and if these postulations are correct we may expect that the present fishfauna of Billiton shows a great similarity with that of the other islands just mentioned.

The collections of Mr. KUIPER contain 41 species. Two of them, *Clarias batrachus* and *Clarias teysmanni* occur with a query in the list. The first has been mentioned by BLEEKER as an inhabitant of Billiton and we may therefore retain it in the list of the true freshwater fishes of that island, but it is safer to leave the second species out of consideration, as being a doubtful case. We also omit *Megalops cyprinoides* from our list, as it is a marine species. This

brings the number of species to 39. We must however add the 6 species recorded by BLEEKER but not collected by Mr. KUIPER, and so we come to a total of 45 species, which we can group as follows: ¹⁾

Billiton, Banka, Sumatra, Borneo.....	28 species.
Billiton, — , Sumatra, Borneo.....	9 species.
Billiton, — , Sumatra, —	4 species.
Billiton, Banka, Sumatra, —	1 species.
Billiton, Banka, — , Borneo.....	2 species.
Billiton, — , — , —	1 species.
Total.....	45 species.

It appears now that one species is endemic: *Nemachilus kuiperi* n. sp. From the remaining 42 occur in Sumatra (93.3 % of the total), 39 in Borneo (86.7 %) and 31 in Banka (68.4 %). All species, excepting of course the endemic one, occur either in Sumatra or Borneo and 37 species (82.2 %) are common to both islands. This is in accordance with our expectation.

Geologically Banka and Billiton are very similar, and there is reason to suppose that they are the remains of an old landmass. In the freshwater fish-fauna there is nothing to support this. The percentage of species Billiton has in common with Banka is less than that of those common to Billiton and Sumatra or Borneo, and all species known from Banka and Billiton also occur either in Sumatra or in Borneo. Also, when we group the species Billiton and Banka have in common according to their probable age, we find that two thirds may belong to the "old" fauna and one third to the "young" or pleistocene fauna, which is the same percentage as that of the species Billiton has in common with Sumatra or Borneo.

The affinity of the fishfauna of Billiton to that of Sumatra is somewhat greater than to that of Borneo. The following species have been found in Sumatra, but not in Borneo: *Rasbora dorsiocellata*, *Rasbora pauciperforata*, *Sphaerichthys osphromenoides*, *Mastacembelus billitonensis* and *Betta picta*. Only the last-named species has also been found on Banka. With Borneo Billiton has two species in common, not known from Sumatra: *Hemirhamphodon phaiosoma* and *Ophiocephalus bankanensis*, both occurring on Banka.

The same slight predominance of the Sumatra-element over the Borneo-element is also apparent in other groups of the fauna (see RENSCH (15) p. 78-81).

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¹⁾ The range outside Sumatra, Borneo, and Banka has not been considered.

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