

**CLARIAS BATU, A NEW SPECIES OF CATFISH
(TELEOSTEI: CLARIIDAE) FROM PULAU TIOMAN,
PENINSULAR MALAYSIA**

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ABSTRACT. - *Clarias batu*, new species, is described from freshwater streams on Pulau Tioman off the east coast of Pahang, Peninsular Malaysia. It is distinguished from its congeners by the following suite of characters: elongated body (body depth at anus 9.0-11.4 % standard length), caudal fin completely separate from the dorsal and anal fins, distance between occipital process and dorsal origin 9.9-11.8 % standard length, and body in life dark greyish-brown above with about 9-14 vertical rows of relatively sparse arrangement of small, well-spaced, cream-coloured spots above the lateral line.

KEY WORDS. - Clariidae, *Clarias*, Peninsular Malaysia, new species.

INTRODUCTION

Catfishes of the genus *Clarias* (Clariidae) are characterised by their slender bodies, dorsal and anal fins with long bases, flat bony head, a broad terminal mouth with four pairs of long barbels, and an accessory air-breathing organ. The genus is found in Southeast Asia and East Asia westwards through India and the Asia Minor to Africa. In Southeast Asia, at least 12 nominal species have been described or identified, of which 6 are presently considered to be valid (Smith, 1945; Kottelat et al., 1993).

Pulau Tioman is an island located in the South China Sea, some 45 kilometres off the southeast coast off the state of Pahang in Peninsular Malaysia. Four species of primary division freshwater fishes are recorded from the island (Lim, 1994), viz. *Puntius lateristriga*, an endemic species of blind cave balitorid loach, *Sundoreonectes tiomanensis*, whose congeners are known only from Borneo not the Malay Peninsula (Kottelat, 1990), and two species of *Clarias*. One of them has been identified as *C. teijsmanni*. The other, with the long body has been previously identified as *C. nieuhofii* (Alfred, 1966; Lim, 1994). These specimens, however, have their dorsal and anal fins completely separate, not fused like those of *C. nieuhofii* sensu stricto. Other characters observed from comparisons with a large series of

this taxon and other *C. nieuhoftii* from Malaysia and Indonesia led to its description herein, as a new species.

MATERIAL AND METHODS

Specimens are deposited in the following institutions: Academy of Natural Sciences, Philadelphia (ANSP); Natural History Museum, London (BMNH); California Academy of Sciences, San Francisco (CAS); the collection of Maurice Kottelat, Cornol (CMK); Malaysian Department of Wildlife, Kuala Lumpur (MDW); Museum National d'Histoire Naturelle, Paris (MNHN); Naturhistorisches Museum, Vienna (NMW), Nationaal Natuurhistorisch Museum, Leiden (RMNH); Department of Zoology, University of Malaya, Kuala Lumpur (UMKL); United States National Museum, Washington (USNM); and Zoological Reference Collection, National University of Singapore (ZRC).

Measurements under 150 mm were made with dial calipers and above 150 mm, with dividers and ruler. The measurements, made from point to point, follow Teugels (1986) with the following exceptions: standard length is measured from the tip of the snout to the posterior end of the hypural complex, length of the caudal fin is measured from the posterior end of the hypural complex to the tip of the longest ray of the caudal fin, and head depth is measured at the tip of the occipital process. All barbel lengths are measured from base to tip. Measurements of bilaterally occurring characters, such as pectoral spine length and pelvic fin length, were made on the left side of the body. Fin ray counts were made from radiographs and follow that of Hubbs & Lagler (1947); number of caudal fin rays given is for the principal caudal rays. Gill raker counts are those on the upper and lower ramus of the first gill arch. Vertebral counts are reported as preanal + postanal = no. of vertebrae (sensu Kottelat & Lim, 1994) and were taken from radiographs, with the fused PU_2+U_1 considered a single vertebra and the vertebrae incorporated into the Weberian apparatus counted as four vertebrae. Numbers in parentheses following a particular count indicate the examined specimens with that count.

Clarias batu, new species

(Figs. 1, 2, 4a, 5a, 7)

Clarias nieuhofti (nec Valenciennes) - Tweedie, 1936: 18; Alfred, 1966: 98.

Clarias aff. *nieuhoftii* - Lim, 1994: 9, fig. 2a.

Prophagorus nieuhofti (nec Valenciennes) - Hora & Gupta: 1941: 43 (in part).

Material examined. - (all localities on Pulau Tioman, Pahang, Malaysia). - Holotype - ZRC 40087, 1 ex., male, 245 mm SL; Sungai Baharu, on right side of Tekek-Juara trail (towards Juara); H. H. Ng et al., 28 Jun.1996.

Paratypes - ZRC 40088, 8 ex., 101.3-228 mm SL; CMK 13010, 1 ex., 167 mm SL; locality data as for holotype. - ZRC 40089, 9 ex., 179-305 mm SL; BMNH 1997.2.4.7-8, 2 ex., 191-263 mm SL; UMKL, 2 ex., 203-255 mm SL; CAS 90501, 1 ex., 250 mm SL; RMNH 33019, 1 ex., 265 mm SL; Sungai Nipah; coll: H. H. Ng et al., 28 Jun.1996.

Others (non-types) - ZRC 2595, 1 ex., 290.0 mm SL; Sungai Sedagong (Sungai Ayer Besar); N. Smedley, Apr.1927 - ZRC 1654, 5 ex., 170-242 mm SL; Sungai Ayer Besar; E. R. Alfred, 28 May.1958. - ZRC 39230, 4 ex., 219-288 mm SL; Sungai Pasal, downstream on trail to rock fall; H. H. Tan et al., 18 Sep.1995. - ZRC 39222, 2 ex., 100.2-183 mm SL; Sungai Ayer Raja at Kampung Genting; P. K. L. Ng et al., 15 Sep.1995. - ZRC 39224, 2 ex., 175-210 mm SL; Sungai Besar waterfall along Tekek-

Juara trail; P. K. L. Ng et al., 16 Sep.1995. - ZRC 39225, 2 ex., 212-224 mm SL; Sungai Durian Kallang, upstream near base of Bukit Paya; P. K. L. Ng et al., 17 Sep.1995. - ZRC 39229, 4 ex., 193-228 mm SL; Sungai Durian Kallang, at rock fall; H. H. Tan et al., 18 Sep.1995. - ZRC 40091, 1 ex., 221 mm SL; Sungai Asah; coll: H. H. Ng et al., 26 Jun.1996. - ZRC 40092, 3 ex., 235-303 mm SL; MDW, 2 ex., 238-280 mm SL; Sungai Paya; H. H. Ng et al., 25 Jun.1996. - ZRC 40090, 3 ex. (with damaged tails, in same series as the nine paratypes, ZRC.40089, 203-235 mm SL; Sungai Nipah; H. H. Ng et al., 28 Jun.1996. - ZRC 41448, 1ex., 255 mm SL; ZRC 41449, 10 ex., 104.7-265 mm SL; Sungai Nipah; H. H. Tan et al., 24 Jun.1997.

Diagnosis. - *Clarias batu* is distinguished from its congeners in possessing the following unique combination of character states: body slender, body depth at anus 9.0-11.4% in SL; distance of occipital process to dorsal fin origin 9.9-11.8% in SL; dorsal and anal fins separate from caudal fin.

Description. - Body cylindrical, relatively long (Fig. 1); in %SL: body depth at anus 9.0-11.4, predorsal length 31.4-34.5, preanal length 43.9-48.0, prepelvic length 36.6-41.8, prepectoral length 16.4-19.8, dorsal fin length 65.4-70.9, anal fin length 51.4-59.8, pelvic fin length 7.2-8.4, pectoral fin length 9.2-12.3, pectoral spine length 5.6-8.8, distance between occipital process and dorsal fin origin 9.9-11.8, depth of caudal peduncle 5.5-7.1, caudal fin length 12.0-15.6, head length 21.2-23.7, head width 15.8-17.9, head depth 9.7-11.3; in %HL: snout length 26.2-32.0, interorbital distance 46.2-49.2, eye diameter 4.8-6.7%HL, width of occipital process 20.8-35.7, length of occipital process 8.7-12.8.

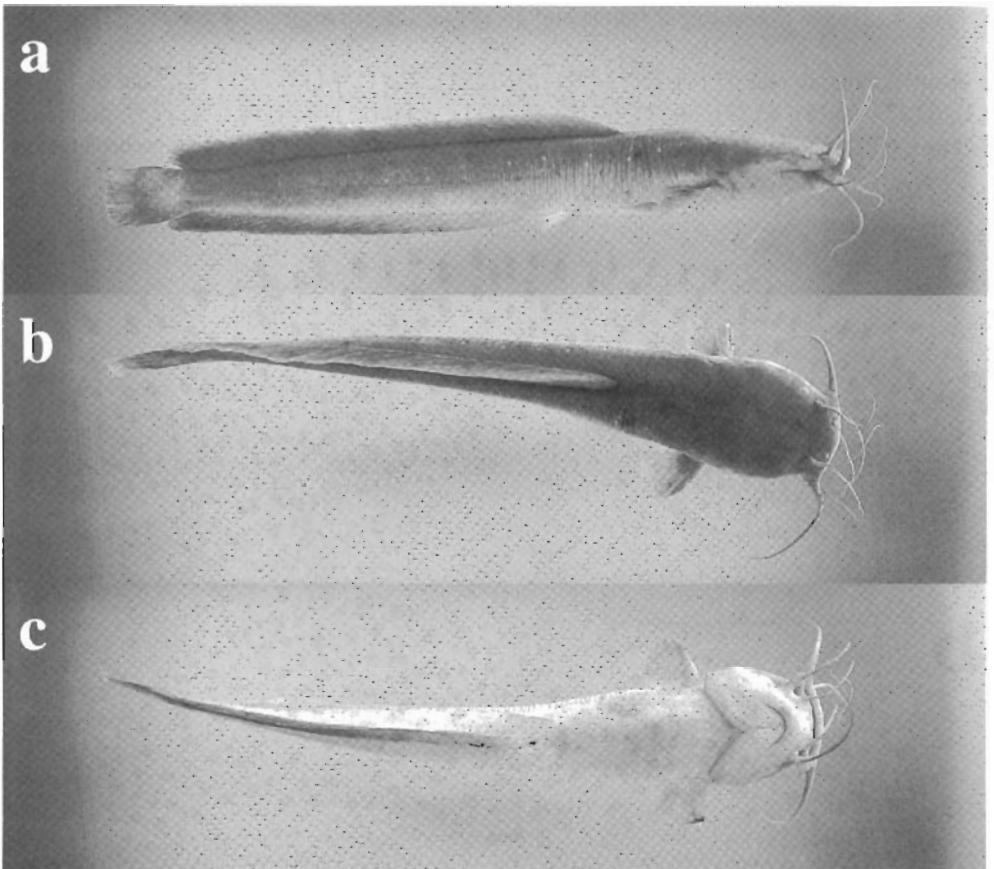


Fig. 1. *Clarias batu*, holotype, ZRC 40087, 245 mm SL; (a) lateral, (b) dorsal and (c) ventral aspect.

Skin smooth. Lateral line median, beginning just after operculum and ending at caudal peduncle. Openings to secondary sensory canals on body arranged regularly on upper part of flanks, in vertical branches above lateral line, often visible as white spots. Eye small and subcutaneous.

Four pairs of barbels with thick, fleshy base, and which taper gradually toward tips; in %HL: length of nasal barbel 62.4-97.5, length of maxillary barbel 115.2-139.0, length of inner mandibular barbel 60.2-77.2, length of outer mandibular barbel 97.0-113.6. Nostril tube short, not extending beyond edge of mouth when directed forwards.

Head large, flat, oval-shaped when viewed from the top, and wider than the body. Dorsal surface of head smooth. Anterior fontanelle short and squat ("sole-shaped" of Teugels, 1986), its anterior edge reaching imaginary line connecting anterior orbital borders; in %HL: length of anterior fontanelle 12.8-16.1, width of anterior fontanelle 4.6-8.3. Occipital fontanelle oval, narrower than anterior fontanelle, its posterior edge reaching imaginary line connecting base of pectoral spines; in %HL: length of occipital fontanelle 6.6-11.2, width of occipital fontanelle 3.7-6.1.

Vomerine toothplate (Fig. 2a) slightly longer and narrower than premaxillary toothplate (Fig. 2b); in %HL, length of vomerine toothplate 8.6, width of vomerine toothplate 26.7, length of premaxillary toothplate 7.7, width of premaxillary toothplate 30.3. Vomerine teeth subgranular, premaxillary teeth villiform. First branchial arch with 17 (2) or 18 (1) gill rakers, 3 (2) or 4 (1) on upper ramus and 14 (3) on lower ramus. Branchiostegal rays 8.

Fin-ray counts: dorsal 67 (1), 68 (2), 69 (5), 72 (1), 73 (1), 74 (1) or 75 (2); anal 61 (1), 62 (3), 63 (2), 64 (2), 65 (1), 66 (2), 67 (2) or 70 (1); pectoral I, 8 (4) or I, 8, i (1); pelvic i, 5 (4) or i, 6 (1); caudal 7/7 (3), 7/8 (1), 8/7 (3), 8/8 (5) or 8/9 (2). Pectoral spine broad, skin-

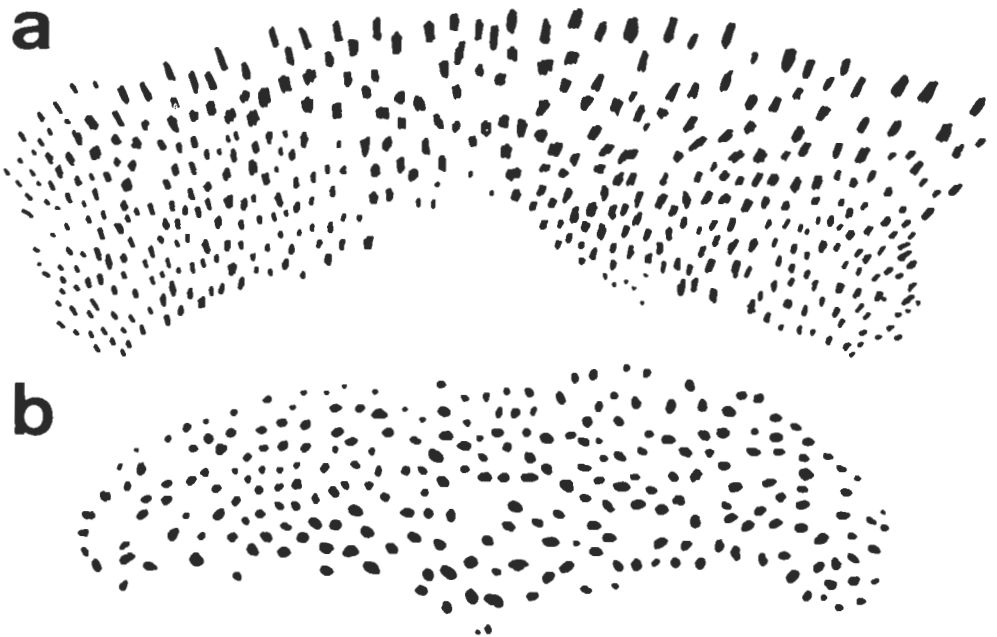


Fig. 2. *Clarias batu*, ZRC 1654, 240 mm SL; (a) premaxillary and (b) vomerine toothplates.

covered, outer margin smooth, inner margin with small medially directed serrae. Posterior margin of dorsal fin rounded, not joined to caudal fin (Fig. 3a). Posterior margin of anal fin rounded, not joined to caudal fin (Fig. 3a). Posterior margin of caudal fin rounded.

Mature males with a white, cone-shaped genital papilla located anterior to the anal fin. Mature females with a round genital protuberance similarly located anterior to the anal fin (Fig. 4).

Vertebral formula: 20-22+46-49=67-71 [21+46=67 (1), 20+48=68 (2), 20+49=69 (1), 21+48=69 (6), 22+47=69 (1), 21+49=70 (2) or 22+49=71 (1)].

Live and freshly-preserved (in 10% formalin) specimens are a uniform dark, brown to greyish-brown above and on the sides, and white below, the line of demarcation sometimes discrete.

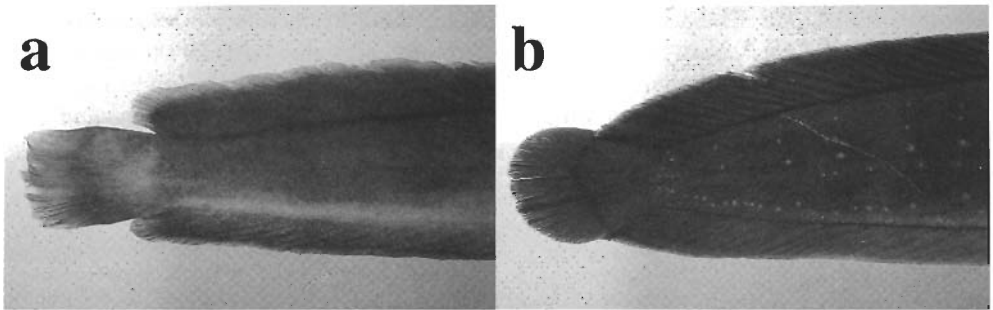


Fig. 3. Comparison of the degree of median fins fusion in (a) *Clarias batu* (ZRC 40087, 245 mm SL) and (b) *Clarias nieuhofii* from Sarawak (ZRC 39743, 308 mm SL).

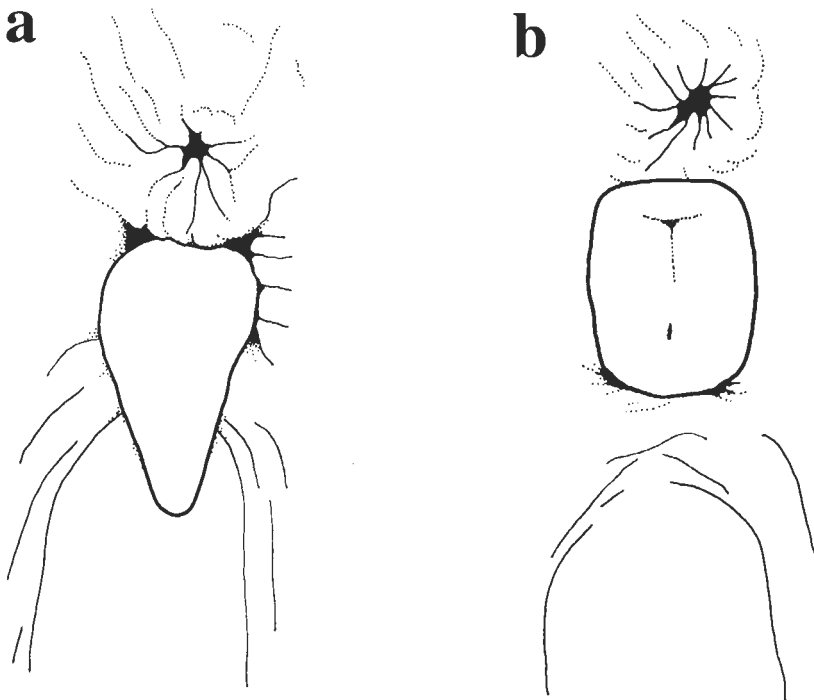


Fig. 4. Genital papillae of *Clarias batu*; (a) male (BMNH, 263 mm SL) and (b) female (BMNH, 191 mm SL).

About 9-14 transverse rows of small white spots along the upper flanks (Fig. 5a). These spots are small and sparse in distribution, ranging from 1-5 per transverse row, corresponding to lateral line pores. The colour of the dorsal, anal and caudal fins as per body, pelvic and pectoral fins opaque white. Fin rays dusky.

Unpigmented specimen with pink eye, creamy-white body and fins.

Distribution. - Apparently endemic to Pulau Tioman. *Clarias batu* has been collected in streams draining the western and southern slopes of the island, and from Sungai Baharu on the eastern slope (Fig. 6).

Etymology. - Batu is Malay for rock and refers to the rock and boulder-strewn torrent streams which it inhabits. It is used as a noun in apposition.

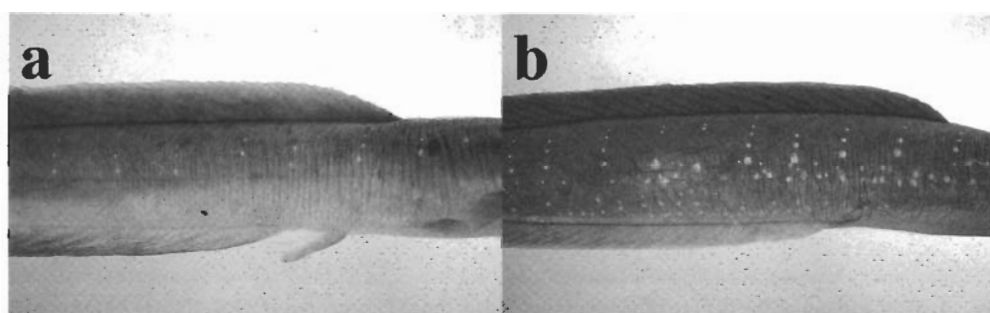


Fig. 5. Comparison of the body colour pattern on the lateral side of (a) *Clarias batu* (ZRC 40087, 245 mm SL) and (b) *C. nieuhofii* from Sarawak (ZRC.39743, 308 mm SL).

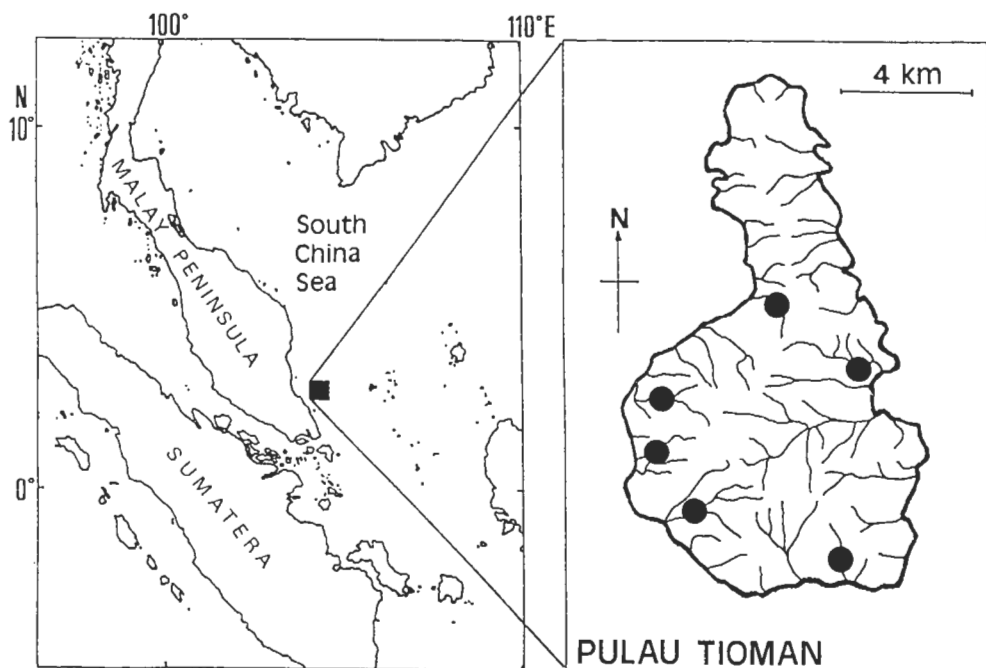


Fig. 6. Map showing location of Pulau Tioman. Circles indicate collection localities.

Ecological notes. - *Clarias batu* has been collected only from the freshwater sections of torrent streams which drain the slopes of the hilly interior of Pulau Tioman. The biotope consists generally of clear, cool, fast-flowing water, with a pH of 6.9 (recorded at type locality on 28 June 1996) over a substrate of sand, rocks and large granite boulders. It seems to be nocturnal, emerging into the open at night. The cyprinid *Puntius lateristriga* and a gobiid *Glossogobius* cf. *celebius* are frequently observed together with *C. batu*. Although *C. batu* is easily baited with strong-scented foods, such as banana fritters, corned beef, chicken offal and rice, it appears to be largely carnivorous, subsisting on small fish, crustaceans, and insects. A gravid female of 180 mm SL had about 140 eggs in the ovaries. On Peninsular Malaysia, *C. teijsmanni* is the only congener found in similar habitats.

Remarks. - On Pulau Tioman, a congeneric taxon closely resembling *C. teijsmanni* is found (Lim, 1994: 9, fig. 2b), but not in sympatric association with *C. batu*. This form can be distinguished by its shorter body (body depth at anus about 14.0 %SL), and its narrower occipital process-dorsal origin distance (5.9-8.2 %HL vs. 9.9-11.8 %HL in *C. batu*). However, this species has thus far, only been found in the drainages on the eastern side of the island, whereas *C. batu* occurs mainly on the western and southern drainages. *Clarias teijsmanni* was however, not collected from Sungai Baharu, the only drainage on the eastern slope where *C. batu* was obtained.

The various species of Asiatic *Clarias* can, for convenience, be classified into two general categories. One category consists of forms with a relatively elongate, slender body (body depth at anus 8.7-12.5 %SL) and the other category consists of forms with stout, deeper bodies (body depth at anus 13.7-17.1 %SL). The former category includes the following nominal species: *Clarias gilli* Smith & Seale, 1906; *C. nieuhofii* Valenciennes in Cuvier & Valenciennes, 1840, and *C. pentapterus* Bleeker, 1851, of which only *C. nieuhofii* is presently considered valid (see below). The latter category includes all other nominal species of Asiatic *Clarias*.

The former category is presently found only in Southeast Asia and it is to these species that *C. batu* appears to be allied. *Clarias* having a relatively elongate and slender body form have not been reported from other parts of Asia. Within this category, only *C. nieuhofii* is presently regarded as valid, all other nominal species being regarded as its junior synonyms; *C. pentapterus* has been synonymised under *C. nieuhofii* by Bleeker (1858) himself, while *C. gilli* has been similarly synonymised by Fowler (1941). Although the type locality of *C. nieuhofii* was given only as "the East Indies", we are unable to find meristic or morphometric differences between *C. nieuhofii* and *C. pentapterus*, which was described from Java. All these nominal species share overlapping meristic characters, i.e. 87-106 dorsal-fin rays, 74-87 anal-fin rays and 74-81 vertebrae; these characters can be used to differentiate *C. nieuhofii* (sensu lato) from *C. batu*. Upon examination of the holotype of *C. gilli* (USNM 55620), we found some differences in the morphometrics that suggest that *C. gilli* may not be conspecific with *C. nieuhofii* (interorbital distance 36.3 %HL in *C. gilli* vs. 40.1-46.4 in *C. nieuhofii*; eye diameter 3.9 %HL in *C. gilli* vs. 5.1-8.0 in *C. nieuhofii*; length of occipital process 7.1 %HL in *C. gilli* vs 8.3-18.2 in *C. nieuhofii*). However, fresh collections of *C. gilli* need to be made, and a large series studied for intraspecific variation before its status can be determined. Pending such a study, we tentatively retain *C. gilli* and *C. pentapterus* as synonyms of *C. nieuhofii*.

Clarias batu most closely resembles *C. nieuhofii* in having an elongate, slender body. It differs from *C. nieuhofii* primarily by its separate dorsal, anal and caudal fins (vs. fused

dorsal, anal and caudal fins) (Fig. 3). *Clarias batu* appears to be the only species of elongate *Clarias* known to have its median fins completely separate from the caudal fin. The other elongate forms in the region have either partially or completely confluent median and caudal fins. Other differences separating the two species are discussed below.

The genus *Prophagorus* Smith, 1939, has been proposed for *C. nieuhoftii* and other species with united dorsal, anal and caudal fins. However, this character is difficult to use on its own. While it is present only in some species, it is also sometimes present in species which usually have the median and caudal fins separated. This is most often the result of damage to the caudal region and subsequent healing and regeneration. For instance, *C. cataractus* (Fowler, 1939) and *C. pulcher* Popta, 1904 (subjective synonyms of *C. teijsmanni* according to Weber & de Beaufort, 1913) were both described as having dorsal and anal fins confluent with the caudal fin. The radiographs of several specimens of *C. batu* with median fins confluent with the caudal fin (ZRC 40090; Fig. 7), and the holotypes of *C. cataractus* (ANSP 84862) and *C. pulcher* (RMNH 7542) confirm that this is indeed true. The caudal region appears asymmetrical and the hypurals are either missing or extremely short and partially fused, confirming that these are teratological cases. This observation has been discussed by previous authors (e.g. Deraniyagala, 1932; Hora, 1936) and Teugels (1986) has synonymised several species of African *Clarias* on this basis. Following Tweedie (1952: 86) and Alfred (1966: 98), *Prophagorus* is herein retained as a synonym of *Clarias*.

Confluent median and caudal fins are, however, a naturally-occurring feature of *C. nieuhoftii*. Examination of the radiographs of the holotype of *C. nieuhoftii* (MNHN B300) and the syntypes of *C. pentapterus* (RMNH 6804) show that the hypural plate is intact, and that the fusion of the median fins is not due to damage to the caudal region and subsequent regrowth. Similarly, fusion of the median fins is noted on 25 specimens identified as *C. nieuhoftii* from the Sabak Bernam area of Selangor (Peninsular Malaysia), Sarawak (Borneo) (Fig. 3b), Pulau Bintan, and Jambi (Sumatra).

Clarias batu can be differentiated from *C. nieuhoftii* by several meristic differences, particularly in the number of vertebrae and the number of dorsal- and anal-fin rays. *Clarias batu* has 67-75 dorsal-fin rays (vs. 87-106 dorsal-fin rays) and 61-70 anal-fin rays (vs. 74-



Fig. 7. Two specimens of *Clarias batu* (ZRC 40090) with confluent regeneration of median fins resulting from damage to the caudal region.

87 anal-fin rays). In the number of vertebrae, *C. batu* (68-71 vertebrae) appears to be intermediate between *C. teijsmanni* (60-64 vertebrae) and *C. nieuhoftii* (74-81 vertebrae).

Another useful character in distinguishing *C. batu* from *C. nieuhoftii* seems to be the relatively large distance between its occipital process and the dorsal fin origin (9.9-11.8 % SL vs. 5.7-9.3 %SL in *C. nieuhoftii*). *Clarias batu* also differs from *C. nieuhoftii* in general body colouration, and the distribution and density of white spots on the flanks. Examination of fresh *C. nieuhoftii* from mainland Peninsular Malaysia, Borneo and Sumatra (see comparative material) have shown that, in life, *C. nieuhoftii* is generally dark grey, and has two parallel rows of densely-concentrated small white spots located below and along the lateral line, and perpendicular to, the 14 or so well-spaced, vertical rows of small white spots (Fig. 5b). There are also white spots scattered across the lower side of the flanks just above the anal fin. Bleeker's (1862: pl. 99 fig. 2) illustration of *C. nieuhoftii* also exhibits this colour pattern. *Clarias batu*, in contrast, is generally dark brown or greyish-brown, and usually lacks the lateral row of white spots across the sides. The vertical rows of small white spots are present, but these are more sparse in distribution and concentration (Fig. 5a). Each vertical row has at most five white spots. Those on the posterior part of the body are often reduced to a single white spot. At Sungai Nipah where part of the type series was obtained, an albino specimen (ZRC 41448) was collected. The occurrence of albinism in Asian *Clarias* has been reported and is commonly seen in *C. batrachus* (Smith, 1945).

With regards to its habitat, *C. batu* has only been collected in small, shallow, boulder-strewn streams with swift, clear water of pH close to 7. However, all recent collections of fishes identifiable as *C. nieuhoftii* have been made in areas in peat swamps, or in lowland streams with acidic water (pH less than 6).

Comparative material . -

Clarias nieuhoftii :

JAVA - MNHN B300, 1 ex., holotype, 375 mm SL; no other data. - NMW 46994, 1 ex., 390 mm SL; Buitenzorg [=Bogor]; D. Adensamer, 1895. SUMATRA - ZRC 37506, 1 ex., 140.2 mm SL; Riau Archipelago, Pulau Bintan N (1°10'26.2"N 104°27'28.3"E); H. H. Tan et al., 25 Apr.1994. - ZRC 37522, 1 ex., 140.3 mm SL; Riau Archipelago, Pulau Bintan, 49 km on highway from Tanjung Uban to Tanjung Pinang; H. H. Tan et al., 24 Apr.1994. - ZRC 38978, 1 ex., 206 mm SL; Jambi, Pasar Angso Duo (fish market) at Jambi; P. K. L. Ng et al., 13 Jun.1995. - ZRC 39093, 3 ex., 212-362 mm SL; Riau, fish market at Rengat; P. K. L. Ng et al., 15 Jun.1995. BORNEO - CMK 6868, 1 ex., 187 mm SL; Kalimantan Barat, Mintas Sembolong, a short cut between meanders south of the Kapuas River mainstream, upstream of Nanga Embaluh. - CMK 10581, 1 ex., 198 mm SL; Kalimantan Barat: Sungai Melawi basin, Sungai Kelawai between Nanga Pintas and about 3 km upstream. - ZRC 39743, 2 ex., 272-308 mm SL; Sarawak, market in Serian, caught by fishermen from Batang Kerang; P. K. L. Ng et al., 14-17 Jan.1996. - ZRC 40071, 3 ex., 194-209 mm SL; Kalimantan Selatan, Banjarmasin, Pasar Kuin (floating market); H. H. Ng & O. Chia, 30 May.1996. - RMNH.6804, 2 ex. (syntypes of *Clarias pentapterus*), 315-317 mm SL; Bleeker collection. MALAY PENINSULA - ZRC 13629, 1 ex., 110.0 mm SL; Johor, Kota Tinggi. Gunung Pantii foothills; P. K. L. Ng et al., 16 Sep.1990. - ZRC 15390, 1 ex., 165 mm SL; Selangor, North Selangor peat swamp forest, Sungei Tenggi; 1991-92 Zoology Honours class, 20 Jun.1991. - ZRC 15391, 1 ex., 129.0 mm SL; Selangor, North Selangor peat swamp forest, stream 0.2 km from 45 km mark on road to Sungei Besar; 1991-92 Zoology Honours class, 17 Jun.1991. - ZRC 15392, 1 ex., 75.8 mm SL; Selangor, North Selangor peat swamp forest, stream at 43 km marker on road to Sungei Besar; 1991-92 Zoology Honours class, 18 Jun.1991. - ZRC 17676-17677, 2 ex., 132.0-226 mm SL; Selangor, North Selangor peat swamp forest; P. K. L. Ng & T. H. T. Tan, 24 Aug.1991. - ZRC 24584, 2 ex., 154-253 mm SL; Selangor, Sabak Bernam (North Selangor peat swamp forest); P. K. L. Ng et al., Jun.1992. THE PHILIPPINES - USNM 55620, 1 ex. (holotype of *Clarias gilli*), 292 mm SL; Mindanao, Rio Grande; Dr. Morse, Oct.1903.

Clarias cataractus

ANSP 64862, 1 ex., holotype, 180.8 mm SL; Thailand: waterfall at Trang; R. M. de Schauensee, 13 Oct. 1936 (photograph and radiograph examined).

Clarias pulcher

RMNH 7542, 1 ex., holotype, 83.5 mm SL; Borneo : Howong; A. W. Nieuwenhuis, 1898.

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