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# FIELDIANA: ZOOLOGY

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## NEW SPECIES OF FRESH-WATER CATFISHES FROM NORTH BORNEO

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### INTRODUCTION

During the course of two zoological expeditions to North Borneo in 1950 and 1956, extensive collections of fresh-water fishes were made. Among them were the new forms described below. Most of the fishes were caught in the Kinabatangan River, the largest in North Borneo, or in its tributaries between Malapi ( $5^{\circ} 30' \text{ N.}/118^{\circ} 16' \text{ E.}$ ) and Kuamut ( $5^{\circ} 13' \text{ N.}/117^{\circ} 30' \text{ E.}$ ). The two principal localities are Deramakot ( $5^{\circ} 17' \text{ N.}/117^{\circ} 33' \text{ E.}$ ) and Lamag ( $5^{\circ} 30' \text{ N.}/117^{\circ} 50' \text{ E.}$ ). A few specimens were obtained in a tributary of the Kalabakan River, which empties into the sea at the extreme southeastern corner of North Borneo. Between 1950 and 1956 the junior author collected additional material from the Segama River, which lies immediately south of the Kinabatangan basin, and from the Labuk River north of Sandakan Harbour.

Abbreviations used are CNHM (Chicago Natural History Museum) and SU (Natural History Museum, Stanford University).

### **Wallago maculatus**, new species

*Holotype*.—Chicago Natural History Museum no. 68038. An adult caught in the Kinabatangan River at Deramakot, Kinabatangan District, North Borneo, on May 5, 1956, by Robert F. Inger and P. K. Chin.

*Diagnosis*.—A *Wallago* with a row of large black blotches below the lateral line, with 56–64 branched anal rays, and with 13–15 branchiostegals.

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*Description of holotype.*—Dorsal i,4; pectoral I,14; ventral i,9; anal ii,64; branchiostegals 14; gill rakers 5 + 13; standard length 332 mm.

Body compressed behind head; dorsal profile concave over eyes, rising to dorsal origin, then horizontal; ventral profile convex; head broad, 3.82, width 1.55 in length; body deepest before ventral insertion, 4.88; snout broadly rounded in outline, flat above, four times eye diameter; nostrils one eye diameter apart, the anterior about same distance from mouth; eye 10.73 in head, 5.5 in interorbital; lower jaw extending beyond upper; maxilla ending below center of eye; both jaws with six or seven irregular rows of depressible, conical teeth, those of inner rows the longest; vomerine teeth in separated oval patches; maxillary barbel ending at level of third or fourth anal ray; mandibular barbel not reaching edge of gill membrane, shorter than ventral fin; gill rakers very stiff, some forked, less than one-fourth length of gill filaments.

Dorsal origin above last third of pectoral, fin shorter than pectoral and slightly longer than postorbital part of head, all rays flexible; pectoral inserted low on side, osseous portion of first ray about 2.5 in head, second and third branched rays longest; pectorals overlapping ventrals; ventrals moderately short, about three-fifths length of dorsal, overlapping origin of anal; anal base 1.6 in standard length; anal narrowly separated from caudal; caudal damaged, deeply forked in paratypes.

Color (shortly after death) olive above, silvery below, with a row of bold dark blotches below lateral line. In alcohol slate above, lighter below, with blotches conspicuous; fins with a very light dusting of melanophores on membranes; dorsal membrane darker; a small black spot at base of caudal.

Measurements (in millimeters): Total length 365; standard length 332; head length 86.9, width 56.1; body depth 68.0; snout 33.9; eye 8.1; interorbital 44.6; anal base 205.

*Paratypes.*—Eleven (CNHM 68033–36) from tributaries flowing into the Kinabatangan at Deramakot; 3 (CNHM 44843, 68037) from the Kinabatangan River at Lamag.

Standard length varies from 86.8 to 320 mm. The maxillary barbel is relatively longer in smaller fishes, overlapping the anterior third of the anal at a maximum. The black blotches have faded in the largest paratype, but were as conspicuous as in all the others when the fish was fresh.

Gill raker counts are 3–5+10–14, total 13–19; they vary with standard length as shown in Table 1.

TABLE 1.—Variation in Gill Rakers on the First Arch in *Wallago maculatus*

Standard length . .	87	87	106	109	114	119	121	125	140	158	163	173	320	332
Rakers, lower limb .	10	11	11	10	11	13	13	12	13	14	12	13	13	13
Rakers (total) . . .	13	15	14	14	15	16	17	16	18	19	16	18	17	18

In the smaller fishes the cores of developing rakers can be seen in the body of the gill arch.

The number of unbranched anal rays also varies with size, the two smallest fishes having four such rays and the two largest only two. The total number of rays, however, is independent of standard length. Counts for the entire series including the holotype are: ii-iv, 56-64, total rays 60-66, mean total  $63.2 \pm 0.5$ ,  $N=13$ .

Other counts and proportions are as follows, again including the holotype: pectoral I, 13-15 (mean I,  $14.1 \pm 0.2$ ;  $N=12$ ); ventral i, 7-9 (mean  $8.6 \pm 0.2$ ;  $N=13$ ); branchiostegals 13-15 (mean  $13.6 \pm 0.2$ ;  $N=14$ ); head 3.74-4.01 (mean  $3.89 \pm 0.03$ ;  $N=12$ ); depth 4.50-5.90 (mean  $5.17 \pm 0.13$ ;  $N=10$ ).

*Comparisons.*—This species is the only known member of the genus that has a row of large black spots low on the sides. Its coloration further differs from that of *miostoma* in having pale dusky instead of black fins. The total anal ray counts (60-66, mean 63) are lower than those of other species, *miostoma* having 64-72, *leeri* 67-73, *tweediei* 70-74, and *attu* 86-93. The branchiostegals (13-15, mean 13.6) are also fewer in number, *miostoma* having 15-16, *leeri* 16-17, *tweediei* about 15 and *attu* 18-20. Information on *attu*, *miostoma*, and *leeri* is from Weber and de Beaufort (1913), that for *tweediei* from Hora and Misra (*in* Hora and Gupta, 1941).

*Wallago maculatus* appears to have more gill rakers than *miostoma* or *leeri*, but the comparison is complicated by the association between standard length and number of rakers. Weber and de Beaufort give 9 as the count for the lower limb of the first arch, and, though the sizes of the fishes from which these counts came are unknown, these counts are lower than those of *maculatus* (see Table 1). A 308 mm. *miostoma* from Singapore (SU 14839) has 5+11 rakers and a 248 mm. *leeri* from Sumatra (CNHM 15744) has 4+11. Thus both of these have smaller counts than correspondingly large *maculatus*. The holotype of *tweediei* has 3+12 rakers (Hora and Misra, *op. cit.*), and since it is from three to four times the size of the largest *maculatus* it probably has fewer gill rakers than the latter at all sizes. *Wallago attu* has 21 rakers on the lower limb of the arch (Weber and de Beaufort, 1913).

**Ompok sabanus**,<sup>1</sup> new species

*Holotype*.—Chicago Natural History Museum no. 44828. Adult female with enlarged ova from the Segama River at the Segama Estate near Lahad Datu, Lahad Datu District, East Coast Residency, North Borneo. Collected May 30, 1950, by P. K. Chin.

*Diagnosis*.—An *Ompok* with 50–65 anal rays, with mandibular barbel overlapping anterior half of anal, and with maxillary barbel somewhat longer.

*Description of holotype*.—Dorsal 4; pectoral I,12; ventral i,6; anal ii,54; branchiostegals 10; gill rakers 3+13; standard length 134 mm.

Head 5.40, slightly depressed over snout; body compressed, dorsal profile slightly convex, rostral-dorsal profile almost straight, a weak concavity behind eyes; ventral profile convex anteriorly; body deepest at anal origin, 3.87; snout short, subequal to eye; nostrils separated by half an eye diameter, anterior one at tip of snout, both mesad from root of maxillary barbel; eye covered by skin, 4.90 in head, 2.60 in interorbital; interorbital 1.90 in head; maxilla ending before orbit and at level of orbital center; teeth pointed, in bands, two to four rows in upper jaw, four rows in lower, vomerine teeth in a single transversely elongate band, constricted at center; maxillary barbel overlapping half of anal; mandibular barbel ending 10 mm. anteriorly.

Dorsal origin just anterior to anal origin, distance from tip of snout 3.2 in standard length, 2.3 in distance to base of caudal; first dorsal ray longer than head minus snout; pectoral inserted low on side, longer than head, stiff portion of spine subequal to head minus snout; ventral small, slightly longer than eye diameter; anal base 1.53 in standard length; a distinct gap between anal and caudal; caudal deeply forked, the lobes pointed.

Color (in alcohol) pale brown, somewhat darker along back; dark humeral spot; a thin mid-lateral black line, ending at caudal base in a diffuse round dark spot; fins hyaline.

Measurements (in millimeters): Total length 167.5; standard length 134.0; head length 24.5; body depth 34.5; eye 5.0; interorbital 13.0; predorsal 41.5; anal base 87.0.

*Paratypes*.—Eleven (CNHM 44829) from the type locality; 99 (CNHM 44830–35, 68024–29, 68031) from the Kinabatangan basin between Malapi and Kuamut; one (CNHM 68030) from a tributary of the Kalabakan River, Tawau District.

<sup>1</sup> Sabah is an old name for North Borneo.

The mandibular barbel may overlap as little as one half or as much as three fourths of the anal. The maxillary barbel is always a few millimeters longer, but it does not reach the caudal.

Variation in counts and body proportions is as follows (including holotype): pectoral I,11-13 (mean I,12.5±0.1; N=13); anal ii,53-64 (mean ii,58.3±0.3; N=44); branchiostegals 9-12 (mean 10.5±0.1; N=32); gill rakers 3-5+10-17, total 13-22 (mean total 17.1±0.3; N=29); standard length 68.8-132 mm.; head 4.23-5.73 (mean 5.18±0.06; N=24); depth 3.91-4.73 (mean 4.18±0.05; N=20).

Males over 100 mm. long have 8-14 (mean 10.9±0.4; N=16) retrorse hooks on the inside of the pectoral spine.

*Remarks.*—This catfish is one of the most abundant fishes in the flat portion of the basin of the Kinabatangan River. At Deramakot the fishermen using cast nets caught more *Ompok sabanus* in the river than any other species and 24 of the paratypes were obtained this way. An additional 22 were caught in the river by means of seines, and 19 others were collected in the mouth of a small, muddy tributary. Significantly, not one was collected in the clear, rock-bottom streams in the Deramakot area, although the single individual from the Kalabakan basin came from a clear-water creek.

*Comparisons.*—This form is similar to *eugeniatus* Vaillant (type locality Kapuas River, southwestern Borneo) from which it differs in pectoral ray and branchiostegal counts and in barbel lengths. The late Dr. L. Bertin (Museum National, Paris) examined the type and paratype of *eugeniatus* and informed us that the pectoral counts of both are I,11. Although the range of pectoral counts in *sabanus* is I,11-13, only one of the 43 counted has 11 rays. A similar overlap occurs in branchiostegal counts, which Dr. Bertin determined as 9 and 9/10 in *eugeniatus*. Only two specimens of *sabanus* have as few as 9, the others ranging up to 12. The counts given for *eugeniatus* of Sumatra by Weber and de Beaufort (1913) agree with those of the type and paratype in both characters.

The lower branch of the first gill arch in Sumatran *eugeniatus* has 12 rakers (Weber and de Beaufort, 1913). One paratype of *sabanus* has 10 and two others have 12. The other 27 *sabanus* counted have from 13 to 17 on the lower limb.

Although individual variation is shown by the barbels, their relative lengths also distinguish these two forms. All known specimens of *eugeniatus* have mandibular barbels exceeding the length of the maxillary and reaching beyond the caudal base. The maxillary is the

longer barbel in *sabanus* and in no specimen does it reach the end of the anal.

*Ompok sabanus* and *O. eugeniatus* are the only Indo-Australian *Ompok* in which the mandibular barbel extends beyond the tip of the pectoral. The first further differs from *borneensis* and *leiacanthus* in having the anal separated from the caudal, from *weberi* in having more anal rays (55–66 as opposed to less than 50 in *weberi*), from *hypophthalmus* in having fewer anal rays (more than 75 in *hypophthalmus*), and from *bimaculatus* in having more gill rakers on the lower limb of the first arch (10–17 as opposed to 9 in *bimaculatus*).

***Kryptopterus parvanalis*, new species. Figure 46.**

*Holotype*.—Chicago Natural History Museum no. 68014. Adult from Kinabatangan River at Deramakot, Kinabatangan District, North Borneo, collected May 6, 1956, by Robert F. Inger and P. K. Chin.

*Diagnosis*.—A *Kryptopterus* totally lacking a dorsal fin, with maxillary barbel usually reaching the end of the preopercle or slightly beyond, and with mandibular barbel shorter than eye diameter.

*Description of holotype*.—Dorsal absent; pectoral I,14; ventral i,7; anal 75; caudal i,15,i; branchiostegals 14; gill rakers 7+19; standard length 201 mm.

Body compressed; dorsal profile straight, with concavity over head; ventral profile convex; head 4.71, flattened above; body deepest at ventral insertion, 4.43; snout broadly rounded, about twice eye diameter; nostrils separated by two-thirds of eye diameter, anterior pair near tip of snout; eye covered by skin, 5.78 in head, 2.45 in interorbital; interorbital 2.36 in head; lower jaw extending beyond upper, maxilla ending before orbit and opposite its lower third; teeth pointed, depressible, in bands of four or five rows in each jaw; pointed vomerine teeth in a V-shaped double row; maxillary barbel reaching end of preopercle; mandibular barbel about one half of eye diameter; gill rakers subequal to filaments, about half eye diameter.

Pectoral inserted in lower half of side, slightly longer than head minus snout, stiff portion of spine less than head minus snout; pectoral overlapping ventral; ventral short, less than twice eye diameter, not reaching anal; anal base 1.7 in standard length; anal narrowly separated from caudal; caudal deeply forked, lobes pointed.

Color (in alcohol) pale brown, much darker along mid-dorsal area; a dark humeral spot; fins hyaline.



FIG. 46. *Kryptopterus paranalis*, new species; slightly reduced.

Measurements (in millimeters): Standard length 201; head length 42.7; body depth 45.4; snout 15.1; eye 7.4; interorbital 18.1; anal base 120; pectoral 33.9.

*Paratypes*.—Sixteen (CNHM 68015–22) from the type locality; 8 (CNHM 44840–42) from the Kinabatangan River between Lamag and Bilit; 3 (CNHM 44837–38) from the Segama River at Lahad Datu; 1 (CNHM 44839) from the Labuk River.

Standard length varies from 57.2 to 244 mm. The maxillary barbel in three does not reach the end of the preopercle; in all others it extends to the end of the preopercle or between the latter and the opercle. The mandibular barbel is minute in all. Variation in counts and proportions (including the holotype) is as follows:

Pectoral I,13–15 (mean I,13.9±0.2; N=19); anal 71–83 (mean 76.1±0.6; N=22); ventral i,6–8 (mean i,7.2±0.1; N=18); branchiostegals 13–16 (mean 14.1±0.2; N=18); gill rakers 4–7 +17–21, total 22–27 (mean 24.3±0.3; N=20); head 4.19–4.92 (mean 4.62±0.04; N=18); snout in head 2.64–3.22 (mean 2.88±0.04; N=13); depth 4.19–5.02 (mean 4.62±0.06; N=16).

The relative eye size decreases with increase in standard length; thus the eye-in-head ratio is 4.98 in a 101 mm. specimen and 6.48 in one 244 mm. long. The interorbital width has a more or less constant relation to head length, the interorbital ratio varying from 2.10 to 2.45, in paratypes 101 to 244 mm.

*Comparisons*.—This form differs from other *Kryptopterus* lacking dorsal fins in the smaller anal count, number of gill rakers, and relative sizes of the barbels. It is most similar to *apogon* Bleeker. However, *apogon* has 78 to 91 anal rays (*parvanalis* 71–83), 15 to 17 branchiostegals (*parvanalis* 13–16, mean 14.1), 5+12–14 gill rakers (*parvanalis* 4–7 +17–21), and maxillary barbels that do not extend beyond the orbit (usually to end of preopercle in *parvanalis*). Data for *apogon* are from Bleeker (1851, 1862) with the exception of the gill raker count. The latter was supplied by Dr. M. Boeseman, Rijks-museum, Leiden.

The Leiden museum has in its collections eight *apogon* placed in one jar by Bleeker. These range in length, according to Dr. Boeseman's measurements, between 119 and 350 mm. Bleeker's (1851) measurements of the four types were 118–175 mm. Bleeker later received additional specimens from the type locality (Bandjermassin, Borneo), from other places in southern and southwestern Borneo, and from Sumatra. In the Atlas Ichthyologique (1862, 2: 92) Bleeker listed twelve specimens (as *micropogon*=*apogon*) with a size



range of 118–320 mm. As the minimum size remained 118, it is highly probable that the smallest specimen measured by Dr. Boeseman (119 mm.) is one of the types. Gill raker count in that specimen is 5+13. The eight *apogon* examined by Dr. Boeseman fall into two sharply marked groups on the basis of gill raker count and size. The smaller group of five, 119–160 mm. total length (standard length 100–137), has 5+12–14 gill rakers. The larger group of three, 260–350 mm. total length (227–300 mm. standard length), has 5–6+20–22 gill rakers. Apparently *micropogon* (= *apogon*) of the Atlas is a composite species. Assuming that the smallest specimen (119 mm.) is actually the smallest member (118 mm.) of Bleeker's type series, *apogon* (or *micropogon*) has gill raker counts of 5+12–14. The identity of the larger specimens remains problematical. The difference in counts of the two size groups is probably not size-dependent, if one can argue by analogy from *parvanalis*, for the latter spans the two size groups without a corresponding dichotomy in gill raker counts.

*Kryptopterus micronema* Bleeker has 86 to 93 anal rays, 14 gill rakers, and a maxillary barbel that does not extend beyond the orbit (Weber and de Beaufort, 1913). *Kryptopterus hexapterus* Bleeker has more pectoral rays (I,16–17), a smaller head (at least 6.5 times in length), and longer barbels (both pairs reaching end of head) than *parvanalis*.

***Pangasius tubbi***,<sup>1</sup> new species. Figure 47.

*Holotype*.—Chicago Natural History Museum no. 68047, from the confluence of the Deramakot River with the Kinabatangan River, Kinabatangan District, North Borneo. Collected May 6, 1956, by Robert F. Inger and P. K. Chin.

*Diagnosis*.—A *Pangasius* with teeth in distinct, elongate vomerine and palatal groups, the two meeting at a point or narrowly separated and forming an oblique angle or arc; maxillary barbel usually reaching base of pectoral; eye large, four to five times in head; anal with about forty rays.

*Description of holotype*.—Dorsal II,7; pectoral I,12; ventral i,5; anal iv,35; branchiostegals 8; gill rakers 5+12; standard length 228 mm.

Dorsal profile horizontal behind dorsal, sloping downward in straight line before dorsal; ventral profile convex, deepest at insertion of ventrals; depth 4.18; head 4.76, subconical; snout blunt; mouth

<sup>1</sup> Named for Mr. J. A. Tubb, formerly Director of Fisheries, Colony of North Borneo.

subterminal; anterior nostril its diameter distant from mouth; nostrils separated by slightly more than diameter of anterior one; posterior nostril above line between anterior nostril and top of orbit; eye large, lower portion cut by horizontal from corner of mouth, 4.94 in head, 3.30 in interorbital; interorbital evenly convex, 1.50 in head, maxillary barbel reaching end of opercle; mandibular barbel reaching below pupil; teeth in jaws small, in bands of three to five rows; vomerine teeth in two transversely elliptical groups narrowly separated, major axis of each group about twice the minor; palatal teeth in similar patches, each group narrowly separated from the vomerine tooth patch; palato-vomerine teeth forming a broad, evenly curved arc.

Dorsal origin above posterior half of pectoral, snout-dorsal distance 2.92 in standard length; dorsal spine moderately strong, with low serrations posteriorly, tip broken (1.75 in head of a 147 mm. paratype); adpressed dorsal not reaching level of anal origin; adipose inserted over last third of anal, base half its height and less than half of eye; pectoral inserted just above horizontal from corner of mouth, pointed; pectoral spine moderately strong, finely serrated posteriorly, subequal to head; ventrals subequal to postorbital part of head, reaching anal origin; anal origin slightly behind center of standard length, its base 3.29 in standard length; margin of anal slightly concave; tips of caudal lobes missing, fin deeply forked in paratype.

Color (in alcohol) grayish, without distinct markings; much lighter on belly; dorsal and caudal faintly dusky; other fins pigmentless.

Measurements (in millimeters): Standard length 228, head 47.9, depth 54.5, snout 17.6, eye 9.7, interorbital 32.0, anal base 69.4, pectoral spine 44.3.

*Paratypes*.—Seven (CNHM 68044–46) from the type locality; one (CNHM 68048) from the Kinabatangan River, ten miles upstream from Deramakot, Kinabatangan District; six (CNHM 44856–59) from the Kinabatangan River near Lamag; seven (CNHM 44860) from the Segama River, near Lahad Datu.

The palatal tooth patches contact the vomerine groups at a point in several specimens. Barbel length varies slightly, the maxillary reaching between the end of the opercle and the base of the pectoral, and the mandibular extending to a vertical from the pupil or from the posterior rim of the orbit.

Variation in body proportions and meristic characters in all specimens is as follows: dorsal II,7–8 (8 in one); pectoral I,11–12 (mean I,11.7±0.1; N=19); ventral i,5; anal iv–vi, 33–38, total rays 38–43

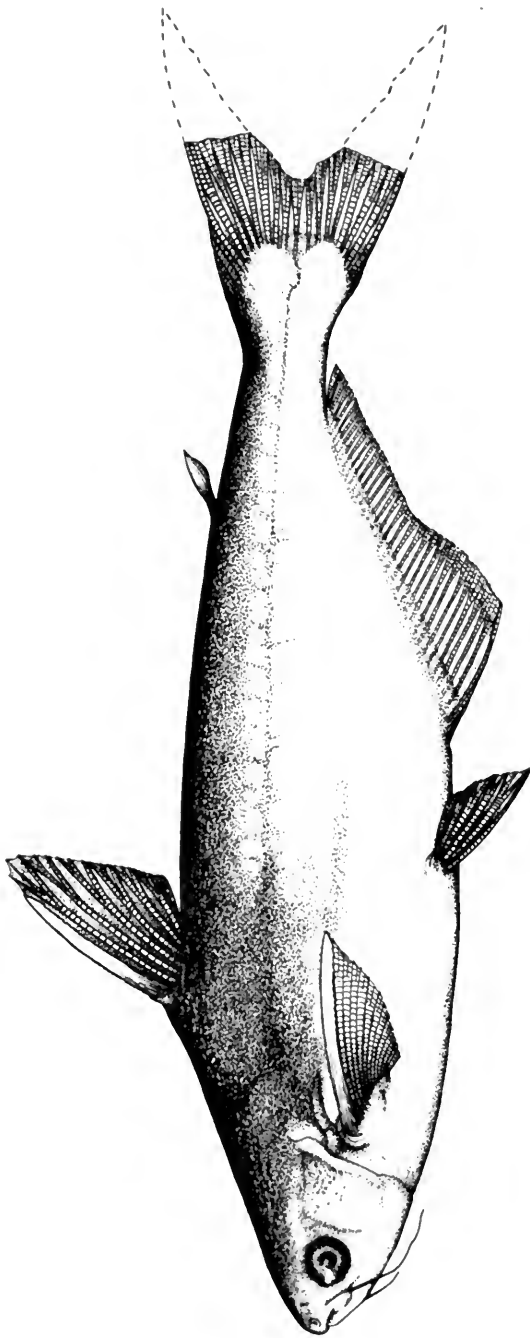


FIG. 47. *Pangasius tubbi*, new species; X 0.8.

(mean  $39.7 \pm 0.3$ ;  $N=20$ ); branchiostegals 7-10 (mean  $8.5 \pm 0.2$ ;  $N=19$ ); gill rakers 3-5+8-12, total 11-17 (mean  $14.0 \pm 0.4$ ;  $N=19$ ); standard length 64.5-228 mm.; head 3.91-5.04 (mean  $4.39 \pm 0.06$ ;  $N=21$ ); depth 3.97-4.94 (mean  $4.39 \pm 0.07$ ;  $N=14$ ); eye 3.91-4.97, ratio increasing with standard length; anal base in standard length 2.99-3.50 (mean  $3.30 \pm 0.04$ ;  $N=15$ ).

*Remarks.*—The holotype was caught in a trammel net. One paratype (68048) was collected with a seine over a gravel bar and seven (68044-46) with a cast net, all in the Kinabatangan River.

*Comparisons.*—The high anal count distinguishes *P. tubbi* from all of its Indo-Malayan congeners except *polyuranodon* Bleeker (type locality Bandjermassin, Borneo), *pleurotaenius* Sauvage (type locality Thailand), *fowleri* Smith (type locality Thailand), and *longibarbis* Fowler (type locality Thailand). *P. pleurotaenius* is distinguished by its lateral black band. The long maxillary barbel of *longibarbis*, reaching the anal, differentiates it from *tubbi*. The maxillary barbel of *fowleri* is smaller than that of *tubbi*; these two forms are further differentiated by the arrangement of the palatal tooth patches, which are perpendicular to the vomerine groups in *fowleri* and oblique in *tubbi*.

The vomerine teeth of *polyuranodon*, in a single large quadrate group of which the two axes are subequal, separate it from *tubbi*. These two species also differ in depth (*polyuranodon* 5.0-5.3) and head (*polyuranodon* 5.2-5.5).

In addition to the high anal count, *tubbi* differs from other Bornean *Pangasius* in the following characters: arrangement and proportions of palatovomerine teeth (*nasutus* Bleeker, *nieuwenhuisi* Popta, and *pangasius* Hamilton), length of barbels (*macronema* Bleeker, *miconema* Bleeker, and *dezmanni* Weber and de Beaufort), and various body proportions.

### **Leiocassis robustus**, new species. Figure 48.

*Holotype.*—Chicago Natural History Museum no. 68001, from the Kinabatangan River at Deramakot, Kinabatangan District, North Borneo. Collected by Robert F. Inger and P. K. Chin on May 12, 1956.

*Diagnosis.*—A *Leiocassis* with head covered by smooth skin; head wide, interorbital longer than snout; pectoral spine more than half head length; maxillary barbel reaching pectoral; adipose distinctly longer than its distance from dorsal; no bands or spots on sides.

*Description of holotype.*—Dorsal II,7; pectoral I,9; ventral i,5; anal v,10; caudal i,15,i; gill rakers 7+13; total length 275 mm.; standard length 223 mm.

Robust; dorsal and ventral profiles about equally convex; depth at dorsal origin 3.42; head subconical, length 3.84, breadth 1.12 in length, depth 1.36 in length; skin of head smooth, no exposed bones posteriorly; occipital process parallel-sided, 8.2 mm. wide at base, 21.8 mm. long, end bifurcated around tip of basal process of dorsal fin; snout blunt, slightly damaged at tip; eye in anterior half of head, small, 8.9 in head length, 4.0 in interorbital; interorbital larger than snout, 2.2 in head; vomerine teeth in a crescentic band, thickest in center; nasal barbel ending somewhat more than one eye diameter behind eye; maxillary barbel reaching base of pectoral; outer mental barbel extending just beyond edge of gill membrane directly behind it; inner mental barbel about half as long as outer.

Dorsal origin much closer to tip of snout than to caudal flexure; spine stout, without teeth, 1.2 in head, osseous portion shorter than first soft ray; dorsal base 1.46 in adipose base; adipose 5.25 in standard length; dorsal-adipose distance 1.33 in adipose; pectoral inserted low on side; spine stout, 1.2 in head, posterior border with 26 strong serrae; tip of pectoral below last rays of dorsal; humeral process bluntly pointed, its post-opercular length once and a half its width and longer than snout; ventral insertion below mid-point of dorsal-adipose gap, separated from anal by an eye diameter; anal origin behind origin of adipose, end opposite that of adipose; anal base 1.33 in adipose; caudal deeply forked, both tips with a short filament; caudal peduncle about 1.5 times its least depth.

Color (in life) dark reddish brown, lighter below; no dark spots or bands; in alcohol uniform slate gray, lighter below; fins dusky.

Measurements (in millimeters): Total length 275; standard length 223; head length 58.2; head width 51.7; head depth 42.9; interorbital 26.4; eye 6.6; dorsal base 29.2; adipose base 42.5; dorsal-adipose 32.0; dorsal spine 47.2; pectoral spine 47.2.

*Paratypes*.—CNHM 68002-3 (5) from the type locality; CNHM 44827 from Lamag, Kinabatangan District, North Borneo.

These agree with the holotype in all characters mentioned in the diagnosis. In all specimens the parallel-sided occipital process meets the basal process of the dorsal fin. The variation in counts and proportions given below includes the holotype.

Dorsal II,7; pectoral I,8-9 (one with 8); ventral i,5; anal v-vi,10-11 (mean branched rays  $10.6 \pm 0.2$ ); gill rakers 5-8+12-15, total 19-22 (mean total  $20.2 \pm 0.5$ ); standard length 103.5-227 mm.; dorsal spine in head length 1.12-1.56 (mean  $1.25 \pm 0.06$ ); pectoral spine in head length 1.19-1.32 (mean  $1.24 \pm 0.02$ ).

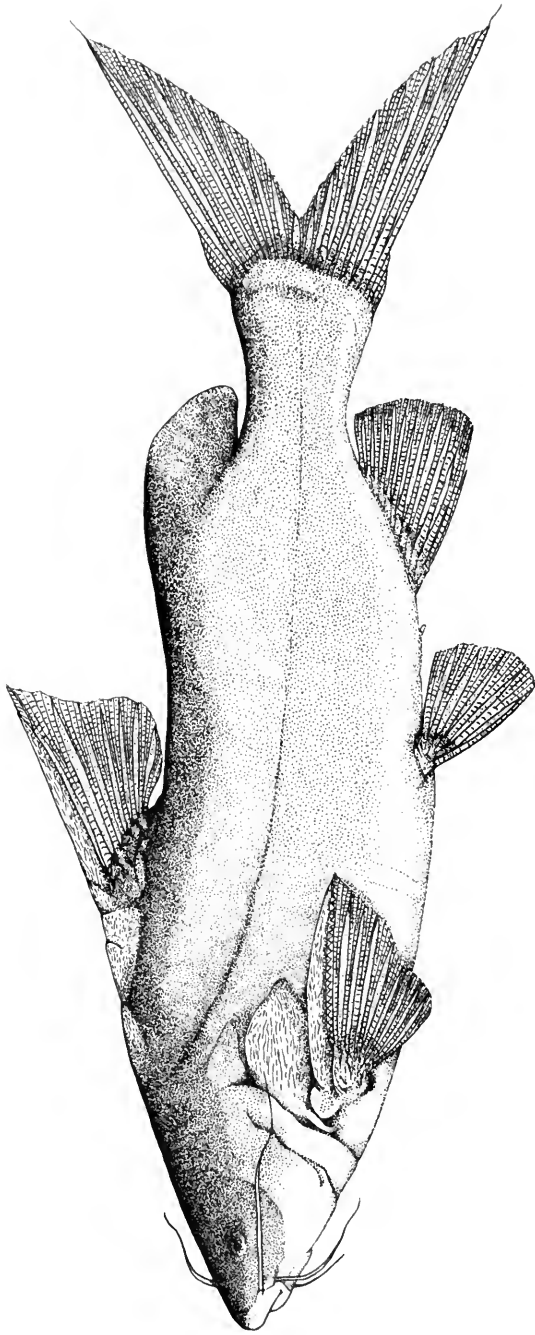


FIG. 48. *Leiocassis robustus*, new species;  $\times 0.7$ .

Certain characters change with age so that mere ranges and averages are relatively meaningless. The data (Table 2) show that as size increases there is also an increase in the number of serrae on the pectoral spine, a relative reduction in head length, a relative widening of the head (shown both by overall head width and by interorbital width), a relative increase in body depth, and a relative increase in the length of the adipose fin.

*Remarks.*—This catfish has been collected so far only in the muddy water of the Kinabatangan River, despite intensive fishing in small, clear tributaries. Six of the seven specimens were caught on hook-and-line baited with earthworms and while the Kinabatangan was in flood. The local people insist that this species can be caught only at high water. No information is available for the seventh fish except that it came from the Kinabatangan River.

*Comparisons.*—The deep body and wide head distinguish *robustus* from all Indo-Malayan *Leiocassis* having the head covered with smooth skin. It also differs from all except *fuscus* Popta and *mahakamensis* Vaillant in the absence of contrasting light and dark spots or bands laterally. The dorsal spines of both *fuscus* and *mahakamensis* are less than half the head length and therefore much shorter than the spine in *robustus*. The distance between dorsal and adipose is longer than the base of the adipose in *fuscus*, *mahakamensis*, and *stenomus* but much shorter in *robustus*.

In addition to the distinctions in body proportions, *robustus* differs from *poecilopterus*, *micropogon*, and *hosi* in the number of serrae on the pectoral spine. Table 2 indicates a correlation between standard length and the number of pectoral serrae in *robustus* so that the inter-specific differences in this character might be questioned. However, the four *Leiocassis poecilopterus* at hand have standard lengths of 141–158 mm. yet have fewer serrae (15–18) than smaller or larger *robustus*. The five *micropogon* available vary from 49 to 97 mm. and all have either 10 or 11 serrae; the largest *micropogon* is roughly the same size as the smallest *robustus* (103.5 mm.) yet has 7 fewer serrae (11 vs. 18).

Both *micropogon* and *poecilopterus* have fewer gill rakers (totals 11–13 and 12–15, respectively) than *robustus* (19–22).

The maxillary barbel, which reaches the base of the pectoral in *robustus*, is much shorter in *micropogon*, *saravacensis*, *baramensis*, *merabensis*, and *hosi*, not extending behind the center of the head in the five last.

TABLE 2.—Ontogenetic Changes in Certain Counts and Body Proportions of  
*Leiocassis robustus*

Standard length (mm.) . . . . .	103.5	135	175	178	205	223	227
Standard length/head length . . . .	3.69	3.64	3.76	3.72	3.76	3.98	3.91
Standard length/body depth . . . . .	4.03	3.66	3.82	3.70	3.42	3.42	3.00
Standard length/adipose length . . .	5.38	5.00	4.29	4.46	4.31	5.26	4.00
Head length/width . . . . .	1.24	1.21	1.22	1.20	1.15	1.12	1.07
Head length/interorbital . . . . .	2.59	2.36	2.40	2.25	2.20	2.21	2.09
Pectoral spine serrae . . . . .	18	20	23	22	24	26	26

***Mystus sabanus***, new species

*Holotype*.—Chicago Natural History Museum no. 68088 from the Kinabatangan River at Deramakot, Kinabatangan District, North Borneo. Collected April 7, 1956, by Robert F. Inger and P. K. Chin.

*Diagnosis*.—A *Mystus* with adipose fin several times length of anal base; median fontanel reaching base of occipital process; nasal barbel not extending beyond end of preopercle; eye five or more in head length.

*Description of holotype*.—Dorsal II,7; pectoral I,10; ventral i,5; anal v,8; caudal i,15,i; gill rakers 6+16; branchiostegals 11; total length 165 mm.; standard length 120 mm.

Dorsal profile rising evenly and rather steeply from tip of snout to origin of dorsal, thence sloping evenly to narrow part of caudal peduncle; ventral profile almost horizontal to anal origin, rising to waist of peduncle; depth 5.24; head moderately broad, scarcely tapering to tip of snout, length 3.64, smooth; fontanel ending at base of occipital process; anterior nostril tubular, near mouth opening; posterior nostril separated from anterior by half an eye length; eye centered between tip of snout and end of preopercle, 5.89 in head, 21.43 in standard length; maxillary tooth band curved, its width about 6 in its length, length of band 2.89 in head, 10.53 in standard length; maxillary barbel reaching caudal, nasal barbel reaching end of preopercle, outer mental barbel almost to ventrals, inner mental barbel beyond gill membrane.

Origin of dorsal two-fifths of distance from snout to caudal flexure; spine moderate, weakly serrated behind, half of head length; margin of dorsal straight, base 1.88 in adipose; adipose half height of dorsal, base 3.19 in standard length; dorsal-adipose distance about one-fourth dorsal base; pectoral low on side; spine stout, weakly serrated behind, subequal to dorsal spine; margin of pectoral straight; ventrals inserted below end of dorsal, not reaching anal, margin weakly convex; anal origin approximately below center of adipose, anal base



2.98 in base of adipose; caudal deeply forked, upper lobe with a long filament.

Color (in alcohol) pale yellowish brown, lighter below; a dark humeral spot; membranes of dorsal, anal, and caudal dusky; other fins colorless.

Measurements (in millimeters): Standard length 120; head 33.0; depth 22.9; eye 5.6; dorsal base 20.0; adipose base 37.6; dorsal-adipose 5.1; anal base 12.6.

*Paratypes*.—CNHM 68061 (1), 68085–87 (6) from the type locality; CNHM 68062 (5), 68089 (3) from the Kinabatangan River ten miles upstream from Deramakot; CNHM 44851 from Segama River at Lahad Datu, Lahad Datu District, North Borneo.

The maxillary barbels of several do not quite reach the base of the caudal. The nasal barbels reach the end of the preopercle in about four-fifths of the paratypes and between the eye and the end of the preopercle in the remainder. The following counts and body proportions include those of the holotype.

Dorsal II,7; pectoral I,9–10 (I,9 in one); ventral i,5; anal iv–v,8–9 (mean of branched rays  $8.4 \pm 0.2$ ; N=10); gill rakers 5–6+14–16, total 19–22 (mean total  $20.5 \pm 0.3$ ; N=10); branchiostegals 9–13 (mean  $10.7 \pm 0.2$ ; N=10); standard length 40.1–152 mm.; head 3.22–3.85 (mean  $3.62 \pm 0.06$ ; N=9); depth 4.24–5.88 (mean  $4.97 \pm 0.18$ ; N=8); eye 4.97–6.57 in head, 17.22–23.93 in standard length; maxillary tooth band 2.70–3.05 in head, 9.50–11.07 in standard length; adipose base 2.80–3.25; anal base 2.45–3.58 in adipose.

*Comparisons*.—The lengths of the adipose fin and the barbels distinguish *sabanus* from all *Mystus* of southeastern Asia except *nigriceps*, *cavasius*, *baramensis*, and *micracanthus*. The last has only a very short fontanel widely separated from the occipital process and is thus sharply distinct from *sabanus*. Furthermore, *micracanthus* has a precaudal spot not found in *sabanus*. The adipose fin is shorter in *baramensis* than in *sabanus*, its distance from the dorsal equaling one third to one half the dorsal base in *baramensis* but at most one fourth (and usually much less) the dorsal in *sabanus*. The barbels of *baramensis* are also shorter than those of *sabanus*, the nasal, for example, rarely reaching beyond the eye in the former but usually to the end of the preopercle in *sabanus*.

Both *Mystus nigriceps* and *M. cavasius* have larger eyes, narrower heads, and longer adipose fins than *sabanus*. Limiting comparison to fishes in the size range 55–135 mm., the head ratios for four Indian

*cavasius*, four from Thailand, two from Sumatra (*nigriceps* or *cavasius*), and seven *sabanus* are, respectively: 4.13–4.45, 4.01–4.47, 3.80–4.56, and 3.22–3.85. Eye in standard length ratios for the same fishes, respectively, are: 13.71–15.31, 14.67–17.60, 12.93–14.76, and 17.22–23.93. The ratios of standard length to length of maxillary tooth bands are, respectively: 12.00–15.69, 17.60–19.72, 16.73–18.42, and 9.50–11.07. The adipose fins in standard length ratios are 2.17–2.26 in two from Thailand, 2.26 in one from Sumatra, and 2.80–3.25 in *sabanus*. Furthermore, young *cavasius* (or *nigriceps*) from Thailand have distinct lateral stripes, which are not found in *sabanus* of the same size. Information on three Indian, two Thailand, and one Sumatran fish was kindly provided by Dr. E. Trewavas and Mrs. A. Martin of the British Museum.

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