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## Notes on the Ichthyology of Surinam (Dutch Guiana)

The Catfish genera *Hoplosternum* and *Callichthys*, with key to the genera and groups of the family *Callichthyidae*<sup>1)</sup>.

by

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### INTRODUCTION

This paper is based on the material of Callichthyid catfishes (genera *Hoplosternum* and *Callichthys*) present in the collections of the Zoological Museum, Amsterdam. The study was induced by some specimens of „kwi-kwi” introduced from Paramaribo by Mr. Arn. J. D'Ailly mayor of Amsterdam. Some of the specimens are still alive in the local aquarium.

Two forms may clearly be distinguished and identified as *Hoplosternum littorale* (HANCOCK, 1828), and *Hoplosternum thoracatum* (VALENCIENNES, 1840), though both are subspecifically different.

The same holds for our material of *Callichthys callichthys*.

Beside the three species reported on in the present paper, material of the other genera and species of *Callichthyidae*, in particular of *Corydoras*, has been studied. On the *Corydoras* species from Surinam I will report at a later date.

Data on behaviour and ecology were supplied to me by Mr. Peter CREUTZBERG, at present marine biological officer in the service of the British Government in Sierra Leone, who attended a Dutch scientific expedition to Surinam in 1948—1949, and by Mr. Ingvar KRISTENSEN of the Zoological Station of the Nederlandse Dierkundige Vereniging (Dutch Zoological Society) at Den Helder.

### Superfamily LORICARIICAE n.n.

*Hypostomatina* GÜNTHER, 1864, Cat. Fishes Brit. Mus. 5: 221—265 (*Argina* l.c.: 222, and *Loricarina* l.c.: 225).

Catfishes, having the anterior and posterior nostrils close together, generally with a short flap between them; lower lip reverted and much

<sup>1)</sup> Received December 16, 1951.

dilated, forming a broad flap more or less deeply notched in the middle (GÜNTHER, l.c. : 221, and further diagnosis).

Three families may be provisionally included, viz. *Astroblepidae*, *Callichthyidae*, and *Loricariidae*. Probably, if more will be known of this group of catfishes, more families will have to be included.

From GÜNTHER's osteological studies and references (laid down in his Catalogue, l.c.), and from the extensive anatomical studies of REISSNER (REICHERT, Arch. Anat. Physiol., 1859: 421—438), and of BRIDGE & HADSON (Phil. Trans. Royal Soc., London, 1893, B. 184; 65—333, pls. 11—19) the close relationship of the *Callichthyidae* and *Loricariidae* may be assumed.

Of all forms involved, *Astroblepus* is especially suitable to serve as a representative of the probable ancestors, having:

- (1) two or more rows of teeth in both jaws. There are teeth in both jaws in *Hoplosternum*, in the lower jaw only in *Callichthys*, few or none in *Corydoras*, and few or none (bifid hooked ones) in all *Loricariidae*.
- (2) *Astroblepus* has a pectoral count of 1/9 to 1/12, whereas this number varies from 1/7 to 1/10 in *Callichthyidae*, and usually 1/6 in *Loricariidae*. This character appears to be of more value than many workers have attributed to it.

For these two reasons, beside several others, I should prefer to consider *Astroblepus* (which moreover is naked) to belong to a distinct family, rather than to a subfamily of the *Loricariidae* (GOSLINE, 1947, Arq. Mus. Nac., 41: 81).

It is for the above reasons also, that I believe *Hoplosternum* to represent an earlier stage in phylogeny than *Callichthys*, which is more advanced in that it has among others, the coracoids not expanded, pectoral count 1/7, dentition reduced to a little patch of small teeth on both sides in the lower jaw only, and a greatly reduced fontanel, which is almost entirely grown over in specimens in the material reported on below.

#### Family Callichthyidae Gill

*Callichthypoides* BLEEKER, 1863, Nederl. Tijdschr. Dierk., 1: 82.

*Loricarina* GÜNTHER, 1864, p.p., l.c. : 225.

*Callichthyidae* GILL, 1872, Arr. fam. Fishes: 19; GOSLINE, 1940, Stanf. Ichth. Bull., 2 (1): 1—29 (revision); GOSLINE, 1945, Bol. Mus. Nac. (Zool.), 33: 72—77; Van der STICHEL, 1946, South American Nematooonath. *Callichthyidae*: 119—133.

Catfishes with two longitudinal rows of scutes Completely covering the sides, two pairs of rictal barbels.

#### KEY TO GENERA AND SPECIES OF *Callichthyidae* (modified after GOSLINE, 1940)

- 1a Snout depressed, the interorbital width greater than or equal to the depth of the head at the anterior margin of the orbit, ..... subfamily *Callichthyinae* n.n.
- 2a Eye more or less superiorly situated, its diameter contained two or more times in its distance from the lower end of the bony opercle,

- 3a Nuchal plates not meeting along mid-dorsal line; coracoids expanded on the surface of the abdomen between pectoral bases; eye 3.8 in the interorbital width,  
 ..... tribe *Cascaduridi* n.n.  
 (genus *Cascadura* ELLIS, 1913)
- 3b nuchal plates fused across midline between the supraoccipital and the dorsal,  
 ..... tribe *Callichthyidi* n.n.
- 4a coracoids expanded on the surface of the abdomen between bases of pectorals; suborbital bones not covered with flesh,  
 ..... genus *Hoplosternum* GILL, 1858
- 5a azygous preadipose scutes extending only one half to two thirds of distance between adipose and dorsal; postorbital a weak vertical rod; no platelet below anterior scute of upper lateral series; all caudal rays of approximately same thickness; body, dorsal, and caudal more or less spotted,  
 ..... — *thoracatum* (VALENCIENNES, 1840)
- 6a head 3-3.35 in standard length; interorbital about 5 in standard length; eye 7-7.25 in head, 4.2-4.6 in interorbital; coracoids in both sexes about 2 eye diameters apart; dorsal with 9 soft rays; pectorals with 7 branched rays, spine in larger males 4.5 in standard length,  
 ..... — *t. thoracatum* ssp.
- 6b head 3.5-4 in standard length; interorbital width about 6 in standard length; eye 6-8 in head, 3-4 in interorbital; coracoids in contact anteriorly or free from each other, about 1 eye diameter apart; dorsal with 7-8 soft rays; pectorals with 8 or 9 branched rays, spine in larger males about 3 in standard length,  
 ..... — *t. surinamensis* new subspecies
- 5b azygous preadipose scutes extending the entire distance between adipose and dorsal; postorbitals well developed, longer than deep; a roundish platelet below anterior scute of upper lateral series; outer caudal rays considerably thickened; body, dorsal and caudal plain in colour,  
 ..... — *littorale* (HANCOCK, 1828)
- 7a head 3-3.35 in standard length; interorbital about 5 in standard length; inner rictal barbels extending to base of ventrals, outer ones to base of pectorals; coracoids anteriorly in contact in males and nearly so in females; azygous preadipose scutes 9-11, normally 10; gill-rakers 7-8+15 in outer series, and 2-3+7 short, knob-like ones in inner series of first arch; length of fontanel 1.5-2 times eye-diameter, its width 2.5-4 in its length,  
 ..... — *l. daillyi* new subspecies
- 7b head 3.5-3.8 in standard length; interorbital width about 6 in standard length; inner rictal barbels extending beyond base of ventrals, outer ones extending beyond base of pectorals; coracoids separate anteriorly in both sexes for at least 0.8 eye-diameter, azygous preadipose scutes 7-10, normally 8; gill-rakers 6 or 7 + 11 or 12 in outer series, and 2+8 or 9 in inner

- series of first arch; fontanel less than 1.5 eye-diameter, its width 2 or less in its length,  
..... — *l. littorale* ssp.
- 4b abdomen between pectorals completely covered with flesh; suborbitals covered with flesh,  
..... genus *Callichthys* SCOPOLI, 1777
- 8a azygous preadipose scutes extending only one half distance to dorsal or slightly more, outnumbering less than 15; depth of head about 1.5 in its length, length less than 4 in standard length,  
..... — *c. callichthys* ssp.
- 8b azygous preadipose scutes extending two thirds to four fifths distance to dorsal, 20 to 23 in number; depth of head about 2 in its length, length 5 or slightly less in standard length,  
..... — *c. bolteni* new subspecies.
- 2b eye lateral, diameter 1.3 or less in distance from lower end of bony opercle,  
..... tribe *Dianemidi* n.n.
- 9a nuchal scutes not meeting dorsally,  
..... genus *Cataphractops* FOWLER, 1915
- 9b nuchal scutes fused across midline between occipital and dorsal,  
..... genus *Dianema* COPE, 1872
- 1b snout compressed or rounded, interorbital width considerably less than depth of head at forward rim of orbit; barbels at either end of mouth not reaching much beyond gill opening; lower lips reverted to form a single pair of short barbels,  
..... subfamily *Corydoradinae* n.n.
- 10a nuchal scutes not meeting above; coracoids more or less expanded; fontanel elongate,  
..... tribe *Corydoradidi* n.n.
- 11a dorsal 1/7-9,  
..... genus *Corydoras* LACÉPÈDE, 1803
- 11b dorsal 1/10-12,  
..... genus *Brochis* COPE, 1872
- 10b nuchal scutes meeting along the midline between occipital and dorsal; abdomen between pectoral bases entirely covered with flesh; fontanel small, roundish,  
..... tribe *Aspidoradidi* n.n.  
..... genus *Aspidoras* VON IHERING, 1907

### Genus HOPLOSTERNUM Gill

*Hoplosternum* GILL, 1858, Ann. Lyc. Nat. Hist., N.Y., 6: 395 (Genotype by original designation *Callichthys laevigatus* VALENCIENNES = *Hoplosternum littorale* HANCOCK).

*Hoplosternum* VAN DER STICHEL, 1946, l.c.: 121-126 (references and description of material in Leiden and Amsterdam).

This genus consists of several species described by various authors, reduced to two variable species by EIGENMANN (1912, Mem. Carn. Mus. 5: 216-219). Most of the synonyms given by EIGENMANN doubtless

are synonyms, but careful examination of old, undescribed material, and newly collected specimens from Surinam, together with a study of living specimens from Surinam, Brazil and (probably) Venezuela, led me to conclude that at least the Surinam specimens represent distinct subspecies of either *littorale* or *thoracatum*. Further investigation of material will certainly provide us with data on which a ready division of both species could be based.

The material of forms from localities other than Surinam in the collections at my disposal is not sufficient to draw any further conclusions, and I therefore provisionally leave all non-Surinam forms of both species in the typical subspecies.

The Columbian/Venezuelan form *H. thoracatum magdalenae* (EIGENMANN, 1913) (described as separate species) will probably prove to be readily subspecifically distinguishable from the Amazonian (typical) form also, and to differ from it in more characters than in the more forked caudal only.

#### **Hoplosternum thoracatum (VALENCIENNES)**

Provisionally divided into three subspecies, *thoracatum*, *magdalenae*, and *surinamensis* ssp.n.

#### **Hoplosternum thoracatum thoracatum (VALENCIENNES)**

*Callichthys thoracatus* VALENCIENNES, 1840, in Cuvier & Valenciennes, 15: 230, pl. 443 (Martinique, Mana).

*Hoplosternum thoracatum* GILL, 1858, l.c.: 396 (Trinidad; since there is doubt about the exactness of the locality given by VALENCIENNES, I would like to consider Trinidad the type locality of this subspecies, the original description in every respect agreeing with specimens from Trinidad).

#### **Hoplosternum thoracatum surinamensis new subspecies**

*Callichthys thoracatus* KNER, 1855, Sitz. ber. Akad. Wiss., Wien, 17: 108 (Surinam).

*Hoplosternum thoracatum* BLEEKER, 1864, Silures de Surinam: 26 (Surinam).

*Hoplosternum longifiliis* BLEEKER, 1864, l.c.: 27, p.p. (Surinam).

Z.M.A. No. 100.292, holotype, best preserved male specimen, 145.2 mm. st.l., leg. de WEGER, 1907, Surinam (? locality).

Z.M.A. No. 100.293, paratypes, 2 males, 154.8 and 122.7 mm. st.l., leg. coll.?, South America (? Surinam).

Z.M.A. No. 100.295, paratypes, 2 females, 117.2 and 85.6 mm. st.l., leg. Max. WEBER, 18 XI 1893, Surinam (? locality).

Z.M.A. No. 100.297, paratype, 1 male, 126.7 mm. st. l., leg. Max. WEBER, 189?, Surinam (? locality).

Z.M.A. No. 100.298, paratype, 1 female, 107.4 mm. st.l., Surinam (Paramaribo), died in Zoo-aquarium, Amsterdam 1949.

Z.M.A. No. 100.299, paratypes, 1 male 93 mm, 5 females, 107.6, 112.0, 101.8, 93.5, 93.0, and 60.5 mm st.l., leg. BOLTEN, 1906, Surinam (Paramaribo).

Z.M.A. No. 100.300, paratype, 1 female, 91.5 mm. st.l., leg. Max. WEBER, 18 XI 1893, Surinam (? locality).

Z.M.A. No. 100.301, paratype, 1 male, 94.0 mm. st.l. ? West-Indies, died in Zoo-aquarium, Amsterdam.

Body compressed, depth greater than width, nearly equal at the end of the occipital. Width of the head almost equal to its length, which is

3.5—4 (3.45—4.15) in standard length. Ventral profile horizontal; dorsal profile hardly descending backwards, and steeply so as from the dorsal spine forwards, with a nearly flat surface. Apex of first nuchal plate circular in juvenils (upto 60 mm. st. 1.), truncate in older specimens; the second plate emarginate.

Fontanel oval, elongate in juvenils (up to 7 long and 2.3 wide, in hundredth of st. 1.), roundish in adults (from 2.6 to 5.8 long, and 2.2 to 2.8 wide, 100th. st. 1.)

Eye 6—8 in head, 3—4 in interorbital. Barbels long, the inner ones reaching to base of ventrals or even to about half-way ventrals, never beyond tip; outer ones beyond base to half-way pectorals, never beyond tip.

Teeth in upper jaw none, in lower jaw a small elongate patch at the sides only.

Sides covered with 24 to 25 scutes in the upper and 22 to 23 in the lower lateral series; both caudal lobes with 2 small platelets at the base; 4 scutes (in one specimen 5) meeting at the dorsal surface behind the dorsal fin. Preadipose azygous plates 7 to 8; all scutes covered with bristles.

D. I/i/7 (seldom I/i/6); A I/i/6 (seldom I/i/5); V. I/5; P. I/8-9; C. i/6-6/i.

Head 24.4—30.0 (hundredth of standard length) depth 26.8—31.6; width 25.0—31.6; depth caudal peduncle 15.2—19.9; snout 9.8—12.8; eye 3.0—5.9; interorbital 17.0—20.0; length dorsal spine 7.6—10.9; anal spine 8.0—13.6; pectoral spine 32.4—36.4 in males, and 16.8—21.0 in females and juvenils; not recurved or claw-shaped in either sex.

Dorsal rounded; anal rounded; caudal truncate; ventrals rounded.

Coracoids close together in males, meeting almost along entire margin; separate less than 2 eye-diameters in females, or nearly so in juvenils, diverging backwards.

*Hoplosternum thoracatum* subspecies; measurements in 100th. of standard length.

subspecies	length of head											length of snout					
	24	25	26	27	28	29	30	31	32	33	9	10	11	12	13	14	
<i>thoracatum</i> <sup>1)</sup>	—	—	—	—	—	—	X	X	X	X	—	—	X	XX	X	—	
<i>surinamensis</i>	1	4	2	1	2	3	2	—	—	—	4	7	4	2	—	—	
males	1	2	1	—	2	—	—	—	—	—	2	3	1	—	—	—	
females	—	2	1	1	—	3	1	—	—	—	2	4	2	—	—	—	
juvenils <sup>2)</sup>	—	—	—	—	1	1	1	—	—	—	—	—	1	2	—	—	
subspecies	depth of body							width of body									
	25	26	27	28	29	30	31	32	25	26	27	28	29	30	31		
<i>thoracatum</i> <sup>1)</sup>	—	X	X	X	X	—	—	—	X	XX	X	—	—	—	—		
<i>surinamensis</i>	1	—	4	1	4	5	1	1	2	2	7	3	1	—	2		
males	—	—	2	—	—	3	1	—	—	—	3	3	—	—	—		
females	—	—	1	1	3	2	—	1	—	1	4	—	1	—	2		
juvenils	1	—	1	—	1	—	—	—	2	1	—	—	—	—	—		

<sup>1)</sup> From literature, including 4 specimens in collections Z.M.A. No. 100291, coll. EIGENMANN, Essequibo (♂ 57.6 mm. and ♀ 58.8 mm.), and Z.M.A. No. 100294, South-America (? locality) (2 ♂♂ 67.0, and 97.5 mm.).

<sup>2)</sup> Juvenils up to 60 mm. standard length.

Colour (alcohol) uniform brownish, some with darker flecks, which are, however, not as conspicuous as in typical subspecies; fins plain.

The specimens from Surinam have 8 soft dorsal rays of which 7 are branched, whereas there are 9 soft rays in the specimens from Gluck Island (Br. Guiana); there are 6 soft anal rays in 9 specimens from Surinam (of which 5 branched ones), and 7 soft anal rays in 7 specimens from Surinam, against only 5 soft anal rays in the Gluck Island specimens. The number of soft pectoral rays in Surinam specimens is 8 in 7 specimens, and 9 in 7 specimens, against only 7 in Gluck Island specimens.

### *Hoplosternum littorale* (HANCOCK)

For the present divided into two subspecies, viz. *littorale*, and *daillyi* ssp.n.

### *Hoplosternum littorale littorale* (HANCOCK)

*Callichthys littoralis* HANCOCK, 1828, Zool. Journ., 4: 244 (Demerara, British Guiana).

*Hoplosternum littorale* EIGENMANN & EIGENMANN, 1888, Proc. Calif. Acad. Sci., Ser. 2, 1 (2): 164 (Surinam, Gurupa, Para, Santarem, Tabatinga, Arary, Silva, Lake Saraca, Villa Bella, Porto do Moz, Lake Hyanuary, Ueranduba).

The type-locality of this subspecies should be restricted to the Demerara river system in British Guiana.

### *Hoplosternum littorale daillyi* new subspecies

*Hoplosternum littorale* EIGENMANN & EIGENMANN, 1888, l.c.: 164, p.p. (Surinam?).

Z.M.A. No. 100.277, holotype, male specimen 116.2 mm. st.l., leg. Mr. Arn J. D'AILLY, 1949, Surinam (near Paramaribo), and paratype, male specimen 110.8 mm. st.l., taken along with holotype, bearing the same data; both died in the Amsterdam aquarium.

Z.M.A. No. 100.261, paratype, female specimen 114.5 mm. st.l., coll. P. WAGENAAR HUMMELINCK, 2 VIII 1948, Surinam, Kwattaweg, in swamp.

Z.M.A. No. 100.821, paratypes, male 123.0 mm., and female 119.1 mm. st.l., leg. Max WEBER, 1893, Surinam (Paramaribo), died in Amsterdam aquarium.

Z.M.A. No. 100.282, paratype, female 107.2 mm. st.l., leg. BOLTEN, 1906, Surinam (Paramaribo).

Z.M.A. No. 100.283, paratype, female 90.0 mm. st.l., coll. ?, South-America (? Surinam).

Z.M.A. No. 100.284, paratype, male 79.0 mm. st.l., died zoo-aquarium, South-America (? Surinam).

Z.M.A. No. 100.285, paratype, male 104.0 mm st.l., leg. Max WEBER, 1889, Paramaribo, Surinam.

Z.M.A. No. 100.286, male 149.0 mm. st.l., paratype, coll. BOLTEN, 1906, Surinam (? locality).

Body compressed, depth greater than width along the whole body. Head as long as broad, length 3—3.35 in standard length; the head being longer in juvenile specimens. Profile is even convex, steep in some specimens.

Fontanel oval, pear-shaped in some, roundish in old specimens and very small (from 5.2 to 11.2 long, and 2.7 to 4.2 broad, 100th of standard length).

Eye 5—7.5 in head, 3.5—5 in interorbital. Barbels long, the inner ones reaching to the base of ventrals, or slightly beyond; outer ones to base of pectorals, seldom beyond.

Scattered minute patches of very small teeth in both jaws.

Sides covered with 25 to 26 scutes in the upper and 22 to 23 in the lower lateral series; both caudal lobes with 2 (exceptionally 3) small platelets at the base. Preadipose azygous plates 9 to 11; all scutes covered with bristles.

D. I/i/7—8; A. I/i/5—6; V. I/5; P. I/8—9; C. i/6—6/i.

Head 29.2—33.5 (hundredth of standard length); depth 29.0—34.4; width 22.5—28.0; depth caudal peduncle 16.0—17.4; snout 9.0—12.5; eye 3.6—5.1; interorbital 18.2—20.0; length dorsal spine 7.8—12.5; length anal spine 6.7—11.2; length pectoral spine 23.2—33.6 in males, 15.6—18.8 in females and juvenils; the spine recurved and claw-shaped in larger males.

Dorsal rounded; anal rounded; caudal truncate to deeply emarginate, the outer rays thickened; ventrals rounded to pointed.

Coracoids in contact or joined along whole length, usually fully exposed, or in very old specimens partly to entirely covered with skin; processes close together anteriorly, diverging posteriorly, not overlapping.

Colour (alcohol) olivaceous to brownish, some specimens with a double series of lighter spots along the flanks; fins dusky, marbled in some specimens.

*Hoplosternum littorale* subspecies; measurements in 100th. of standard length

subspecies	length of head									length of snout				
	26	27	28	29	30	31	32	33	34	9	10	11	12	13
<i>littorale</i> <sup>1)</sup>	X	X	X	—	—	—	—	—	—	X	X	—	—	—
<i>daillyi</i>	—	—	—	1	4	—	4	—	1	1	1	3	3	2
males	—	—	—	1	4	—	1	—	—	1	1	3	1	—
females	—	—	—	—	—	—	3	—	1	—	—	—	2	2
subspecies	depth of body						width of body							
	29	30	31	32	33	34	23	24	25	26	27	28		
<i>littorale</i> <sup>1)</sup>	—	X	X	—	—	—	—	—	X	X	—	—		
<i>daillyi</i>	1	2	1	2	1	3	1	2	2	2	1	2		
males	1	2	1	2	—	—	1	2	2	—	1	—		
females	—	—	—	—	1	3	—	—	—	2	—	2		

<sup>1)</sup> From literature, and including 1 specimen in collection Z.M.A. No. 100.125. coll. EIGENMANN, Georgetown Market (♂ 115.4 mm.).

### Genus *CALLICHTHYS* Scopoli, 1777<sup>2)</sup>

*Callichthys* GRONOW, 1763, Zooph. Gron. Fasc. Anim. Quad. 4: 127 (= *Callichthys* LINNÉ, 1749, Amoen. Acad. 1: 599) (Genotype by monotypy *Callichthys cirris quattuor* GRONOW = *Silurus callichthys* LINNÉ, 1758).

*Callichthys* VAN DER STICHEL, 1946, l.c.: 119—121 (references and description of material in Leiden and Amsterdam).

<sup>2)</sup> Opinion 20 to the International Rules en Zoological Nomenclature accepted the names of GRONOW, 1863. This opinion, however, has been cancelled later on, 4th Meeting I.C.Z.N., Paris, July, 1948 (Bull. Zool. Nom. 4: 66).

Name written *Calichthys* by SCOPOLI (lapsus calami).



The many species constituting this genus were reduced to one variable species by EIGENMANN (1912, l.c.).

### *Callichthys callichthys* (LINNÉ)

Just as with *Hoplosternum*, most of the old species described in this genus will prove to be based on material from localities where the populations are subspecifically distinguished from the typical form. On account of the material available I should like provisionally to recognize two geographical subspecies, viz. *C. callichthys callichthys*, and *C. c. bolteni* ssp.n.

### *Callichthys callichthys callichthys* (LINNÉ)

*Silurus callichthys* LINNÉ, 1758, Syst. Nat. 10 (1): 307 (America).

*Callichthys tamoata* BLEEKER, 1863, p.p., Ned. Tijdschr. Dierk. 1: 82 (South-America; no clear type locality is given and the description is apparently based on material not originating from Surinam only. Therefore *C. tamoata* BLEEKER, 1863 = *C. tamoata* LINNÉ, 1754 = *Silurus callichthys* LINNÉ, 1758).

There can be no doubt but that the material on which the original description of this species by LINNÉ was based did come from Brazil, being the "tamoata" of MARCGRAVE (1648, Hist. Nat. Bras., Pisc. Bras.). The type locality of the typical form should therefore be Brazil, rather than British or Dutch Guiana, and restricted to the district where "tamoata" is the vernacular name.

This subspecies could be characterized by the counts and measurements (in 100th of standard length) expressed by the following figures:

Length of head 19.0—22.0; depth of head 18.0—20.0; preadipose plates about 12, covering about half the distance to the last dorsal ray; pectoral spine not very strongly armed in either sex; usually 29 lateral scutes in the upper series; fontanel usually very small or entirely grown over.

### *Callichthys callichthys bolteni* new subspecies

*Callichthys tamoata* BLEEKER, 1864, p.p. Silures de Suriname, p. 22 (It is not clear from his description, whether the material examined by BLEEKER, is identical with the present subspecies. Since the name "tamoata" is used by BLEEKER (1863, and 1864) not readily in connection with Surinam forms only, it should be considered a synonym. Moreover it seems inadvisable to connect this vernacular name of the typical form with populations from other localities).

Z.M.A. No. 100.303, holotype, female 112.6 mm. st.l., leg. Max WEBER, 1895, Surinam (? locality), taken along with paratypes, male 111.1 mm, and female 99.7 mm. st.l.

Z.M.A. No. 100.305, paratype, female 92.8 mm. st.l., coll. ? (Surinam).

Z.M.A. No. 100.307, paratype, female 88.6 mm. st.l., leg. Max WEBER, 1893, Surinam.

Z.M.A. No. 100.308, paratype skeleton and armature of specimen of about 100 mm. st.l., leg. Max WEBER, Surinam.

Z.M.A. No. 100.313, paratypes, male 142.0 mm. and female 131.4 mm. st.l. leg. BOLTEN, 1906, Surinam (Paramaribo).

Z.M.A. No. 100.314, paratype, male 137.4 mm. st.l., leg. BOLTEN, 1907, Surinam (? locality).

Body more or less rounded, depth at dorsal spine equals width. Head flat, broad, depressed; its length 4.2—5, its width 3.4—3.7 in standard length. Body and caudal peduncle gradually compressed backwards. Profile steep; fontanel circular, very small to fully grown over in large specimens. Occipital broad, with short and broad, rounded process. Suborbitals covered with skin.

Eye small, 2.6—3.2 in snout, 8—9 in head, about 6 in interorbital.

Mouth terminal. Upper jaw toothless, lower jaw with small patch of minute teeth on either side.

Lateral scutes leaving naked area on dorsal and ventral surfaces, 27—29 in the upper, and 26—28 in the lower series; 3 small platelets at the base of both caudal lobes.

Preadipose azygous plates 18 to 23, not meeting lateral scutes. All scutes covered with bristles.

D. I/i/7 (8); A. I/i/5; V. I/5; P. I/7; C. I/6—6/i.

Head length 20.0—24.5 (in 100th of standard length); head depth 15.2—18.4; head width 26.5—29.8; body depth 21.0—25.7; depth caudal peduncle 14.1—20.6; snout 5.9—8.4; eye 2.0—2.9; interorbital 15.5—18.0; length dorsal spine 2.3—5.2; length anal spine 2.3—4.2; length pectoral spine 19.0—26.0 in males, 14.1—16.5 in females and juveniles; spine not claw-shaped though slightly recurved at the tip in older males; outer margin of spine densely covered with bristles.

Dorsal rounded, anal rounded, when depressed reaching in males beyond, in females up to base of caudal. Caudal broadly rounded; ventrals rounded to slightly pointed.

Colour (alcohol) dark bluish-brown; fins dusky with dark roundish spots in most specimens.

*Callichthys callichthys* subspecies; measurements in 100th. of standard length.

subspecies	length of head											length of snout				
	19	20	21	22	23	24	25	26	27	28	29	6	7	8	9	10
<i>callichthys bolteni demararae</i> <sup>1)</sup>	X	X	X	X	—	—	—	—	—	—	—	X	X	—	—	—
	—	1	—	—	2	2	3	—	—	—	—	1	4	3	—	—
	—	—	—	—	—	—	—	X	XX	X	—	—	—	XX	X	X
subspecies	depth of body							depth of head								
	20	21	22	23	24	25	26	13	14	15	16	17	18	19	20	
<i>callichthys bolteni demararae</i> <sup>1)</sup>	—	—	—	X	X	X	—	—	—	—	—	—	X	X	X	
	—	1	3	2	1	1	—	—	—	1	3	2	2	—	—	
	X	XX	X	—	—	—	—	X	X	XX	—	—	—	—	—	

<sup>1)</sup> I provisionally consider the Demarara specimens as described by EIGENMANN (1912), including Z.M.A. No. 100.304, coll. EIGENMANN, Demarara, British Guiana, a distinct subspecies on account of the differences stated above. The measurements of the Demarara specimen at hand are indicated by xx. This geographical subspecies is further distinguished in having only 10 (specimen at hand) azygous preadipose plates, reaching to half-way the distance to last dorsal ray. Its colour (alcohol) is bluish, mottled.

SOME NOTES ON BEHAVIOUR AND ECOLOGY. — The members of the sub-family *Callichthyinae* (tribe *Callichthyidi*) are peculiar inhabitants of the enormous swamps of South-American river systems. They have adapted themselves to the repeated drying up of the swamps by developing intestinal respiration.

In the dry season they are often found in thousands together, partly covered with mud, waiting for the first rains to arouse them. They at once start courtship. The males build their "bubble-nests" (much as the Anabantid fishes do) between reeds and grasses, using plant particles to make it solid. Then the females are invited to deposit their eggs in it, whereas the nest and eggs, and later on the newly hatched young are cared for by the father.

It has been proved that even in large tanks with plenty of water, and a good supply of oxygen, a sudden shower is the only way of inducing these fishes to reproduce, to start building their nests. It seems unnecessary that the tank should have dried up before. Only water introduced from above, like a shower in nature, seems to be the sign that the coast is clear for offspring, which would not be able to survive the dry period. It need not even be fresh water or rain water, for water taken from the tank and brought back by means of a watering-can works quite the same. The day after the shower, it be artificial or not, the males start blowing bubbles.

**Photomechanical reproduction**