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Two New Catfishes of the Genus *Parasilurus*  
found in Lake Biwa-ko

By

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So far as the genus *Parasilurus*<sup>1)</sup> is concerned, there has been known only one species *P. asotus* (LINNÉ), recorded from Japanese waters including Lake Biwa-ko (Lake Biwa).

In the course of his study on the fish fauna endemic to Lake Biwa-ko the author has been able to distinguish three forms of catfishes inhabiting there; variations found in these forms being not reducible to a range of fluctuations of one species, *P. asotus*. After a detailed comparative study, it has been revealed that there was no intermediate between any two of these forms and that morphological discrepancies among them well accorded with the differences in their habitats.

In view of the range of variations found in a lot of specimens of *P. asotus* obtained from various districts of Japan and from other parts of the continent, the author has come to a conclusion that two of the three forms of catfishes found in Lake Biwa-ko must be described as new species endemic to that district. The third form is no other than the common catfish, *P. asotus*, which is widespread in Japanese waters.

The following diagnoses were prepared on the basis of specimens in both fresh and preserved conditions. The counts and measurements were generally made according to the standard practice outlined by MATSUBARA (1955), except for a few special cases which will be remarked in each paragraph. The counts and measurements on the holotype will be given first and those on the paratypes in parentheses.

**Key to the Japanese species**

- 1(2) Mandibular barbel quite feeble. Caudal unequal, with upper lobe much longer than the lower. ....*Parasilurus biwaensis* n. sp.

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1) The author prefers to refrain from making a discussion about the generic name, though HORA (1936) considered that the difference between *Parasilurus* and *Silurus* of generic value was only a matter of a minor difference in regard to mandibular barbels.

- 2(1) Mandibular barbel normal. Both lobes of caudal fin nearly equal in length.  
 3(4) Eye protruded noticeably so as to be seen from below. ....  
 ..... *Parasilurus lithophilus* n. sp.  
 4(3) Eye normal, invisible from below. .... *Parasilurus asotus* (LINNÉ).

### 1. *Parasilurus biwaensis* n. sp.

(Fig. 1)

—Biwako-ohnamazu (new Japanese name)—

*Holotype*: MIKU (Marine Biological Institute of Kyoto University) No. 34407, a female nearly mature specimen, 672 mm in standard length (750 mm in total length), collected from off-shore of Onoé, on May 11, 1961.

*Paratypes*: Three specimens: MIKU No. 34408, first specimen (mature male), 780 mm in standard length (872 mm in total length), collected at Ohsaki, on July 26, 1958; MIKU No. 34409, second specimen (mature female), 850 mm in standard length (946 mm in total length), collected on the rocky shore of Chikubushima, on June 29, 1961; MIKU No. 34410, third specimen (young male), 465 mm in standard length (528 mm in total length), collected at Suga-ura, on June 13, 1961. All the localities of these specimens are restricted to the northern part of Lake Biwa-ko.

*Description*. D. 5 (5-6); A. 80 (77-82)<sup>2)</sup>; C. 15 (17-18); P. I, 15 (I, 13-15); V. 14 (12-13); branchiostegals 16 (14-17).

Head 4.4 (4.3-4.4) in standard length; depth 6.0 (4.8-5.4); width 6.9 (5.9-6.7); depth of caudal peduncle 23.0 (17.5-20.5); height of dorsal fin 14.5 (13.5-16.5); same of anal fin measured at mid-point 16.5 (14.0-17.5); longest pectoral ray 9.3 (9.1-10.0); predorsal length 3.2 (3.0-3.3); preanal length 2.1 (2.0-2.2).

Eye 11.5 (10.5-12.5) in head; interorbital width (distance between inner rims of both eyes) 2.00 (2.00-2.05); width of head 1.45 (1.30-1.35); snout (distance from tip of snout to the line across front of eyes) 3.6 (3.8-4.3).

Body elongate and compressed posteriorly as in *P. asotus*. Dorsal side of body generally horizontal in profile, but lower outline gently declining outwards from mandible to the base of pelvic fin, then running straightly backwards to the base of caudal fin. Trunk well developed. Pectoral extending slightly beyond the end of base of dorsal fin; depressed dorsal scarcely reaching a vertical through the base of pelvic fin; ventral extending somewhat beyond the origin of anal fin.

Head depressed and elongate; snout rather long but the anterior margin truncated in dorsal view. Mouth broad, mandible projecting far beyond upper jaw when mouth is closed.

2) The first paratype measuring 780 mm in standard length is excluded from the description because of its abnormal condition of fin rays.

Teeth on both jaws arranged in a broad villiform band which is so curved as to form a patch of horse-shoe shape; vomerine teeth band rather broad, but constricted at middle.

Small eye directs supro-laterally; margin of eye distinct; interorbital space broad and flat.

Nostrils far apart; nasal tube small and almost hidden in surrounding skin. Barbels rather poorly developed; the premaxillary one nearly reaching the base of pectoral fin, taking 67% (58-88%) of head length (in two mature paratypes the barbel extending merely to opercle); mandibular one short and very feeble, measuring 14% (7.3-9.5%) of head length; ratio of premaxillary to mandibular, 6.1 (6.1-9.2).

Gill membranes on both sides free from isthmus and slightly overlapping.

Dorsal fin with narrow base, widened distally. Caudal fin with distinct unequal lobes, the superior lobe decidedly larger than the inferior one. Anal fin continuous into caudal fin. Integument covering anal ray rather thin, the height measured from the base of the fin attaining 71% (70-83%) of ray length at mid-point. Pectoral stretching out, triangular in outline. Outer edge of pectoral spine roughened with weak serrations; inner edge serrated weakly in female, strongly in male (these features agree well with those of *P. asotus*). Pelvic fin small and rounded.

Numerous minute pinhole-like structures present on dorsal part of head and also on both dorsal and lateral surfaces of body. Besides, some short naps<sup>3)</sup> remain on breast side of the junior paratype, 465 mm in standard length. Lateral line appears to be dull in coloration.

Colour in living fish is liable to change according both physiological conditions and age of the fish<sup>4)</sup>. Ground colour of mature fish, in general, slatish laterally and dorsally with superficial shine of metallic purple; caudal fin, marginal area of anal fin, and dorsal side of ventral fin slatish; marginal area of dorsal fin and dorsal side of pectoral fin dusky. Basal part of anal fin and ventral side of paired fins variable from lilac-purple to fleshy coloration. Belly and ventral side of head pure white.

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3) In *P. asotus* and in the following species, the structure mentioned above occurs only in smaller specimens (about 10-15 mm in total length). BERG (1949) called the similar structure as 'nap' in his study on *Silurus glanis* LINNÉ.

4) When the fish is caught and kept in water under strong light or in unhealthy conditions, the slatish ground colour may change into olive yellow, and sometimes the skin is reticulated with small irregular mesh-pattern of darker or silvery tint, while the belly and ventral side of head remain in pure white.

Young fish generally has light blue coloration with superficial shine of pink, and rather large irregular pattern of darker colour with shine in purple is present on the lateral side instead of being reticulated as in mature fish.

Colour in formalin is greyish above, superficial shine of metallic purple becoming vanished.

## 2. *Parasilurus lithophilus* n. sp.

(Fig. 2)

—Iwatoko-namazu<sup>5)</sup> (new Japanese name)—

*Holotype*: MIKU No. 34411, a mature male, 390 mm in standard length (432 mm in total length), collected near Onoé, April 11, 1961.

*Paratypes*: Three specimens: MIKU No. 34412, first specimen (female), 361 mm in standard length (404 mm in total length), date of collection as in holotype; MIKU No. 34413, second specimen (female), 321 mm in standard length (357 mm in total length), collected near Onoé, Feb. 24, 1961; MIKU No. 34414, third specimen (male), 523 mm in standard length (586 mm in total length), collected on the rocky shore of Chikubushima on June 29, 1961. All the specimens seem to be in mature condition and their localities are restricted to the northern part of Lake Biwa-ko.

*Description*. D. 4 (5); A. 83 (75-88); C. 17 (17-18); P. I, 11 (I, 11-12); V. 11 (11-12); branchiostegals 13 (14-16).

Head 5.0 (4.9-5.6) in standard length; depth 5.3 (5.1-5.7); width 6.4 (6.7-7.1); depth of caudal peduncle 19.5 (17.5-20.5); height of dorsal fin 21.0 (15.5-18.0); length of anal ray measured at mid-point 14.5 (12.5-16.5); longest pectoral ray 10.5 (9.05-10.0). Predorsal length 3.3 (3.2-3.3); preanal length 2.4 (2.4). Eye 8.7 (8.8-9.4) in head length; interorbital width (distance between inner rims of both eyes) 1.90 (1.60-1.85); width of head 1.25 (1.10-1.30); snout (distance from tip of snout to a line across front of both eyes) 4.1 (3.2-4.1).

Posterior part of body compressed fairly excessively as compared with that of *P. asotus*. Head markedly depressed; in profile, dorsal side of body markedly elevated from nape to the origin of dorsal fin, then running horizontally backwards to the tip of caudal. Ventral side of body broadly rounded at belly in lateral view, but nearly straight from vent to caudal; body deepest immediately behind vent.

Pectoral fin nearly extending to the vertical line across the origin of dorsal fin; dorsal fin when depressed extending to the vertical line across the pelvic fin base, but never reaching the perpendicular line across the origin of anal fin; pelvic fin situated immediately in front of anal so that posterior margin of the former covering anterior part of the latter.

In dorsal view posterior part of head widened characteristically; gill membrane well covering pectoral fin base, which extrudes laterally. This character of head is quite different from that of the preceding species, in which the head is long and slender, and is also different from that of *P. asotus*, in which head is massive and rounded.

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5) The name was used by AOYAGI (1957), who first described the peculiarity of coloration in this catfish.

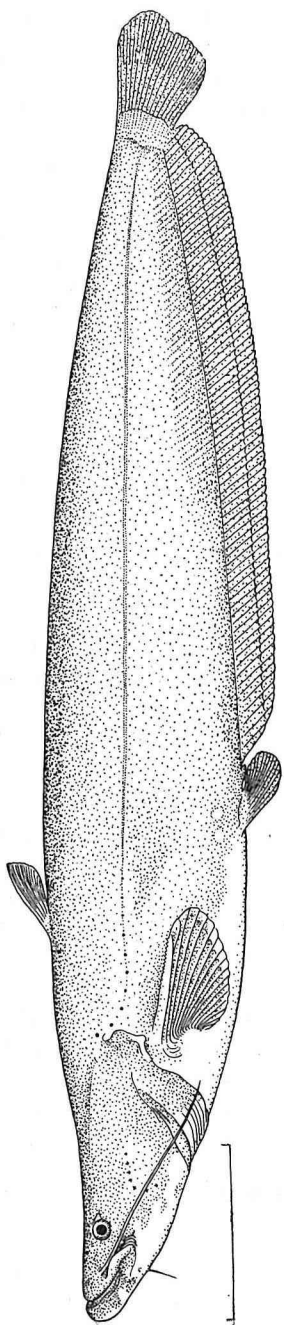


Fig. 1. Lateral aspect of the holotype of *Parasilurus biwaensis* n. sp. Scale bar indicates 100 mm.

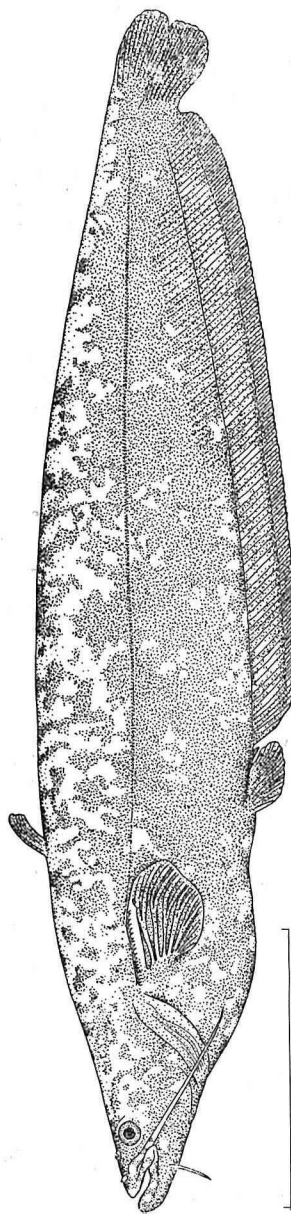


Fig. 2. Lateral aspect of the holotype of *Parasilurus lithophilus* n. sp. Scale bar indicates 100 mm.

Teeth on both jaws arranged in a broad villiform band which is so curved as to form a patch of shallow horse-shoe shape. Vomerine teeth band separated into two halves situated rather closely.

Margin of eye very distinct; eye small but protruding, with round surface, situated laterally so as to be seen sufficiently from the ventral side of head. Interorbital surface wider and shallower than in the preceding species.

Nostrils far apart; anterior one bearing nasal tube which is projecting upwards from general dorsal contour in the lateral view of head; posterior one has collar-like aperture which is also projecting in the same manner.

Barbels rather long but thinner and smoother than those of *P. asotus*; premaxillary extending fairly beyond the base of pectoral, measuring 85% (106-114%) of head length; mandibular measuring 18% (20-23%); ratio of premaxillary to mandibular 4.8 (4.9-5.7).

Gill membranes on both sides free from isthmus, scarcely overlapping.

Dorsal fin situated just behind the portion of characteristically elongated integument upheaval; the fin itself short and narrow, often degenerated as to be illustrated in the holotype into a mere simple rod. Caudal fin with lobes in equal length which is divided by a deep fissure<sup>6)</sup>; the superior lobe is oval in shape while the inferior one broad and bluntly truncated. Caudal continuous into anal; anal thickly covered with integumental covering, height measured from base of the fin attaining 80% (75-86%) of ray length at mid-point of the fin. Pectoral not elongate, rather round in appearance; spine of pectoral fin as in *P. asotus*.

Small tubercles, instead of pinholes in the preceding species, present on dorsal part of head, and also on both dorsal and lateral surfaces of body. Lateral line conspicuous in coloration as in *P. asotus*, series of yellow openings being arranged into a single row anteriorly, double rows posteriorly according to individuals.

Colour in living fish is in two phases. Ground colour light yellowish brown and covered with obscure darker pattern when captured from depth, but this phase in coloration easily changes into the black phase in shallow water or in an aquarium. Such black fish furnished with olive-yellowish finger-like pattern dorsally and sparsely scattered yellowish spots laterally, although these markings vary rather remarkably in tint, being orange-brown in some specimens (entirely black specimens occur in extreme). On head and caudal portion the yellow pattern becoming brown. Ventral sides of head and belly whitish, being covered densely with finger-like pattern of dusky violet. Dorsal and paired fins blackish with yellowish margin. Anal fin black.

Colour in formalin greyish black with dusky yellowish pattern instead of clear black in living fish.

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6) In most of the specimens examined, the fissure is so deep as to separate the two lobes entirely. In some examples, however, the two lobes are connected with each other by a thin membrane.

*Remarks.* In several literature we can find some notes on the special nature of the catfishes in Lake Biwa-ko. The oldest literature is a manuscript entitled "Kogyo-kō"<sup>7)</sup>, written in 1806, in which the name "Iwatoko-namazu" is applied for the aberrant form. Another manuscript is "Kochū-sanbutsu-zushō"<sup>8)</sup> written in 1815, with an illustration of the fish. The descriptions are, however, very incomplete in view of the modern taxonomy. The authors of these books also made brief comments on the character of coloration and the habitat of the fish.

Other authors who had given some notices on aberrant forms in their recent researches unfortunately refrained from going deep into the taxonomic problem; some of them only emphasized the high variability of coloration in common catfish, *P. asotus* (LINNÉ), while others underestimated the variations of these fishes as to be of mere ecological value (KAWABATA, 1931, etc.).

The present author has paid a special attention, in the preliminary study, to the range of variations in *P. asotus* widely distributed in the Far East. The character of the fish eventually varies not only with the difference of localities but also with the age. Moreover, the colour changes to a considerable extent in different physiological condition of the fish. These infraspecific variations are carefully considered in the present study. It is also true that even morphological characters of catfishes, such as the relative length of head, forms of the vomerine teeth and of the caudal fin, and the number of anal fin rays are variable, as were noticed by several authors (RENDAHL, 1928; TANAKA 1928; HORA, 1936).

Regardless of such wide variability of *P. asotus* in the morphological aspects, each of the three species is provided with the definite pattern of characteristics. At the same time, the life pattern of each species is actually limited from the ecological point of view. A long series of specimens of the common catfish collected from various districts, including Lake Biwa-ko, show characteristics which seem to adapt to the muddy habitat of this species. On the other hand, two other forms occurring in Lake Biwa-ko are proved to occupy different habitats, namely *P. biwaensis* in off-shore and *P. lithophilus* on rocky reefs. From these points of view, the author has come to a conclusion that there occur in Lake Biwa-ko two distinct species of catfishes in addition to the common catfish, *P. asotus*.

The new species described in the present paper do not accord with any of the defined forms of the Asiatic Continent, so far as is known from literature. There remain, however, several doubtful 'species', recorded from the River Yang-tze Kiang, to be determined. It is necessary to make detailed comparison of specimens taken from various parts of the water-system in future.

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7) KOBAYASHI, Y. [Some remarks on the fishes of the lake.]

8) FUJII, S. [Illustrated book on the productions of the lake.]



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