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AN ANALYSIS OF CHINESE LOACHES OF THE GENUS *MISGURNUS*¹

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Chinese loaches of the genus *Misgurnus* are exceedingly variable. A number of species have been described in the past, but recent authors are inclined to look upon their differences as individual variation, and to assign all or almost all to *Misgurnus anguillicaudatus* (Cantor), type locality Chusan, a coastal island south of the Yang-tze River. Berg, 1916, makes this a race of European *Misgurnus fossilis*. The variations are so great, however, that it is difficult to believe that more than one species is not involved. Thus, Jordan and Snyder, 1906, have revived *M. decemcirrosus* Basilewski, 1855, which name is also used by Fowler, 1924, for a fish which the present writer refers to *M. mizolepis* Günther, 1888.

In considerable *Misgurnus* material on hand from different parts of China, several distinct forms are apparently recognizable, complicated by individual variation so as to appear to be races rather than species. However, both in Anhwei and Fukien two such forms occur together, and in Tungting Lake of the Yang-tze River, Hunan, three forms. Nomenclature may best be adapted to the situation by recognizing three species, and two or three races of each. Unfortunately, most of the species of early authors are not described with sufficient accuracy for their names to be available. For the present at least, *decemcirrosus* Basilewski is uncertain from available data; *anguillicaudatus* Cantor is pretty definitely determinable by reason of its definite type locality; *mizolepis* Günther is clear enough.

Referring one of the three species here recognized to *anguillicaudatus* and a second to *mizolepis*, the third is represented in our collections by a plain-colored form from Yunnan and a heavily-spotted form from Tungting, to which, among our material, Berg's, 1916, figure of *Misgurnus fossilis anguillicaudatus* from the north Korean boundary, which may be taken as representative of *Misgurnus mohoity* (Dybowski), 1869, from

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the Onon and Ingoda rivers, east of Lake Baikal, seems to be closest. Without having seen material of this, its typical subspecies, our third Chinese species is provisionally referred to *mohoity*.

Consistency with recognition of three species of *Misgurnus* in China would seem to dictate consideration of European *M. fossilis* as a distinct species rather than as a race of one of these.

The following analysis of *Misgurnus* in China is published with some uncertainty at this time, although our material is probably more extensive than that of earlier writers. It may be considered as a preliminary treatment of the subject, a basis for discussion and for further collecting now in progress, in the light of which it will perhaps be advantageously revised at a later date.

SPECIES AND RACES OF *Misgurnus*

Misgurnus fossilis (Linnæus)

Cobitis fossilis LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 303. Europe.

Misgurnus fossilis BERG, 1916, 'Poiss. Eaux Douces Russ.,' p. 353, Fig.

Differs from Asiatic forms in being marked with bold, lengthwise, dark stripes. Europe.

Misgurnus anguillicaudatus (Cantor)

Cobitis anguillicaudata CANTOR, 1842, Ann. Mag. Nat. Hist., IX, p. 485. Chusan.

Striæ on scales little radiating; the scales more or less embedded or fully exposed. Head large, less than 6 in the length to base of caudal. Slender (depth between 7 and 8). Caudal long, equal to or slightly greater than head. Markings not very bold and sharp. East central China.

Misgurnus anguillicaudatus anguillicaudatus (Cantor)

This race occurs to the eastward, south of the mouth of the Yang-tze, Anhwei south into Fukien. Its limits to the north are uncertain.

Description of a specimen from Ningkwo, Anhwei, September 15 to October 15, 1921, C. H. Pope.—Length to base of caudal 130 mm. Depth in length 7.5; head 5.8. Snout in head 2.7; width of body 1.8; depth of peduncle 1.6; its length 1.3; pectoral 1.4; ventral 1.8; longest dorsal ray 1.5; longest anal ray 2; caudal 0.9. Eye in snout 2; interorbital 1.7; maxillary 1.5; anterior barbel (the longest) 1.

Dorsal 9; anal 7½. Scales about 155.

Elongate and a little compressed; vent at ¼ the distance from anal origin to ventral axil. Snout narrow and blunt; interorbital slightly convex; mouth inferior, horizontal, horse-shoe-shaped, with thick lips; 3 subequal barbels above mouth, of which the anterior is slightly the longest on one side and middle one on the other;

lower lip cleft, with one moderate (posterior) and one short barbel. Dorsal origin equidistant from base of caudal and gill-cleft; ventral origin slightly behind that of dorsal; pectoral reaching $\frac{3}{4}$ to ventral; ventral $\frac{3}{4}$ to anal; caudal narrow, rounded at the end. Scales rather irregular, more or less embedded in thick skin; with numerous slightly radiating striæ.

Dark above, paler below, with scattered faint dark marks of irregular size and placement, some along back as large as eye; caudal lightly barred; dorsal faintly marked; lower fins pale.

Misgurnus anguillicaudatus tungting, new subspecies

A race from the central Yang-tze, dark above, pale below, without large or pronounced markings on the body.

DESCRIPTION OF THE TYPE.—Number 8393, American Museum of Natural History. Huping, Tungting Lake, Hunan, C. H. Pope. Length to base of caudal 89 mm. Depth in length 7.7; head 5.6. Snout in head 2.6; width of body 2; pectoral 1.4; ventral 1.6; longest dorsal ray 1.5; longest anal ray 1.7; caudal 1; depth of peduncle 2; its length 1.2. Eye in snout 2; maxillary 1.6; interorbital 2.4; posterior upper barbel 1.4.

Dorsal 9; anal 8. Scales 143.

A little compressed; vent at $\frac{1}{4}$ the distance from anal origin to ventral axil; snout pointed; interorbital a little convex; eye somewhat superolateral; mouth inferior horizontal semi-circular; 3 barbels above it, the posterior the longest and central one the shortest, posterior 2 closest together; 2 small barbels below, the posterior the longest. Dorsal origin equidistant from base of caudal and center of opercle; ventral origin just appreciably behind that of dorsal; pectoral pointed, reaching $\frac{1}{3}$ the distance to ventral; ventral $\frac{1}{2}$ to anal, approximately in a horizontal plane; caudal narrow, somewhat rounded behind. Scales small, regular, exposed, with close-spaced only slightly radiating striæ.

Dark above and on upper sides; pale, unmarked below; the dark color in fine obscure freckling on sides, with slight tendency to concentrate into a broad dark lateral band anteriorly; a short dark bar at upper caudal base; caudal with fine blackish irregular bars; dorsal a little spotted, and lower fins slightly marked with dusky.

Misgurnus anguillicaudatus erikssoni Rendahl

Misgurnus erikssoni RENDAHL, 1922, Ark. Zool., XV, No. 4, p. 3. Mongolia.

This race has a very long peduncle, depth of same 2.9 to 2.5 in its length.

Misgurnus mizolepis Günther

Misgurnus mizolepis GÜNTHER, 1888, Ann. Mag. Nat. Hist., I, p. 434. Kiu-kiang on the Yang-tze River.

Striæ on scales little radiating, scales embedded, peduncular keels always well developed, sometimes excessively so. Markings sharply contrasted, usually small. Yang-tze River valley and southward along the coast.

Misgurnus mizolepis mizolepis Günther

Deep-bodied (depth 5 to 6), the peduncular keels excessively developed; markings few, small; caudal short. Reaches a large size. Yang-tze Valley.

Description of a specimen from Tungting Lake, Hunan, January 3, 1921, C. H. Pope.—Length to base of caudal 167 mm. Depth in length 5.5; head 5.5. Eye in head 7.5; snout 2.5; interorbital 4; maxillary 3.5; depth of peduncle 1.3; dorsal height 1.5; anal 1.9; pectoral 1.3; ventral 1.7. Ventral under last third of dorsal, not reaching anal. Rudimentary rays of caudal above and below precurrent as fleshy keels.

Dorsal 7; anal 7. Scales about 135.

Color dark, fins and belly paler, brownish, lightly speckled.

Misgurnus mizolepis fukien, new subspecies

More elongate, sides well covered with scattered small black marks. Fukien.

DESCRIPTION OF TYPE.—Number 8394, American Museum of Natural History, Yenping, Fukien, H. R. Caldwell. Length to base of caudal 127 mm. Depth in length 7.1; head 6.6. Snout in head 2.6; width of body 1.5; least depth of peduncle (with keel) 1.4; its length 0.8; pectoral 1; ventral 1.6; longest dorsal ray 1.4; longest anal ray 1.4; caudal 1. Eye in snout 2.5; interorbital 1.6; maxillary 1.4; posterior barbel 0.9.

Dorsal 8; anal 7. Scales about 140.

Compressed; vent at $\frac{1}{4}$ the distance to ventral axil from anal. Snout broad and blunt; interorbital broadly convex; eye slightly superolateral; mouth inferior, horizontal, horse-shoe-shaped, with thick lips, the lower cleft; 3 barbels above (only 2 on one side) the posterior decidedly the longest, 2 small ones below, the posterior the larger.¹ Dorsal origin equidistant from base of caudal and gill-cleft or slightly nearer the latter; ventral origin slightly behind that of dorsal; pectoral pointed; extending slightly more than $\frac{2}{3}$ the distance to ventral; ventral slightly more than $\frac{1}{2}$ to anal; caudal rounded, the precurrent keels prominent and fleshy. Scales irregular, more or less embedded in thick skin with numerous close-set, sub-parallel, slightly radiating striæ.

Dark above to about mid-line of side, paler below. Sides with evenly scattered fine black spots. Caudal speckled; dorsal faintly barred; lower fins plain. Upper basal caudal black spot, squarish, distinct.

Misgurnus mizolepis hainan Nichols and Pope

Misgurnus mizolepis hainan NICHOLS AND POPE, (in press), Bull. Amer. Mus. Nat. Hist.

An elongate form approaching typical *anguillicaudatus*, with bold black markings of irregular size. Hainan Island.

Misgurnus mizolepis grangeri, new subspecies

DESCRIPTION OF TYPE.—Number 8395, American Museum of Natural History, Yen-ching-kaō, Szechwan, November, 1921, W. Granger. Length to base of caudal 117 mm. Depth in length 6.8; head 5.9. Snout in head 3; interorbital 4.5; width of body 1.8; depth of peduncle 1.6; its length 1.2; pectoral 1.4; ventral 2; longest dorsal ray 1.7; longest anal ray 1.8; caudal 1. Eye in snout 2.6; longest barbel 2.

Dorsal 9; anal 7. Scales about 140.

Little compressed except behind the dorsal; peduncular keels strongly developed, thick, the lower extending forward almost to anal axil, the upper stopping short of dorsal axil by a considerable space. Mouth inferior, horse-shoe-shaped, surrounded by 10 barbels as usual; eye small, deep beneath the skin. Dorsal origin equidistant from base of caudal and edge of preopercle; ventral origin appreciably behind that of dorsal; pectoral reaching $\frac{3}{11}$ the distance to ventral; ventral $\frac{1}{2}$ the distance to anal; caudal pointed. Scales imbedded in thick skin, with conspicuous close-spaced subparallel striæ, the striæ above radiating somewhat from those below.

Dark gray above, paler, pinkish on the belly; sides with small, irregular scattered black spots. Dorsal faintly marked; caudal with a few irregular blackish bars and spots, no especially distinct one on its upper base.

Misgurnus mohoity (Dybowski)

Cobitis fossilis var. *mohoity* DYBOWSKI, 1869, Verh. Zool.-Bot. Gesell., Wien, XIX, p. 957. Onon and Ingoda rivers, east of Lake Baikal.

Cobitis fossilis anguillicaudatus BERG, 1916, 'Poiss. Eaux Douces Russ.,' p. 354, Fig. Lake tributary to Tumen-Ula River (north Korean boundary).

Eastern Asia north of the Gobi. The following two forms from western China east to the central Yang-tze are provisionally considered conspecific with *Misgurnus mohoity mohoity* (Dybowski), which differs from them in being more slender, dorsal origin nearer base of caudal than gill-cleft, rather small dark marks evenly scattered on sides.

Misgurnus mohoity yunnan, new subspecies

DESCRIPTION OF TYPE.—Number 8396, American Museum of Natural History, Yunnanfu, Yunnan, October 20, 1920, John Graham. Length to base of caudal 123 mm. Depth in length 6.6; head 5.4. Eye in head 6; snout 2.7; interorbital 5; maxillary 4; width of mouth $4\frac{1}{2}$; posterior maxillary barbel 2.5; width of body 2; depth of peduncle 1.7; its length 1; pectoral 1.5; ventral 2.3; longest dorsal ray 1.5; longest anal ray 2; caudal 1.

Dorsal 9; anal 7. Scales about 130.

Elongate; moderately compressed; the back and belly rounded; vent at $\frac{1}{4}$ the distance from anal origin to ventral axil. Interorbital convex; snout somewhat pointed and compressed; mouth inferior, horse-shoe-shaped; a barbel at the side of the tip of the snout, and 2 close together near the end of the maxillary, the posterior the longer; upper lip loose, lower expanded, free behind, divided in the center; with two small barbels, the outer the longer. Dorsal origin equidistant from base of caudal and gill-cleft; ventral placed slightly before the center of dorsal base; pectoral

extending $\frac{1}{4}$ the distance to ventral; ventral $\frac{1}{2}$ to anal; caudal bluntly pointed, its rudimentary rays precurent in low keels. Scales small, firm, with conspicuous close-spaced radiating striæ.

Olive, finely freckled with pale above; pale below. A small oblique black bar on caudal base near the top; caudal faintly and irregularly barred with dark; dorsal with a few fainter bars; other fins plain.

Misgurnus mohoity leopardus, new subspecies

DESCRIPTION OF TYPE.—Number 8397, American Museum of Natural History, Tungting Lake, Hunan, C. H. Pope. Length to base of caudal 105 mm. Depth in length 6.5; head 5.6. Snout in head 2.7; width of body 1.6; depth of peduncle (including keels) 1.6; its length 1.2; pectoral 1.2; ventral 1.6; longest dorsal ray 1.6; longest anal ray 1.7; caudal 1.2. Eye in snout 2; interorbital 2.2; maxillary 1.9; posterior barbel 1.

Dorsal 8; anal 8. Scales about 135.

Scarcely compressed; vent almost immediately before anal origin, at not more than $\frac{1}{6}$ the distance to ventral axil. Snout rather pointed, narrow; interorbital slightly convex; the eye slightly superolateral; mouth small, horizontal, inferior, semi-circular; 3 barbels above it of almost equal length and equally spaced, two small ones below, the posterior decidedly the longer; lower lip deeply cleft. Dorsal origin equidistant from base of caudal and margin of opercle; ventral origin slightly behind that of dorsal; pectoral reaching $\frac{1}{3}$ distance to ventral; ventral $\frac{2}{3}$ to anal; caudal rounded or slightly pointed, with conspicuous precurent keels, not fleshy. Scales small, rather regular, exposed; with comparatively few radiating striæ.

Back and sides with contrasting dusky spots, rather regular, and increasing in size upward to diameter of eye, the largest along back; caudal finely and irregularly barred with blackish; a black triangular spot at its upper base; dorsal spotted; lower fins with slight, faint marking.

KEY TO THE EIGHT CHINESE RACES OF *Misgurnus*

- 1.—Skin not thickened, scales rather regular and fully exposed. 2.
Skin more or less thickened and scales more or less embedded. 4.
- 2.—Striæ on scales well radiating. Scales moderate (about 130); depth moderate (about 6.5); head large (about 5.5); peduncle moderate (about equal to head); dorsal origin equidistant from base of caudal and gill-cleft. *Misgurnus mohoity*. Yunnan, Tungting. 3.
- Striæ on scales little radiating. Scales moderate (about 145); elongate (depth over 7.5); head large (about 5.5); peduncle moderate (slightly less than head); dorsal origin equidistant from base of caudal and middle of opercle. Sides finely marked with dark, tending to form a broad band anteriorly.
Misgurnus anguillicaudatus tungting. Tungting.
- 3.—Color, freckled olive above, pale below, without dark marking on body. Compressed, width of body 2 in head. *Misgurnus mohoity yunnan*. Yunnan. Color, back and sides with contrasting dark spots, rather regular and increasing in size upward to the diameter of eye along the back. Very little compressed (width 1.6). *Misgurnus mohoity leopardus*. Tungting.

- 4.—Moderate or elongate, peduncular keels about precurent caudal rays sometimes fleshy, not excessively developed. 5.
 Deep (depth less than 6). Skin very thick, peduncular keels greatly developed, fleshy. Black spot at upper caudal base, faint or wanting.
Misgurnus mizolepis mizolepis. Yang-tze Valley.
- 5.—Head large (less than 6). Dusky spotting on sides vague and irregular, the arrangement and size of spots variable; peduncle short, less than head; compressed (width about 2); scales fine and irregular.
Misgurnus anguillicaudatus anguillicaudatus. Anhwei, Fukien, Chusan.
 Head small (6 or more). Dark markings on side contrasted; peduncle long (slightly longer than head), or else little compressed (width of body less than 2), black spot at upper caudal base faint or wanting. *Misgurnus mizolepis*. Hainan, Fukien, Szechwan, Tungting. 6.
- 6.—Spots on sides irregular, varying in size, some as large as eye. Compressed (width 2). *Misgurnus mizolepis hainan*. Hainan.
 Spots on sides small, blackish. Very little compressed (width less than 2). 7.
- 7.—Spots on sides irregular, that on upper caudal base ill-defined or absent.
Misgurnus mizolepis grangeri. Szechwan.
 Spots on sides fine, regular, blackish, that on upper caudal base sharply marked.
Misgurnus mizolepis fukien. Fukien.

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