The Journal of the Shimonoseki University of Fisheries 25 (1) 33 — 40 (1976)

# Note on the Osteology of *Caprodon unicolor* Katayama*

By

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*Caprodon unicolor* Katayama, 1975, a serranid fish, was described as a new species from specimens obtained by trawl in the fishing ground of a sea mount (28°55′ N, 179°38′ W at a depth of 170 m) off Midway Islands, North Pacific Ocean, in July 1972. This species is closely related to *Caprodon schlegelii* (Günther), but differs in having a shorter head, more numerous gill-rakers, maxillary with nearly straight lower margin, deep emargination on caudal fin, orange red body and white tips of caudal fin (Katayama, 1975). The present study on osteology together with sex ratio was attempted to pursue further relationship between the two species.

The materials used are thirteen specimens, 20.1-27.7 cm in standard length, obtained by trawl in the same fishing ground as the type specimens on July 4 and August 13, 1972. Two fish of *C. schlegelii* (about 26 and 35 cm in standard length) were also examined for comparison. Osteological examination was made in five specimens after alizarin treatment or from X-ray photographs. Gonads were examined histologically.

## Observation

1) Cranium (Fig. 1)

The cranium is rather short and high. The interorbital space is wide and slightly concave. The mesethmoid is anteriorly supported along the edge by the vomer and sends back a longitudinal, rather low ridge (mesethmoid vomerine keel). The frontal is the largest membrane bone on the top of cranium; very wide, slightly concave and smooth. The anterior parts of the bone have a large excavation for the reception of the posterior process of the premaxillaries. The posterior parts have a transverse ridge. The sensory canals tunnel longitudinally on each side from the anterior to posterior part of the frontals; the inner branch is connected with the one of the opposite side. Openings are present at the anteriormost, middle and posteriormost points of the canals. The supra-occipital crest develops on the upper side of cranium. The exoccipitals form the foramen

*Contribution from the Shimonoseki University of Fisheries, No. 767.
Received July 8, 1976.

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magnum posteriorly, beneath which each exoccipital condyle is separated by a short distance. The basioccipital is ventrally flate. The myodome opens to the exterior

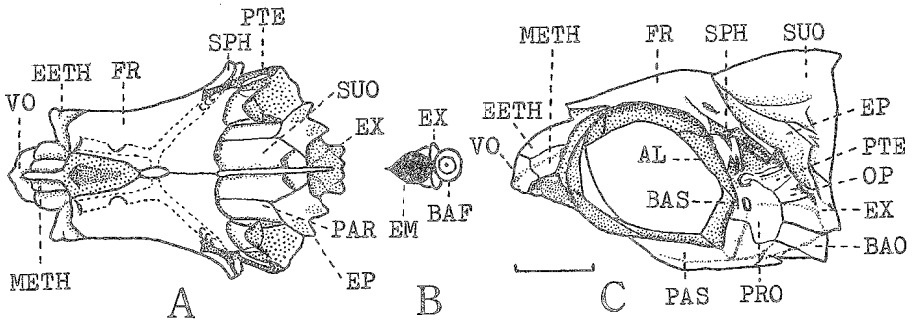


Fig. 1. Dorsal, posterior and lateral aspects of the cranium.
A, dorsal; B, posterior; C, lateral aspect.
AL, alisphenoid; BAO, basioccipital; BAF, basioccipital fossa; BAS, basisphenoid; EETH, ectethmoid; EP, epiotic; EX, exoccipital; FM, foramen magnum; FR, frontal; METH, mesethmoid; OP, opisthotic; PAR, parietal; PAS, parasphenoid; PRO, prootic; PTE, pterotic; SPH, sphenotic; SUO, supraoccipital; VO, vomer.
Scale 10mm.

through a foramen at the posterior notch of the parasphenoid. A sharp projection of the epiotic is directed backward inside the articular facet. The alisphenoids are separated from each other by the anterior opening to the brain cavity. The parasphenoid forms nearly the entire base of the cranium. The bone is mostly straight, but convex under the basisphenoid. The upper edge of the parasphenoid is sharply keeled longitudinally. The anterior part has a lateral wing on each side.

2) Jaws (Fig. 2, A)

The maxillary is broad in the posterior part with a rounded end. Its ventral margin is nearly straight. The supramaxillary is absent. The premaxillary has one or two conical teeth on the outer side of the anterior part, with a row of smaller teeth on the

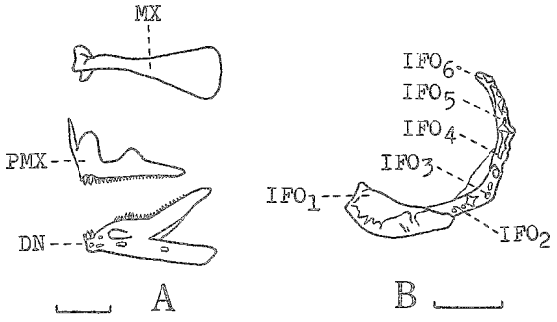


Fig. 2. Lateral aspects of the jaws (A) and the infla-orbiatls (B).
DN, dentary; IFO, inflaorbital; MX, maxillary; PMX, premaxillary. Scale 10mm.

posterior part. The inner side of premaxillary is furnished with villiform teeth. The dentary has a swelling in the anterior half of the upper side, below which some hollows are recognized, the position, diameter and number of the hollows being variable according to the specimens. In the outer side of the dentary there are one or two conical teeth on the anterior part, and three or four conical teeth on the swelling with a row of smaller teeth. The arrangement of villiform teeth in the inner side of dentary is the same as those of premaxillary.

3) Infraorbitals (Fig. 2, B)

The first infraorbital is nearly rectangular in shape, and has a process on the dorsal corner of the anterior part. The subocular shelf of the third infraorbital is prominently developed, stretching even under the second and fourth infraorbitals. The fourth and fifth infraorbitals also have smaller shelves.

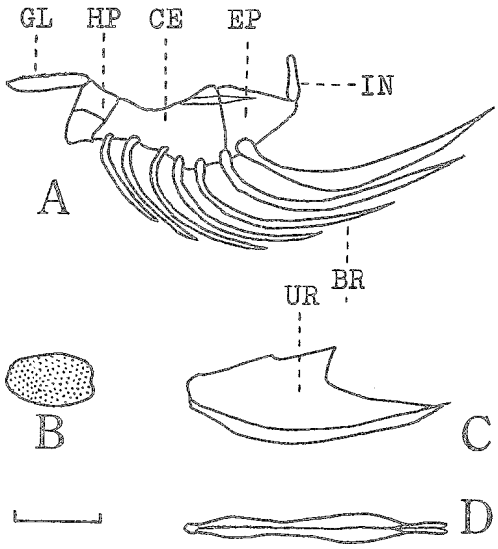


Fig. 3. Lateral aspect of the hyoid arch. A, lateral aspect of the arch; B, dorsal aspect of the glossohyal; C, lateral aspect of the urohyal; D, vental aspect of the urohyal. BR, branchiostegal ray; CE, ceratohyal; EP, epihyal; GL, glossohyal; HP, hypohyal; IN, interhyal; UR, urohyal. Scale 10mm.

4) Hyoid arch (Fig. 3)

The glossohyal is nearly ellipsoid in shape and bears teeth. The hypohyal has a process in the ventral corner of the anterior part. The ceratohyal is large, triangular in shape and deeply concave in the upper margin. There is a channel near the upper margin from the middle of the ceratohyal to the epihyal. The urohyal is long, nearly equal to the length from the anterior end of the glossohyal to the end of the interhyal, and the posterior

edge is concave. Its ventral wing develops except for middle part. The posteriormost part of the ventral side bifurcates to two processes. There are seven branchiostegals, five and a half on the ceratohyal and one and a half on the epihyal. The last ray is much wider than the others.

5) Suspensorium and opercular bones (Fig. 4)

The metapterygoid is triangular in shape, and throws a wing, the metapterygoid lamina, from the inner surface of the bone upward to the lower anterior margin of the hyomandibular. An interosseous space between the metapterygoid lamina and the hyomandibular process is seen slightly posterior to the metapterygoid. The metapterygoid connects with the lower part of hyomandibular, but the metapterygoid lamina does not connect with the latter. The preopercle has a vertical ridge and fine serrae on the ventral and posterior borders. Opercular spines are three in number; the middle one is the longest and the uppermost is sometimes obscure in some specimens. The lower margins of the sub- and interopercles are smooth. Upper end of the subopercle reaches behind the tip of middle spine of the opercle.

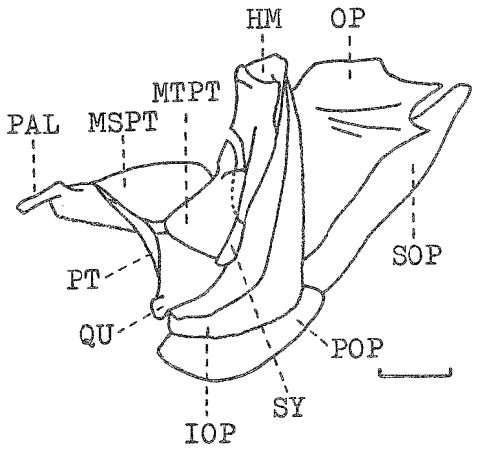


Fig. 4. Lateral view of the suspensorium and opercular apparatus. HM, hyomandibular; IOP, interopercle; MSPT, mesopterigoid; MTPT, metapterygoid; OP, opercle; PAL, palatine; POP, preopercle; PT, pterygoid; QU, quadrate; SOP, subopercle; SY, symplectic. Scale 10mm.

6) Shoulder girdle (Fig. 5)

The posttemporal has two reversed C-shaped projections; the upper one is longer than the lower. The lower projection bears a process at the middle of the ventral side. The posterior surface of the bone is rugose with slightly serrate margin. The cleithrum is very long, and is bent down and forward from the upper 2/5. The upper margin is pointed and a broad wing is sent back just above the scapula for the support of the

postcleithrum. The lower end of the bone is rather rounded. The coracoid is thin and falciform. There is a wide space between the bone and cleithrum: coracocleithral fenestra. The posterior margin of the bone projects backward in a sharp point (post-coracoid process), forming a deep notch between the bone and the lowermost radial of the pectoral fin. The radials are rod-shape and 4 in number, of which one and a half are born by the coracoid, and two and a half by the scapula. The postcleithrum is composed of upper and lower elements; the upper element is oblong; the lower one is rather slender and pointed.

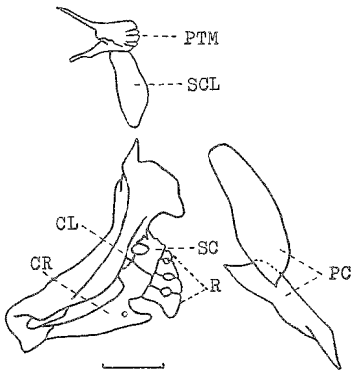


Fig. 5. Lateral view of the shoulder girdle. CL, cleithrum; CR, coracoid; PC, post-cleithrum; PTM, posttemporal; R, radial of pectoral fin; SC, scapula; SCL, supra-cleithrum. Scale 10mm.

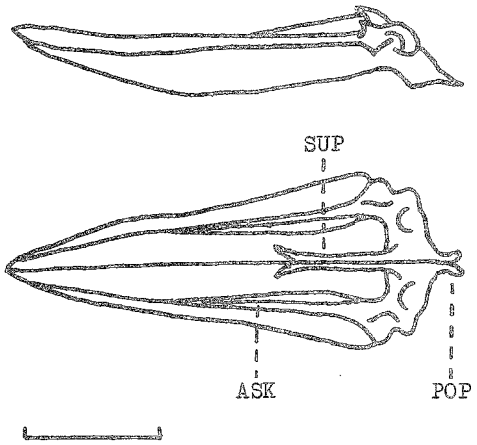


Fig. 6. Lateral (upper) and ventral (lower) aspects of the pelvic girdle.
ASK, accessary subpelvic keel; POP, post-pelvic process; SUP, subpelvic keel.
Scale 10mm.

7) Pelvic girdle (Fig. 6)

The pelvic girdle is almost an equilateral triangle in shape when viewed from the upper or lower side and becomes gradually narrower anteriorly. The girdle has two longitudinal keels running along the dorsal and ventral parts of the outer ridge (suprapelvic keel and subpelvic keel). Another longitudinal low keel on each side, the accessory subpelvic keel, runs inside the subpelvic keel. The opposite halves of the girdle are clearly separated anteriorly. The post pelvic process is short.

8) Vertebral column and caudal skeleton (Figs. 7 and 8)

The total number of vertebrae is 10 + 16 = 26. The atlas is rather small and its neural spinal arch is not co-ossified with the centrum. The first parapophysis occurs on the fourth centrum. The first and second centra have no ribs, but only epipleurals. The first neural spine is inclined forward. The first interneural overlies before the

first neural; the second and third interneurals are interposed between the first and second neurals; the fourth interneural, between the second and third neurals; the fifth and sixth interneurals, between the third and fourth neurals; the seventh interneural, between the fourth and fifth neurals. The first, second and third interneurals are slender and subequal in length, and the fourth is very large. The first hemal spine, which is on the 11th vertebra, is stout and short. A terminal vertebra (ural + penural$_1$), a parhypural, five hypurals, two uroneurals and three epurals constitute the caudal skeleton. The first and fourth hypurals are very wide. The first epural is larger than the others. The second uroneural is long.

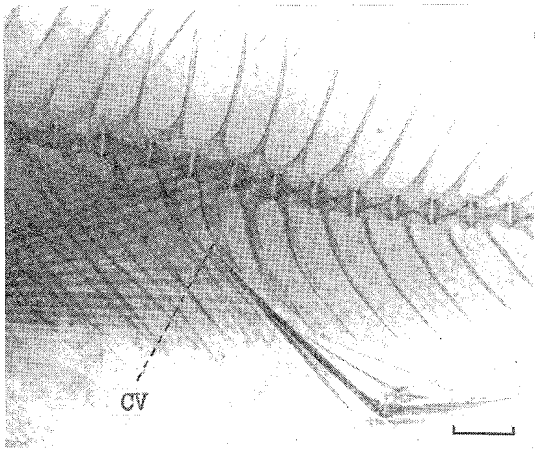


Fig. 7. X-ray photograph of the axial skeleton, especially showing the first hemal spine.
CV, 1st hemal spine. Scale 10mm.

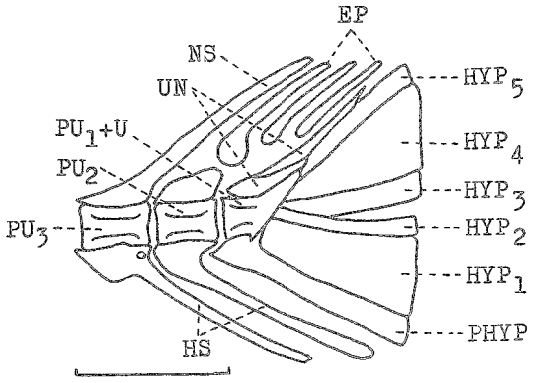


Fig. 8. Lateral view of the caudal skeleton.
EP, epural; HS, hemal spine; HYP, hypural; NS, neural spine; PHYP, parhypural; PU, preural; U, ural; UN, uroneural. Scale 10mm.

9) Sex

The gonads of six specimens of *C. unicolor*, 23.4–27.7 cm in standard length, were examined histologically. Five specimens are females and one specimen of 23.5 cm in standard length is a male. Of the females, one specimen of 25.5 cm in standard length is ripening.

## Discussion

The genus *Caprodon* is known from Chile, New Zealand, New South Wales, Hawaii, Taiwan, Korea and Southern Japan; *C. schlegelii* and *C. longimanus* (= *C. affinis*) had been recognized as distinct species (Günther, 1859; Boulenger, 1895; Tanaka, 1924; Schmidt, 1931; Matsubara, 1955). Katayama (1960) concluded, however, upon careful examination of the specimens referable to both species, with some doubt, that *C. longimanus* is no other than female *C. schlegelii*. In comparison with the osteological observation on *C. schlegelii* made by Katayama (1959), the present specimens of *C. unicolor* differ in the following points: (1) lower margin of maxillary nearly straight (concave in *C. schlegelii*); (2) posterior lower margin of maxillary rounded (pointed); (3) a channel near the upper margin of cerato- and epihyals (none); (4) a process in the anterior lower margin of hypohyal (none); (5) posterior lower margin of urohyal separated (united). The observation on the two specimens of *C. schlegelii* (about 26 and 35 cm in standard length), which was made at the same time, on the other hand, indicates that the characters (2)–(5) mentioned above are individually variable in *C. schlegelii*, and seem to be unimportant as taxonomic characters. Osteologically, the substantial difference between the two species, therefore, is seen only in the shape of the maxillary (1). In addition, the differences between the two species are not recognized in the shape of the red gland of the air bladder as well as the alimentary canal and pyloric caeca. On the present osteological study, the authors conclude that the species is related closely to *C. schlegelii* as Katayama (1975) stated. The color pattern and body shape of the specimens examined histologically suggest that there is no sexual dimorphism in this species.

## Summary

Thirteen specimens of *Caprodon unicolor* Katayama, 20.1–27.7 cm in standard length, were examined osteologically for the purpose to pursue the relationship between the species and *C. schlegelii* (Günther). Substantial difference between the two species is seen only in the shape of the maxillary: the lower margin of maxillary nearly straight in the species, while concave in *C. schlegelii*. The authors conclude, therefore, that *C. unicolor* is related closely to *C. schlegelii* as Katayama stated.

## Acknowledgements

The authors wish to express their sincere gratitude to Prof. Emer. Masao Katayama of the Yamaguchi University and Assoc. Prof. Tetsushi Senta of the Nagasaki University for their valuable suggestions; Mr. Hiroshi Miyauchi, Taiyo Fisheries Co.Ltd., for placing smaples at the authors' disporsal; Dr. John R. Paxton, Australian Museum, Sydney, for critical reading of the manuscript.

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