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NOTES ON THE CLASSIFICATION AND DISTRIBUTION OF
THE INDO-PACIFIC SOAPFISH, *BELONOPERCA*
CHABANAUDI (PERCIFORMES: GRAMMISTIDAE)

by

John E. Randall, Margaret M. Smith, and Katsumi Aida

RHODES UNIVERSITY
GRAHAMSTOWN, SOUTH AFRICA

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ABSTRACT

The former serranid fish *Belonoperca chabanaudi* Fowler & Bean, 1930 is redescribed and transferred to the Grammistidae. This species is wide-ranging in the tropical Indo-Pacific. Recent collections have provided a number of new records within this region, including South Africa, Japan and the Great Barrier Reef.

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NOTES ON THE CLASSIFICATION AND DISTRIBUTION OF THE INDO-PACIFIC SOAPFISH, *BELONOPERCA CHABANAUDI* (PERCIFORMES: GRAMMISTIDAE)

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John E. Randall¹, Margaret M. Smith², and Katsumi Aida³

Fowler and Bean (1930) described and illustrated a new genus and species of serranid fish, *Belonoperca chabanaudi*, from two specimens, the 148-mm holotype from Celebes and a paratype of the same length from off Borneo. The types were collected in 1909 by the U.S. Bureau of Fisheries steamer *Albatross* and deposited in the U.S. National Museum of Natural History. The generic name is derived from the Greek words *belos* (= arrow) and *perke* (= perch), because the contour of the fish resembled an arrowhead.

Schultz in Schultz *et al.* (1953) provided the first record of the species since its original description from a single specimen 112 mm in standard length (SL) taken in the lagoon of Bikini Atoll, Marshall Islands, at a depth of 20 to 40 feet. He used the same drawing as Fowler and Bean to illustrate the fish. He corrected Fowler and Bean's counts of VII dorsal and III anal spines to VIII and II, respectively.

Smith (1954) reported four specimens of *B. chabanaudi* 110–134 mm TL taken in 2 to 10 fathoms off East Africa (Tekomazi Island, Mozambique; Pemba Island, Tanzania; and Shimoni, Kenya). He provided a far more detailed description than Fowler and Bean, or Schultz, including remarks on the unique life colour; his illustration is a photograph. Fourmanoir and Laboute (1976) reported this species from underwater observations at New Caledonia and the New Hebrides and published an underwater photo of one individual, mainly in dorsal view. Allen and Steene (1979) recorded *B. chabanaudi* from Christmas Island in the eastern Indian Ocean, also by underwater observation. Except for Allen and Steene (1979), who listed *B. chabanaudi* in the Grammistidae on our advice, all of the authors who have treated this species have placed it in the Serranidae. As we will demonstrate below, this genus should be placed in the Grammistidae, as defined by Randall *et al.* (1971).

Genus *Belonoperca* Fowler and Bean, 1930

Belonoperca Fowler and Bean, 1930:181 (type-species, *Belonoperca chabanaudi*, by original designation and monotypy).

DIAGNOSIS: Body moderately elongate, the depth 3.5 to 3.7 in SL, and compressed, the width 2.1 to 2.4 in depth; head pointed; snout long, about one third head length; mouth large, the lower jaw projecting, the maxilla reaching to or slightly beyond a vertical through center of eye; posterior border of maxilla concave; supramaxilla present; teeth in villiform bands in jaws, on vomer, and palatines; nasal organ an oval rosette, the long axis horizontal; branchiostegal rays 7; gill membranes united anteriorly, free from isthmus; opercle with three spines; preopercle coarsely serrate; a few spinules on margins of subopercle and interopercle; upper edge of opercle joined by a membrane to body; two separate dorsal fins, the first of VIII or IX spines (usually VIII, the last partially to completely embedded); anal fin with II spines; branched caudal rays 15; pelvic rays I,5, the basal half of the last ray joined to abdomen by a membrane; pectoral fins distinctly shorter than pelvic fins; scales small, ctenoid, not embedded; nape and operculum scaled, the rest of head naked; fins naked except rays and base of caudal which are scaled; vertebrae 9 + 15; predorsal bones 2.

¹Bernice P. Bishop Museum, P.O. Box 19000-A, Honolulu, Hawaii 96819, USA.

²J.L.B. Smith Institute of Ichthyology, Rhodes University, Grahamstown 6140, South Africa.

³Department of Fisheries, Faculty of Agriculture, University of Tokyo, Bunkyo-ku, Tokyo, Japan.

REMARKS: The above diagnosis is compatible with the morphological characters which define the Grammistidae (Randall *et al.*, 1971:169). There remained, however, the question of whether the skin of *B. chabanaudi* produces grammistin-like toxins similar to those present in the mucus of grammistid fishes (Randall, *et al.*, 1971). Actually "grammistin" as shown by Hashimoto & Oshima (1972) for *Pogonoperca punctata* is a series of allied polypeptides containing a moiety of tertiary or quaternary amines.

On May 8, 1978 a specimen of 109 mm SL was speared by the first author and the skin immediately tasted to see if the characteristic bitterness believed to be imparted by grammistins would be evident. There was a distinct bitterness, however it was weak compared to that which one experiences in taste tests of the soapfishes *Grammistes sexlineatus* or *Pogonoperca punctata*. Taste tests for grammistin were also weakly positive for fresh *Belonoperca* later collected in the Maldive Islands and Loyalty Islands.

Skin samples were taken from these specimens and sent to the third author for histological study. The fragile epidermis was largely missing from all these samples, however. Later two better samples were obtained from Warren C. Freihofer from skin removed beneath the right pectoral fin and beside the right pelvic fin of a formalin specimen 99 mm SL collected in the Ninigo Islands, Bismarck Archipelago by Victor G. Springer. These two samples were embedded in paraffin, sectioned at 5 and 10 micra, and stained with hematoxylin-eosin, Sudan black B and periodic acid Schiff (PAS). A section stained with hematoxylin-eosin is shown in figure 1(a) and one stained with Sudan black B in Figure 1(b).

Two types of peculiar cells were found in the epidermis. Type 1 cells contain oil droplet-like granules which stain dark bluish gray with Sudan black B and red with eosin, but not with periodic acid Schiff (PAS). These cells resemble similar cells found in *Grammistes sexlineatus* and *Pogonoperca punctata* which appear to produce grammistin. Type 2 cells contain a homogeneous substance which stains negative or positive with Sudan black B (mostly negative) blue with hematoxylin, and not at all with PAS. This type of cell resembles the peculiar cells believed to secrete the skin toxin of the soapfishes *Aulacocephalus temmincki* and *Diploprion* spp. Possibly both types of cells produce toxins in *Belonoperca*. Ordinary mucous cells (goblet cells) were not detected in the epidermis of *B. chabanaudi*, nor were the multicellular glands of the dermis of the more highly evolved soapfishes such as *Grammistes sexlineatus* present.

It is concluded that *B. chabanaudi* should be placed in the Grammistidae. In having unicellular glands believed to produce grammistin in the epidermis it would seem to be primitive, as has been suggested for *Aulacocephalus* and the two species of *Diploprion*, in contrast to the more specialized *G. sexlineatus* and *P. punctata* which possess multicellular dermal glands.

Belonoperca chabanaudi Fowler and Bean

Plate 1

Belonoperca chabanaudi Fowler and Bean, 1930:182, fig. 4 (type
Tomini, Celebes).

Binang Unang, Gulf of

DESCRIPTION (counts based on 23 specimens from the Bishop Museum, California Academy of Sciences, J.L.B. Smith Institute of Ichthyology, and U.S. National Museum of Natural History and proportional measurements on 10 Bishop Museum specimens 79.4 to 119.4 mm SL): Dorsal rays VIII (rarely IX) + I,10; anal rays II,8; pectoral rays 13 to 15 (usually 14); principal caudal rays 17, uppermost and lowermost rays unbranched; lateral-line scales 69 to 76 (plus 2 or 3 on caudal base posterior to hypural plate); scales above lateral line to origin of dorsal fin 13 to 15; gill rakers (6 to 8) + (13 to 15) (raker at angle included in lower-limb count).

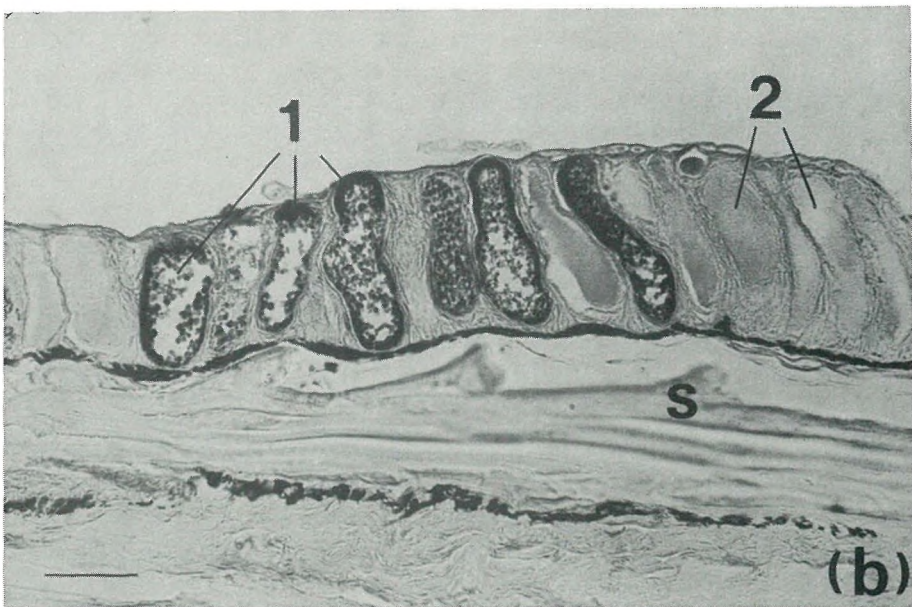
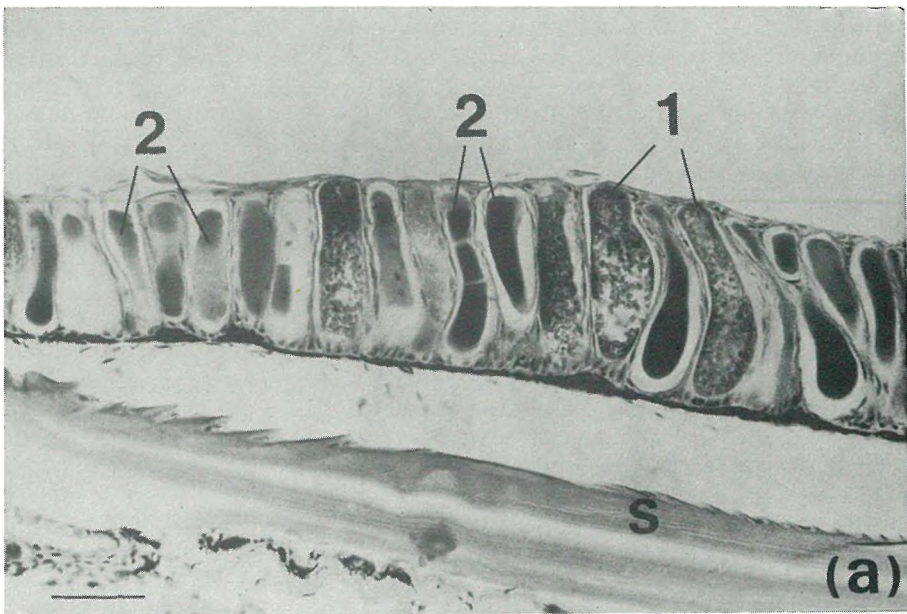


Figure 1. Sections of the skin of *Belonoperca chabanaudi*. (a) hematoxylin-eosin; (b) Sudan Black B. 1. type 1 cells; 2. type 2 cell; s. scale. Bars indicate 50 micra.

Body moderately elongate, the depth 3.5—3.7 in SL, and rather compressed, the width 2.1—2.4 in depth; head large, 2.5—2.7 in SL, and pointed; mouth large, slightly oblique, the lower jaw projecting, the maxilla extending to or slightly posterior to a vertical through center of eye; orbit diameter 5.0—5.6 in head; snout long, 2.8—3.0 in head; interorbital space slightly convex and broad, the bony width 4.7—5.3 in head; least depth of caudal peduncle 2.4—2.6 in head.

Opercle terminating in three flat spines, the middle one most posterior, the upper closer than the lower to middle spine; preopercular margin coarsely serrate (20 to 37 serrae); margin of subopercle with 1 or 2 serrae and interopercle with 4 to 6.

Villiform teeth in bands in jaws (broader anteriorly) in a subtriangular patch on vomer and in a narrow band on palatines; tongue long and narrow, without teeth.

Nostrils about equidistant between edge of orbit and front of snout, the anterior in a membranous tube which is elevated posteriorly.

Small scales on nape (about 30 median predorsal scales) and on operculum (about 13 diagonal rows on cheek), but none on snout, dorsally on head anterior to level of upper margin of preopercle, on sub-orbital bones, maxilla, or ventrally on head; unscaled regions of head notably striated and rugose.

Lateral line complete, slightly arched dorsally beneath first dorsal fin, then gradually curving downward to a short straight portion posteriorly on caudal peduncle; tubes of lateral line simple and horizontal, with a single posterior opening on each scale.

Origin of first dorsal fin posterior to a vertical at pectoral base, above sixth lateral-line scale; third or fourth dorsal spines longest, 2.7—3.4 in head, the last spine partially to completely embedded; membranes of first dorsal fin scarcely incised; second dorsal fin slightly posterior to a vertical through anus, the initial spine slender and closely applied to first soft ray of fin; all dorsal and anal soft rays branched, the posteriormost to base; second to fourth dorsal soft rays longest, 2.4—2.8 in head; first anal spine short, about one-fourth length of second spine; second anal spine slender, closely applied to first soft ray, its length 4.4—6.1 in head; second or third anal soft ray longest, 2.2—2.6 in head; caudal fin truncate to slightly emarginate or double emarginate, its length 1.7—1.9 in head; basal part of caudal fin and rays with small scales, membranes naked; pectoral fins short and rounded, their length 2.6—2.9 in head; upper 2 and lower 3 or 4 pectoral rays unbranched; origin of pelvic fins below lower pectoral base, their length 1.9—2.3 in head.

Color of adults (in alcohol): brown to dark brown with a sharply contrasting pale spot dorsally on anterior half of caudal peduncle (barely visible in lateral view); first dorsal and pelvic fins brown, the dorsal with a large dark brown area; remaining fins with brown rays and clear membranes.

Juveniles of 25 and 36 mm SL differ in having numerous dark spots on the body and head and a prominent dark streak passing posteriorly from eye (Plate 1C).

The following color note was made of a specimen 119 mm SL shortly after being speared by the first author in 18 m outside the reef of Majuro, Marshall Islands: bluish olive with numerous brown dots; a brilliant yellow patch dorsally on front half of caudal peduncle; some orangish around mouth beneath maxilla and under preopercular margin; first dorsal fin orangish black with a pale blue line passing from base of fifth spine forward to base of third spine, then dorsally along posterior edge of outer half of second spine to tip, thence along margin of fin to beyond tip of third spine; blue lines along fifth, sixth and seventh spines (half way on fifth, all the way on seventh); second dorsal and anal fins hyaline with orangish brown rays having small brown spots and blue spots at base; caudal fin similar but without basal blue dots; pectoral fins hyaline with brown rays and a light blue band at base; pelvic fins light bluish with a broad dark brown zone near outer part of fin.

REMARKS: Fish collecting on Indo-Pacific coral reefs in recent years, particularly with the use of ichthyocides, has greatly extended the distribution of *Belonoperca chabanaudi* (Fig. 2). The Bishop Museum has specimens from the following localities: North Male Atoll, Maldive Islands; Madang, New

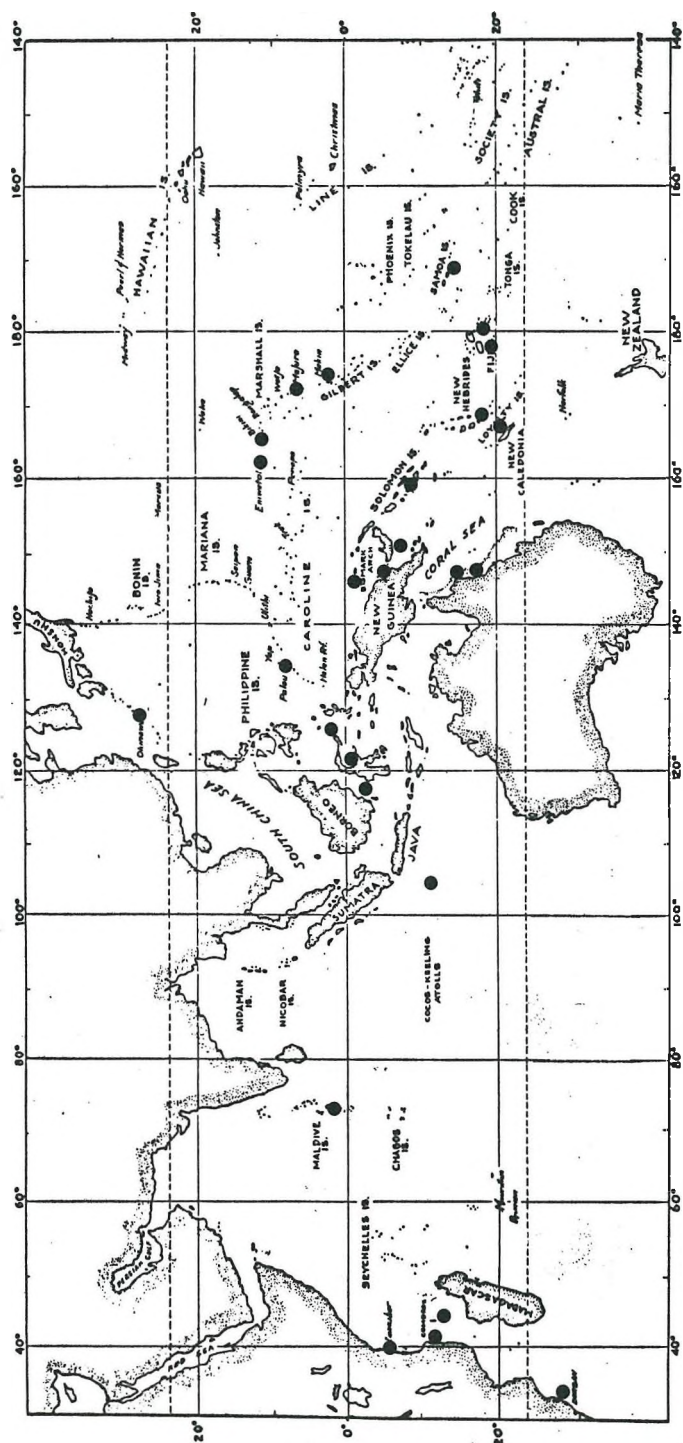


Figure 2. Distribution of *Belonoperca chabanaudi* (each collection locality indicated by ●).

Guinea; Boenakeng Island, Celebes; Savo and Florida Island, Solomon Islands; Uvea, Loyalty Islands; Angulpelu Reef, Palau Islands; Mbengga, Fiji Islands; Enewetak and Majuro, Marshall Islands, and Okinawa, Ryukyu Islands. All of these localities except the Marshall Islands represent new records. Tetsuo Yoshino, however, should be credited with the first capture of the species from the Ryukyu Islands. He collected a specimen 106 mm SL in 12 m at Kuroshima on July 13, 1976. The Australian Museum at Sydney has 13 specimens from Abaiang, Gilbert Islands; Moala in the Lau Group and Viti Levu, Fiji Islands; Savo, Solomon Islands; New Guinea; Lizard Island, Great Barrier Reef and Opal Reef off Cairns, Queensland. The Gilbert Islands and Queensland specimens are new records. The California Academy of Sciences has one specimen from Ngdarak Reef, Palau Islands and one from Grande Comore, Comoro Islands. The J.L.B. Smith Institute of Ichthyology, Rhodes University has the East African specimens reported by Smith (1954), which are discussed above, plus a juvenile taken by the first two authors off Sodwana Bay, KwaZulu in 13 m in June, 1977, which represents the first record for South Africa. In addition to the holotype, single paratype and the specimen from Bikini reported by Schultz, the U.S. National Museum of Natural History has specimens from the Trobriand Islands, New Guinea and the Hermit and Ninigo Islands, Bismarck Archipelago. Richard C. Wass (MS) of the Office of Marine Resources, American Samoa, will record the species from the Samoa Islands from material collected by him. *B. chabanaudi* appears to be absent from the Red Sea, Persian Gulf, continental areas of the Indian Ocean and western Pacific devoid of well developed coral reefs, and islands of Oceania east of Samoa.

This soapfish is generally found by day in caves or beneath ledges. Due to its dark color, often all one sees of it in the deep recesses of caves is the yellow caudal peduncular spot. On rare occasions it will be seen making an excursion during the day from one place of hiding to another. In the failing light of dusk it becomes more active and may swim freely in the more open parts of reefs, though always near the substratum.

Specimens we have examined have been taken in the depth range of 4 to 34 m. Fourmanoir and Laboute (1976) base their sight records at New Caledonia and New Hebrides on fish seen in 10 to 45 m.

The largest specimen is one from the Gilbert Islands deposited under number I.19880-004 in the Australian Museum; it measures 120 mm SL.

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G. David Johnson suspected that *Belonoperca chabanaudi* should be classified in the Grammistidae. He kindly deferred further investigation upon learning of our study of this fish.

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Phillip C. Heemstra reviewed the manuscript.



A. Underwater photo of adult of *Belonoperca chabanaudi*, Maldives Islands.



B. Adult of *B. chabanaudi*, 113 mm SL, BPBM 22301, Okinawa.



C. Juvenile of *B. chabanaudi*, 36 mm SL, RUSI 7407, Kwazulu (N. Natal)

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