

Prionurus chrysurus, a new species of surgeonfish (Acanthuridae) from cool upwelled seas of southern Indonesia

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Abstract

Prionurus chrysurus is described as a new species of acanthurid fish from two specimens taken inshore off eastern Bali. It is also known from a videotape taken of a school off Komodo. It is distinctive in having IX, 23 dorsal rays, III, 22 anal rays, 17 pectoral rays, 8–10 keeled midlateral bony plates posteriorly on the body, numerous small bony plates dorsoposteriorly on the body, and in color: brown with narrow orange-red bars on side of body and a yellow caudal fin. It has been observed only inshore in areas of upwelling where the sea temperature averaged about 23°C. This species is believed to be a glacial relic that had a broader distribution during an ice age but is now restricted to areas of upwelling.

Introduction

The genus *Prionurus* of the surgeonfish family Acanthuridae is known from three western Pacific species, two from the eastern Pacific, and one from the Gulf of Guinea in the eastern Atlantic. All are shallow-water fishes, moderate to large size for the family, and all graze on benthic algae. They often occur in small feeding aggregations to overcome aggressive territorial damselfishes such as those of the genus *Stegastes*. The genus was established by Lacepède (1804) for the species he named *microlepidotus*, known from southern Queensland and New South Wales. It is well named *Prionurus* from the Greek 'prionos' for saw and 'oura' for tail, in reference to the series of 3 to 10 sharp, keeled, bony plates midlaterally on the posterior part of the body. The common name often used for the species of this genus is sawtail. The species of other surgeonfish genera have only one or two caudal-peduncular spines or keeled plates.

Valenciennes in Cuvier and Valenciennes (1835) described the second member of the genus, *P. scalprum*, from Japan, and in 1846 the third, *P. laticlavus*, from the Galápagos Islands (*Xesurus clarionis* Gilbert and Starks in Gilbert, 1897 from the Revillagigedo Islands and *X. hopkinsi* Gilbert and Starks, 1904 are

synonyms). Gill (1862) described the fourth valid species as *P. punctatus* from Cabo San Lucas, Baja California, and Ogilby (1887) the fifth, *P. maculatus*, from New South Wales. Blache and Rossignol (1964) named the one Atlantic species of the genus, *P. biafraensis*, from the island of São Tomé in the Gulf of Guinea.

While making a first scuba dive in Bali in 1982 off the southeast coast at Sanur, the author observed a single individual of a large yellow-tailed species of *Prionurus*. He recognized it as an undescribed species but was unable to collect it. He observed the species a second time off Padang Bai on the east coast of Bali, and a third time as a small aggregation on the north shore of the island of Nusa Penida off eastern Bali. It was not until 1987 that he succeeded in spearing a specimen at Tepekong Island (then called Kambing Island) east of Padang Bai, and a second one was collected off Padang Bai in 1991. In the western Pacific the genus *Prionurus* is clearly antitropical, so it might seem odd to find a species in the warm seas of Indonesia. However, one factor that was common to all the places where this species was seen was the unusually cold sea temperature as a result of

upwelling. Instead of the normal Balinese sea temperature of about 27°C, the temperature was as low as 20°C. Ron Taylor showed the author a videotape of a school of this species taken at Tukoh Lehok Geba, a small, uninhabited rocky island in the Sape Strait off Komodo in the Lesser Sunda Islands of Indonesia. Taylor remarked on how cold the sea was. This species of *Prionurus* may be a glacial relic that had a broader distribution during an ice age when the sea temperature was lower.

The purpose of the present paper is to describe this new species. A brief generic diagnosis and a key to the species of *Prionurus* are given first. Color illustrations of all seven species are provided.

Materials and methods

The holotype was deposited in the Bernice P. Bishop Museum, Honolulu (BPBM) and the paratype in the National Museum of Natural History, Washington, D.C. (USNM).

Lengths of specimens are standard length (SL), measured from the most anterior point of the upper lip to the base of the caudal fin (posterior end of hypural plate). Head length is taken from the posterior end of the opercular membrane to the front of the upper lip, and snout length from the fleshy edge of the orbit to the upper lip. Body depth is the greatest depth from the lower edge of the abdomen to the base of the dorsal spines. Body width is the maximum width just posterior to the gill opening. Interorbital width is the least fleshy width. Orbit diameter is the maximum fleshy diameter. Caudal-peduncle depth is the least depth, and caudal-peduncle length is the horizontal distance between verticals at the rear base of the anal fin and the base of the caudal fin. Lengths of spines and soft rays of fins are measured to where they emerge from the contour of the body. Pectoral-fin length is the length of the longest ray. Pelvic-fin length is measured from the base of the pelvic spine to tip of longest ray.

The last two dorsal and anal rays are close together but counted as separate rays. Pectoral-ray counts include the first two unbranched rays, the uppermost being a short bony splint. Scales are far too small and irregular to be counted, but the lateral-line pores could be seen and counted. Gill-raker counts were made on both the anterolateral and posteromedial sides of the first gill arch (here termed anterior gill rakers and posterior gill rakers respectively).

Data in parentheses in the description of the new species refer to the paratype. Table 1 lists measurements of the holotype and paratype as percentages of the standard length. Proportional measurements in the text are rounded to the nearest 0.05.

Prionurus Lacepède

Prionurus Lacepède, 1804: 211 (type species, *Prionurus microlepidotus* Lacepède, 1804, by monotypy).

Acanthocaulus Waite, 1900: 206 (unnecessary replacement name for *Prionurus*).

Xesurus Jordan and Evermann, 1896: 421 (type species, *Prionurus punctatus* Gill, 1862, by original designation).

Burobulla Whitley, 1931: 321 (type species, *Xesurus maculatus* Ogilby, 1887, by original designation).

Triacanthurodes Fowler, 1944: 332 (type species, *Naseus laticlavus* Valenciennes, 1846).

Diagnosis

Dorsal rays VII–IX, 21–28; anal rays III–IV, 20–25; pectoral rays 16–18; pelvic rays I, 5; caudal fin with 16 principal rays, the shape varying from truncate to slightly emarginate; 3–10 keeled bony plates in a midlateral row posteriorly on body; scales extremely small, not in regular rows, nonoverlapping, each with a cluster of short perpendicular spicules; branchiostegal rays 5; vertebrae 9 + 13; hypurals 5; epurals 2; body deep, the depth varying from 1.6–2.7 in SL (juveniles deeper bodied than adults), and compressed; eye small and high on head; a bony prominence often present anterior to eye; mouth small, low on head, and protruding; teeth uniserial, fixed, close-set, spatulate, and incisiform with denticulate edges.

Remarks

Tyler et al. (1989: 37, fig. 24) illustrated the skeleton of *Prionurus scalprum* and summarized some aspects of the osteology of the genus.

Figure 2 shows the a postlarval stage and transforming specimen of *Prionurus scalprum* from Taiwan.

Smith (1966) divided the Acanthuridae into three subfamilies, Acanthurinae, Prionurinae, and Nasinae. He recognized *Xesurus* as a genus, thus leaving *Prionurus* monotypic, but he added, "It is however doubtful whether *Xesurus* J & E merits more than subgeneric rank in *Prionurus*." Most authors regard *Xesurus* as a synonym of *Prionurus*. Randall (1955: 362) wrote, "There is less basis for the recognition of *Xesurus* than there is for the division of *Naso* into two or more genera."

Based on myological evidence, Winterbottom (1993) divided the Acanthuridae into two subfamilies, the Nasinae and Acanthurinae, and the Acanthurinae into three tribes, Prionurini (*Prionurus*), Zebrasomini (*Zebrasoma* and *Paracanthurus*) and Acanthurinae (*Acanthurus* and *Ctenochaetus*).

Key to the species of *Prionurus*

- 1a. Dorsal spines VII–VIII 2
- 1b. Dorsal spines IX 5
- 2a. Dorsal soft rays 21–22; midlateral keeled bony plates 6; no small bony plates posteriorly on body; adults elongate, the body depth up to 2.7 in SL; large adults with a marked protuberance on snout extending anterior to mouth; dark greenish gray, paler ventrally, the keeled posterior plates dark brown (southern Queensland to central New South Wales) *microlepidotus*
- 2b. Dorsal soft rays 23–28; midlateral keeled bony plates 3; numerous small bony plates posteriorly on body; body not elongate, the depth 1.7–2.0 in SL; no protuberance on snout extending anterior to eye; an oblique dark brown bar posteriorly on head, and a parallel one through eye, the two separated by a whitish zone 3
- 3a. Dorsal soft rays 27–28; numerous small black spots not present on head, body, and dorsal and anal fins (only scattered, very small, black bony plates on posterior half of body); caudal fin yellow (Galápagos Islands, Revillagigedo Islands, Cocos Island, Panama, Colombia, and La Plata Island, Ecuador) *laticlavus*
- 3b. Dorsal soft rays 25; numerous small black spots present on head, body, and dorsal and anal fins; caudal fin solid yellow or gray with small black spots 4
- 4a. Anal soft rays 21; caudal fin gray with numerous small black spots (Gulf of Guinea) *biafraensis*
- 4b. Anal soft rays 23; caudal fin bright yellow (Gulf of California to El Salvador) *punctatus*
- 5a. Midlateral keeled bony plates 3; dorsal soft rays 24–26; anal soft rays 23–25; bluish gray with numerous small yellow spots on head and body, especially dorsally (juveniles with narrow yellow bars on side); peduncular plates blue and black (southern Queensland to New South Wales, Lord Howe Island, and juveniles rarely to New Zealand) *maculatus*
- 5b. Midlateral keeled bony plates 4–10; dorsal soft rays 22–24; anal soft rays 21–23; color not as in 5a 6
- 6a. Midlateral keeled bony plates 4; no small bony plates on body; gray to brown, the caudal fin whitish in life (northern Honshu to Taiwan) *scalprum*

- 6b. Midlateral keeled bony plates 8–10; scattered small bony plates dorso-posteriorly on body; brown with narrow orange-red bars on side of body and yellow caudal fin (Bali and Komodo, Indonesia, in cool upwelled seas) *chrysurus*, new species

***Prionurus chrysurus*, new species
Figures 2, 3; Table 1**

- Prionurus* sp. Randall, 1991: 48, fig. 2 (Bali).
- Prionurus* sp. Lieske and Myers, 1994: 127, fig. 11 (Bali).
- Prionurus* sp. Eichler and Lieske, 1994: 320, middle fig. (Bali).
- Prionurus* sp. Pickell and Siagian, 2000: 137, fig. (east Bali).

Holotype. BPBM 21657, female, 318 mm SL, Indonesia, Bali, “Blue Lagoon”, just N of Padang Bai, under ledge below large head of *Porites*, 10 m, spear, J.E. Randall, 9 November 1991.

Paratype. USNM 363483, female, 391 mm SL, Indonesia, Bali, off E coast, Tepekong Island (formerly Kambing Island), SE side, rocky substratum, 12 m, spear, J.E. Randall, 19 October 1987.

Diagnosis

Dorsal rays IX,23; anal rays III,22; pectoral rays 17; midlateral keeled bony plates posteriorly on body 8–10; scattered small keeled bony plates dorsally on posterior half of body; body depth 2.0–2.2 in SL; brown with narrow orange-red bars on side of body and yellow caudal fin.

Description

Dorsal rays IX,23; anal rays III,22; pectoral rays 17; lateral-line pores 33; midlateral keeled bony plates on posterior half of body 10 (8); anterior gill rakers 5 + 10 (6 + 10); posterior gill rakers 16; pseudobranchial filaments about 35; vertebrae 9 + 13; a single predorsal bone, but first ptergiophore with a stout anterior branch that broadens just anterior to base of first dorsal spine.

Body depth 2.0 (2.2) in SL; body compressed, the width 1.9 (2.2) in depth; head length 3.4 (3.55) in SL; dorsal profile of head forming an angle of about 45° to horizontal axis of head and body; a bony protuberance anterior to eye but extending only slightly before dorsal profile of head; snout length 4.8 (5.2) in SL; orbit diameter 5.05 (5.2) in head length; interorbital space flat medially and strongly convex laterally, the least width 3.35 (3.3) in head; caudal-peduncle narrow, the least depth 3.6 (3.85) in head;

Table 1. Proportional measurements of type specimens of *Prionurus chrysurus*, expressed as percentages of standard length.

	Holotype BPBM 21657	Paratype USNM 363483
Sex	female	female
Standard length (mm)	318	391
Body depth	52.5	45.5
Body width	14.8	15.1
Head length	29.4	28.2
Snout length	20.8	19.3
Orbit diameter	5.8	5.4
Interorbital width	8.8	8.6
Caudal-peduncle depth	8.1	7.3
Caudal-peduncle length	13.1	14.0
Predorsal length	40.2	43.0
Preanal length	48.3	52.8
Prepelvic length	36.7	35.6
Dorsal-fin base	65.6	64.0
First dorsal spine	2.9	2.8
Longest dorsal spine	12.8	12.2
Ninth dorsal spine	10.9	10.5
Longest dorsal ray	11.3	11.0
Last dorsal ray	7.7	6.8
Anal-fin base	43.3	41.2
First anal spine	3.1	3.1
Second anal spine	6.8	6.5
Third anal spine	9.9	10.0
Longest anal ray	12.1	11.4
Last anal ray	7.8	7.6
Caudal-fin length	16.8	20.0
Pectoral-fin length	23.6	23.8
Pelvic-spine length	10.2	10.7
Pelvic-fin length	15.4	14.9

caudal-peduncle length 2.25 (2.0) in head.

Mouth small, terminal, but projecting obliquely downward at an angle of about 45°; lips large and nearly covering teeth; median height of upper lip about twice that of lower lip; teeth as described for genus, the upper teeth 20 (22) and the lower teeth 21 (22).

Keeled bony plates of midlateral series vertically elliptical, the first below base of second dorsal soft ray; these plates small anteriorly, the height of the anterior ones about half orbit diameter; third-from-last plate largest, its height slightly greater than orbit diameter; keels of anterior plates small and hemispherical; keels well developed only on last four or five plates, becoming pointed and slightly antrorse on the last three, the lateral length about one-third orbit diameter; 20 small, faintly keeled, bony plates scattered dorsally on body in space below base of eighth dorsal spine and fifteenth soft dorsal ray; one small keeled bony plate below midlateral series; scales as described for the genus, the skin texture like fine sandpaper; very fine scales covering fins except for

membranes of dorsal and anal fins that have fine scales only basally.

An oblique deep groove extending forward from lower part of orbit, its length about three-fourths orbit diameter; nostrils above anterior half of groove, the anterior vertically elongate and the posterior elongate in direction of groove; upper half of anterior nostril with a small posterior flap.

Dorsal-fin origin above upper end of gill opening, the predorsal length 2.5 (2.3) in SL; first dorsal spine short, 10.1 (9.7) in head length; fifth and sixth dorsal spines longest, 2.3 in head; ninth dorsal spine 2.7 in head; first dorsal soft ray longest, 2.6 (2.55) in head; last dorsal soft ray 3.8 (4.15) in head; anal-fin origin below base of seventh dorsal spine, the preanal length 2.05 (1.9) in SL; first anal spine short, 9.5 (9.1) in head; second anal spine 4.3 (4.35) in head; third anal spine 3.0 (2.8) in head; first anal soft ray longest, 2.4 (2.5) in head; caudal fin truncate, becoming slightly rounded when fully spread (caudal fin of paratype slightly emarginate), the fin length 5.95 (5.0) in SL; pectoral fins pointed, the fourth ray longest, 4.25 (4.2) in SL; origin of pelvic fins distinctly posterior to lower base of pectoral fins, the prepelvic distance 2.7 (2.75) in SL; pelvic spine 2.9 (2.75) in head; pelvic fins just reaching origin of anal fin, the first two rays longest, 1.9 in head.

Color of holotype in alcohol: dark brown, a little paler ventrally, with 17 narrow, lighter brown bars along side of body; keeled bony plates also lighter brown; upper lip darker brown than head, and lower lip distinctly paler; fins dark brown except for light brown caudal fin. Color when fresh shown in Figure 2.

Color in life from underwater photographs: head and anterior body orangish brown, shading to olive-gray posteriorly and to brown ventrally on rest of body; a series of about 17 orange-red bars on side of body, a little narrower than brown interspaces, narrowing as they pass ventrally; numerous small pale green flecks dorsally on posterior two-thirds of body; lips and opercular membrane blackish; keels of last four midlateral bony plates black; small keeled plates dorsally on posterior two-thirds of body dark gray; dorsal and anal fins greenish gray; caudal fin bright yellow; pectoral fins dark brown; pelvic fins brown like ventral part of body.

Etymology

This species is named *chrysurus* from the Greek 'chrysos' for gold or yellow, and 'oura' for tail, in reference to its bright golden yellow caudal fin, the most conspicuous color feature.

Remarks

As discussed in the Introduction, *Prionurus chrysurus* is known from only two of the Lesser Sunda Islands

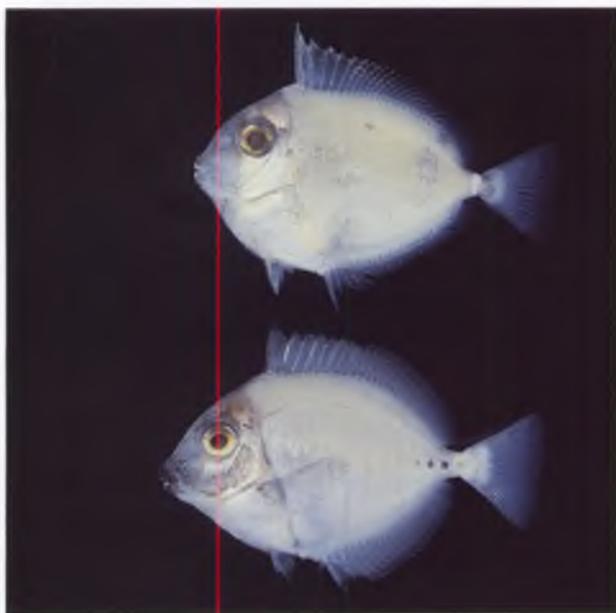


Figure 1. Late postlarval stage (upper) and transforming specimen (lower) of *Prionurus scalprum*, Yeh Liu, northern Taiwan.



Figure 2. Holotype of *Prionurus chrysurus*, BPBM 21657, 318 mm SL, Bali.



Figure 3. Underwater photograph of adult of *Prionurus chrysurus*, N of Padang Bai, Bali.



Figure 4. Underwater photograph of *Prionurus biafraensis*, São Tomé, Gulf of Guinea (Peter Wirtz).



Figure 5. Underwater photograph of *Prionurus laticlavus*, Galápagos.



Figure 6. *Prionurus maculatus*, 375 mm SL, Lord Howe Island (Australian Museum specimen).



Figure 7. Underwater photograph of a school of *Prionurus maculatus*, Lord Howe Island.



Figure 8. Underwater photograph of *Prionurus microlepidotus*, Lady Elliot Reef, southern Great Barrier Reef.



Figure 9. Underwater photograph of a school of *Prionurus microlepidotus*, Lady Musgrave Reef, southern Great Barrier Reef.



Figure 10. Underwater photograph of *Prionurus punctatus*, Espiritu Santo, Gulf of California.



Figure 11. Aquarium photograph of *Prionurus scalprum*, Osaka Oceanarium.

of Indonesia, Bali and Komodo. All of the localities where it has been seen are areas of upwelling where the sea temperature is distinctly cooler than localities where upwelling does not normally occur. In the zones of upwelling, the sea was usually about 23°C, but it sometimes ranges as low as 20°C. One can speculate that this surgeonfish probably had a greater distribution when seas, in general, were cooler as during glacial periods.

This species occurs from inshore to depths of at least 20 m on rocky substrata or coral reefs. It was observed to graze on algae. Most sightings were as solitary individuals, but on two occasions small aggregations were encountered. The one videotaped by Ron Taylor at Komodo consisted of about 30 fish.

Prionurus chrysurus does not appear to be closely related to any species of the genus. It has the highest number of midlateral keeled bony plates and a unique color pattern. It shares IX dorsal spines with two western Pacific species and its yellow caudal fin with the two eastern Pacific species.

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I am grateful to Ron Taylor for providing the videotape that confirmed the occurrence of *Prionurus chrysurus* near Komodo, Peter Wirtz for his photograph of *P. biafraensis*, John E. McCosker of the California Academy of Sciences and David G. Smith of the National Museum of Natural History for information on specimens of *Prionurus*, and Loreen R. O'Hara for the x-ray of the holotype of *P. chrysurus*.

Literature cited

- Blache, J. & M. Rossignol. 1964. *Uraspis cadenati* nov. sp. (Carangidae) et *Xesurus biafraensis* nov. sp. (Acanthuridae). Poissons perciformes nouveaux du Golfe de Guinée. Bull. Mus. Natl. Hist. Nat., sér. 2, 33(5): 479–484.
- Cuvier, G. & M.A. Valenciennes. 1835. Histoire naturelle des poissons. Vol. 12. F.G. Levrault, Paris, xxiv + 482 pp.
- Fowler, H.W. 1944. The fishes in Results of the Fifth George Vanderbilt Expedition (1941) (Bahamas, Caribbean Sea, Panama, Galápagos Archipelago and Mexican Pacific Islands). Acad. Nat. Sci. Phila., Monogr. no. 6: 57–529.
- Eichler, D. & E. Lieske. 1994. Korallenfische Indischer Ozean. Jahr-Verlag GmbH & Co., Hamburg, 368 pp.
- Gilbert, C.H. 1897. Descriptions of twenty-two new species of fishes collected by the steamer "Albatross," of the United States Fish Commission. Proc. U.S. Natl. Mus., 19: 437–457.
- Gilbert, C.H. & E.C. Starks. 1904. The fishes of Panama Bay. Mem. Calif. Acad. Sci., 4: 1–304.
- Gill, T.N. 1862. Catalogue of the fishes of Lower California in the Smithsonian Institution, collected by Mr. J. Xantus. Proc. Acad. Nat. Sci. Phila., 14(3–4): 141–151.
- Jordan, D.S. & B.W. Evermann. 1896. A check-list of the fishes and fish-like vertebrates of North and Middle America. Rep. U. S. Fish Comm., vol. 21 (1895) Append. 5: 207–584.
- Lacepède, B.G.E. 1804. Mémoire sur plusieurs animaux de la Nouvelle Hollande dont la description n'a pas encore été publiée. Ann. Mus. Hist. Nat. Paris, 4: 184–211.
- Lieske, E. & R. Myers. 1994. Coral reef fishes, Caribbean, Indian Ocean and Pacific Ocean including the Red Sea. Harper Collins, London, 400 pp.
- Ogilby, J.D. 1887. On an undescribed fish of the genus *Prionurus* from Australia. Proc. Zool. Soc. Lond., 1887(2): 395–396.
- Pickell, D. & W. Siagian. 2000. Diving Bali. Periplus Editions (HK) Ltd., 223 pp.
- Randall, J.E. 1955. An analysis of the genera of surgeon fishes (Family Acanthuridae). Pacif. Sci., 9(3): 359–367.
- Randall, J.E. 1991. Diving in Bali. Freshw. Mar. Aquarium, 14(5): 47–53.
- Smith, J.L.B. 1966. Fishes of the sub-family Nasinae with a synopsis of the Prionurinae. Ichth. Bull. Dept. Ichth., Rhodes Univ., no. 32: 635–675.
- Tyler, J.C., Johnson, G.D., Nakamura, I. & B.B. Collette. 1989. Morphology of *Luvarus imperialis* (Luvaridae), with a phylogenetic analysis of the Acanthuroidei (Pisces). Smiths. Contrib. Zool., no. 485: v + 78.
- Valenciennes, A. 1846. Table + Ichthyology Pls. 1–10 in A. du Petit-Thouars, Atlas de Zoologie. Voyage autour de monde sur la frégate "Vénus," pendant les années 1836–1839. [The plates were published in 1846.]
- Waite, E.R. 1900. Additions to the fish fauna of Lord Howe Island. Rec. Austral. Mus., 3(7): 193–209.
- Whitley, G.P. 1931. New names for Australian fishes. Austral. Zool., 6(4): 310–334.
- Winterbottom, R. 1993. Myological evidence for the phylogeny of recent genera of surgeonfishes (Percomorpha, Acanthuridae), with comments on the Acanthuroidei. Copeia, 1993(1): 21–39.