



Redescription of *Iniistius jacksonensis* (Ramsay 1881) and description of *Iniistius opalus* sp. nov. from northern Australia (Perciformes: Labridae)

Yoshino Fukui¹

Received: 27 June 2018 / Revised: 31 October 2018 / Accepted: 31 October 2018 / Published online: 1 December 2018
© The Ichthyological Society of Japan 2018

Abstract

The razorfish *Iniistius jacksonensis* (Ramsay 1881) is redescribed based on 10 specimens, including adult individuals, from eastern Australia. A second Australian species, *Iniistius opalus* sp. nov. is described based on 16 specimens from northern waters. Both species can be distinguished from other congeners in having a broad band of small scale rows on the cheek, a single small scale below the eye, first two dorsal-fin spines short, their length similar to those of other spines of dorsal fin, central gill-raker of lower limb of first gill arch with a single branch, greater body depth [33.6–41.5% standard length (SL) in *Iniistius jacksonensis*, versus 33.5–39.2% SL in *I. opalus* sp. nov.], and several small blotches on the anal-fin base. The new species can be distinguished from *I. jacksonensis* by its 10 scale rows below lateral line, four branches on central gill-raker of first upper limb of gill arch (vs. 2 branches in latter), greater head length [32.9–36.0% (mean 34.3%) vs. 29.6–32.1% (31.2%) SL], pre-pectoral-fin length [29.8–32.5% (31.2%) vs. 26.5–29.9% (28.5%) SL], orbit diameter [6.1–7.3% (6.8%) vs. 5.0–6.8% (5.8%) SL] and postorbital length [14.9–18.4% (16.8%) vs. 13.6–16.2% (14.9%) SL], and small blotches on head (vs. no blotches).

Keywords Wrasse · Morphology · New species · Distribution

Introduction

The genus *Iniistius*, popularly called razorfish, was established by Gill (1862) for the Indo-Pacific and eastern Pacific *Xyrichtys pavo* Valenciennes 1840 (originally given as *Xir-ichthys*, but regarded here as a misspelling). *Iniistius* currently includes 21 valid species (51 nominal species), in addition to several apparently undescribed species (Fukui 2017). The endemic Australian razorfish *Iniistius jacksonensis*, described by Ramsay (1881) as *Novacula jacksonensis*

on the basis of a single small specimen from Manly Beach, Port Jackson, New South Wales, was subsequently reported on the basis of single adult individuals from Western Australia by Gloerfelt-Tarp and Kailola (1984) and Sainsbury et al. (1985), and the area between Cape Hawke and Charlotte Head by Waite (1899). Gloerfelt-Tarp and Kailola (1984) mentioned a color difference between the Eastern and Western Australian specimens. However, this difference has not been examined because of lack of specimens.

During a taxonomic study of *Iniistius*, 26 specimens from Eastern and Western Australia resembling *I. jacksonensis* were found to comprise that species (10 specimens) and a new species of *Iniistius*. A redescription of *I. jacksonensis* (Ramsay 1881) is provided and the new species from northern Australian waters is described and compared in detail with its congnate.

This article was registered in the *Official Register of Zoological Nomenclature* (ZooBank) as 88BAE7BB-F9C0-4456-AF08-2E0822CE9F5D.

This article was published as an Online First article on the online publication date shown on this page. The article should be cited by using the doi number.

✉ Yoshino Fukui
k5349298@kadai.jp

¹ The United Graduate School of Agricultural Science, Kagoshima University, 1-21-24 Korimoto, Kagoshima 890-0065, Japan

Materials and methods

Counts and measurements follow Randall and Cornish (2000), except for: snout length — least distance between anteriormost point on the upper lip and anterior margin of orbit; orbit diameter — maximum horizontal diameter of orbit; postorbital length — least horizontal distance between posterior margins of orbit and opercle; least distance between anteroventral margin of orbit and maxilla, preopercle, and interopercle — least distance between bony margin of orbit and bony margins of respective bones. Standard length is abbreviated as SL. All measurements were made on the left side using digital calipers. Pectoral-fin rays, scale rows in longitudinal series, pored lateral-line scales and gill rakers were counted on both sides of the body. The lateral line is interrupted: the anterior section from above gill opening to middle of dorsal body region, the posterior section from midlateral body region to caudal-fin base, defined here as anterior and posterior series of the lateral line, respectively. In the descriptions, data and description of the holotype are presented first, followed by data for paratypes in parentheses when different. Institutional codes follow Sabaj (2016).

Iniistius jacksonensis (Ramsay 1881)

(English name: Australian Keel-head Wrasse) (Figs. 1–4, 7; Tables 1, 2)

Novacula jacksonensis Ramsay 1881: 198 (type locality: Manly Beach, Port Jackson, New South Wales, Australia).

Novaculichthys jacksonensis: Waite 1899: 87, pl. 15 (between Cape Hawke and Charlotte Head, New South Wales, Australia).

Xyrichtys jacksonensis: Francis 1993: 165 (Lord Howe Island, New South Wales, Australia, listed); Johnson 1999: 745 (Moreton Island, Queensland, Australia listed); Hutchins 2001: 39 (Western Australia, Australia, listed); Kuitert

2012: 376, figs. A (Moreton Bay, Queensland, Australia; Sydney Harbour and elsewhere in New South Wales, Australia).

Holotype. AMS A. 9956, holotype, 108 mm SL; caught at Manly Beach, Port Jackson, New South Wales, Australia.

Other specimens examined (Australia). 9 specimens, 129–189 mm SL. **Queensland:** AMS E. 1615, 150 mm SL, Fraser Island, 25°38'S, 153°20'E, FIS *Endeavour*, 29 June 1910; QM I. 12299, 151 mm SL, Moreton Bay, 27°15'S, 153°15'E, M. Drinan, trawl, 31 July 1952; QM I. 12309, 129 mm SL, east of Coolangatta, 28°08'S, 153°30'E, C. Markwell, trawl, 18 Apr. 1952; QM I. 17482, 173 mm SL, Noosa, Laguna Bay, 26°22'S, 153°05'E, E. Grant, handline, 14 Nov. 1979. **New South Wales:** AMS I. 3978, 148 mm SL, off Cape Hawke, 32°30'S, 152°53'E, E. Waite, bottom trawl, 6 Mar. 1898; AMS I. 21556-001, 151 mm SL, off Middle Head, Sydney Harbour, 33°48'S, 151°15'E, J. Campbell, hook and line fishing, Feb. 1980; AMS I. 31249-001, 145 mm SL, Cape Banks Bay, 33°59'S, 151°12'E, M. Smith, trawl, 14 Dec. 1990; AMS I. 34143-001, 153 mm SL, Cape Hawk, 32°15'S, 152°33'E, bottom trawl, FRV *Kapala*, 19 Aug. 1992; BPBM 35033, 189 mm SL, Lord Howe Island, 2 m, J. Earle, powerhead blast, 28 Feb. 1992

Diagnosis. Dorsal-fin rays IX, 12, first two dorsal-fin spines short, their length similar to those of other spines of dorsal fin; anal-fin rays III, 12; pectoral-fin rays 12; lateral line interrupted, pored lateral-line scales 19–21 + 5–6; scale rows below lateral line 10 (rarely 9); small scale below eye; 7 vertical small scale rows on cheek, each row narrowly separated from adjacent rows; central gill raker of upper limb of first gill arch with 2 branches; central gill raker of lower limb of first gill arch with single branch; body depth 33.6–41.5% of SL; head length 29.6–32.1% of SL; pre-pectoral-fin length 26.5–29.9% of SL; orbit diameter 5.0–6.8% of SL; eleventh dorsal-fin soft ray longest, tip of depressed last dorsal-fin soft ray reaching vertical through caudal-fin base; no blotches on head; small milky-white blotches on anal-fin base and caudal peduncle.

Description. Counts and measurement are given in Table 1.

Fig. 1 Preserved specimen of *Iniistius jacksonensis*. AMS A. 9956, holotype, 108 mm SL, Manly Beach, Port Jackson, New South Wales



Body compressed, extremely deep, depth greatest at pectoral-fin origin. Dorsal profile of snout nearly vertical, remaining profile of head before and above eye slightly curved. Fleshy anterior edge of head sharply compressed. Snout long. Eye small. Mouth small, slightly oblique. Lips thin. Teeth in jaws affixed to outer edge of bony ridge. Two pairs of thick, well curved canine teeth at front of each jaw; 14 (13–15) small thick teeth posteriorly on each bony plate behind upper-jaw canine teeth; 14 (14–15) conical teeth posteriorly on each bony plate behind lower-jaw enlarged canines. Tongue slender, rounded, upper surface covered with small papillae. Gill opening short. Gill rakers thick, short, longest on first arch about one-half length of longest gill filament; central gill raker of upper limb of first gill arch with 2 branches; central gill raker of lower limb of first gill arch with single branch. Preopercular margin smooth, extending beyond vertical through ventral margin of orbit. Anterior nostril a tiny aperture, overlain by flap from anterodorsal edge; posterior nostril short, slightly oblique. Suborbital sensory canal with 3 (3–5) short branches, each ending with single pore.

Scales thin, cycloid, scale diameter at midbody nearly equal to orbit diameter; axillary scale half size of scales at midbody. Small scale below eye; 7 vertical small narrowly-spaced scale-rows on cheek. Lateral line interrupted, pored lateral-line scale with single tube; anterior series following dorsal contour of body; posterior series midlaterally on posterior region of body; 2 vertical scale rows between last pored-scale of anterior series and first pored-scale of posterior series.

All dorsal-, anal- and pelvic-fin soft rays branched. Dorsal- and anal-fin spines slender. First dorsal-fin spine extremely slender and flexible, tip connected by thin filament to tip of second dorsal-fin spine; membrane between second and third dorsal-fin spines incised, attached lower to third of third dorsal spine. Origin of dorsal fin slightly posterior to vertical through posterior margin of orbit. Last two dorsal-fin soft rays long, reaching vertical through caudal-fin

base (extending beyond vertical through caudal-fin base in adults <ca. 130 mm SL; Fig. 8e, f). Pectoral fins weakly rounded. Pelvic fins long, origin slightly posterior to vertical through origin of pectoral fin; first soft ray longest, tip reaching anus.

Color of fresh specimen. Based on original description and photograph of single fresh specimen, 189 mm SL (Fig. 2). Juvenile: body greenish-opaline with oblong orange patch behind eye. Caudal fin with five pale blue or orange bars. Indistinct pale lines on membranes of dorsal and anal fins. Each scale on ventral and caudal regions with blue spot. Adult: body grayish-white with poorly defined orange patch from anterodorsal margin of orbit to pectoral-fin base, mid-lateral body to caudal peduncle grayish-yellow. Eye bright orange, pupil black. Lower jaw white. Extremely narrow faint milky-white stripes, extending from posterior margin of preopercle to pectoral-fin base. Small milky-white blotches, size less than orbit diameter, on anal-fin base and caudal peduncle. Dorsal fin grayish-green with milky-white edge and several irregular yellow bars and blotches. Pectoral and pelvic fins milky-white basally, translucent distally. Anal fin milky-white basally, translucent distally, edged with milky-white. Caudal fin grayish-white, with several irregular milky-white bars, posterior bar broad.

Color of preserved specimens. Based on examined specimens, including holotype (Figs. 1, 3). Body uniformly brown. Small dark brown blotches on anal-fin base and caudal peduncle (or absent on body <ca. 130 mm SL, appearing with growth). Fins, except for caudal fin, translucent. Caudal fin pale brown with several irregular brown bars (bars absent on holotype).

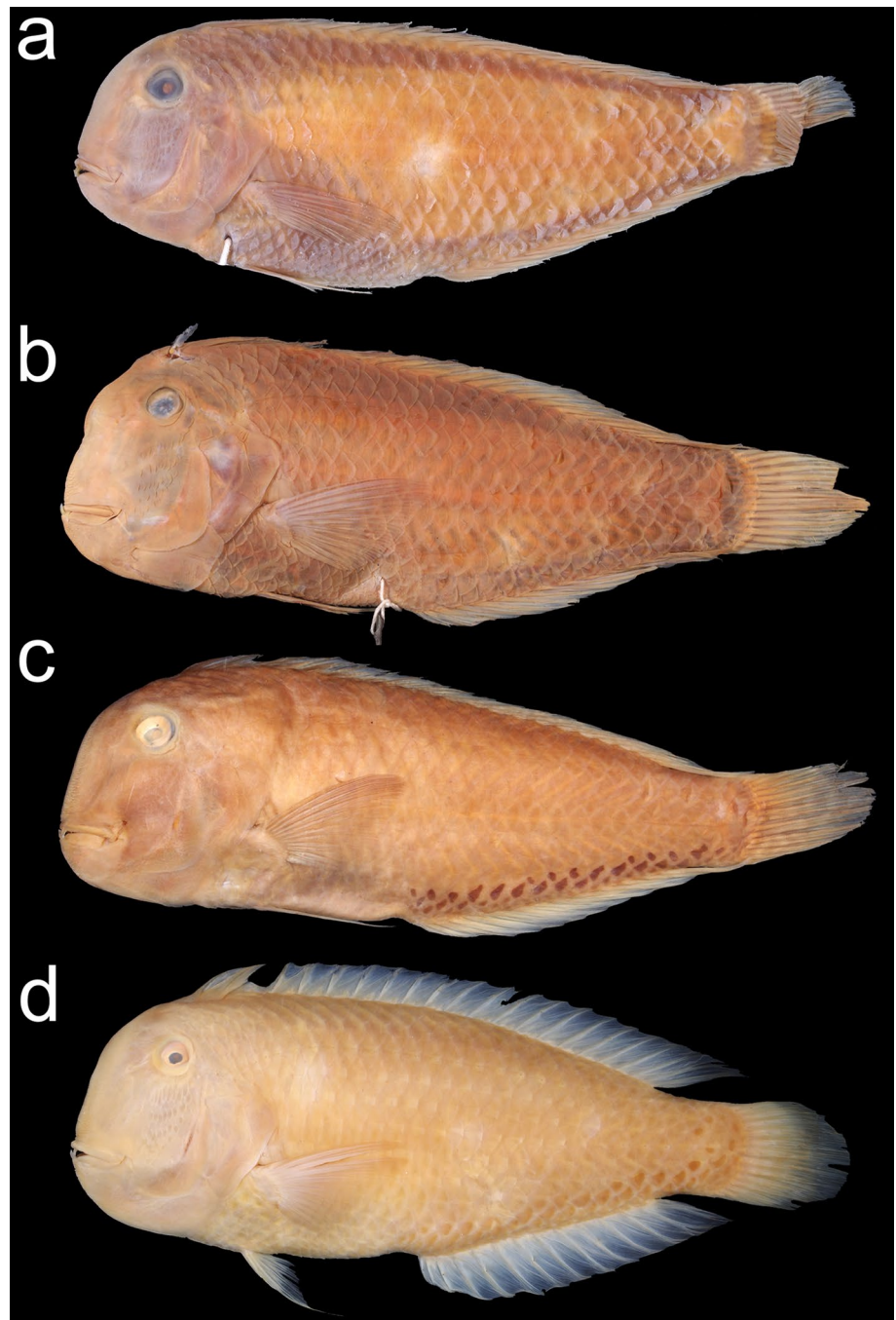
Distribution. Restricted to eastern Australia, having been recorded from Fraser Bay, Queensland to Cape Banks Bay, New South Wales (Fig. 4).

Remarks. *Iniistius jacksonensis* was originally described by Ramsay (1881) on the basis of a single small specimen (AMS A. 9956, 108 mm SL) caught at Manly Beach, Port Jackson. Subsequently, Waite (1899:87–89) reported an

Fig. 2 Fresh specimen of *Iniistius jacksonensis*. BPBM 35033, 189 mm SL, Lord Howe Island, New South Wales



Fig. 3 Preserved specimens of *Iniistius jacksonensis* of different sizes. **a** QM I. 12309, 129 mm SL, east of Coolangatta, Queensland; **b** AMS E. 1615, 150 mm SL, Fraser Island, Queensland; **c** QM I. 17482, 173 mm SL, Noosa, Laguna Bay, Queensland; **d** BPBM 35033, 189 mm SL, Lord Howe Island, New South Wales



adult individual (AMS I. 3978, 133 mm SL) of this species from the area between Cape Hawke and Charlotte Head. Waite noted differences between Ramsay's small specimen and the adult specimen, including the anterodorsal head profile (convex in former vs. vertical in latter), developmental condition of the lower canine teeth (as well developed as upper teeth vs. weakly developed), and occurrence of a membrane between the second and third dorsal-fin spines (absent vs. low membrane). Those differences are regarded here as intraspecific variations. In particular, it has been

known that species of *Iniistius* undergo changes in the anterodorsal head profile (see Fig. 3b), most morphometrics associated with the head changing with growth [e.g., eye position becoming relatively higher (Fig. 8)]. However, no relationship was recognized in the present study between variations in the head profile and growth.

Examination of ten specimens (108–189 mm SL), including the holotype, revealed coloration changes with growth in this species. According to the original description, the fresh coloration of a young individual *I. jacksonensis* resembled

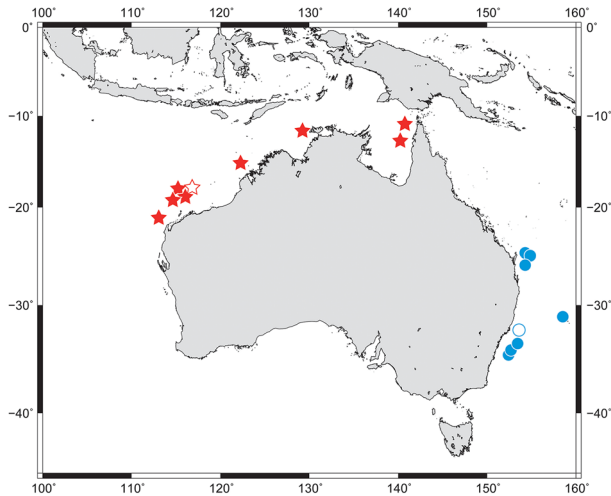
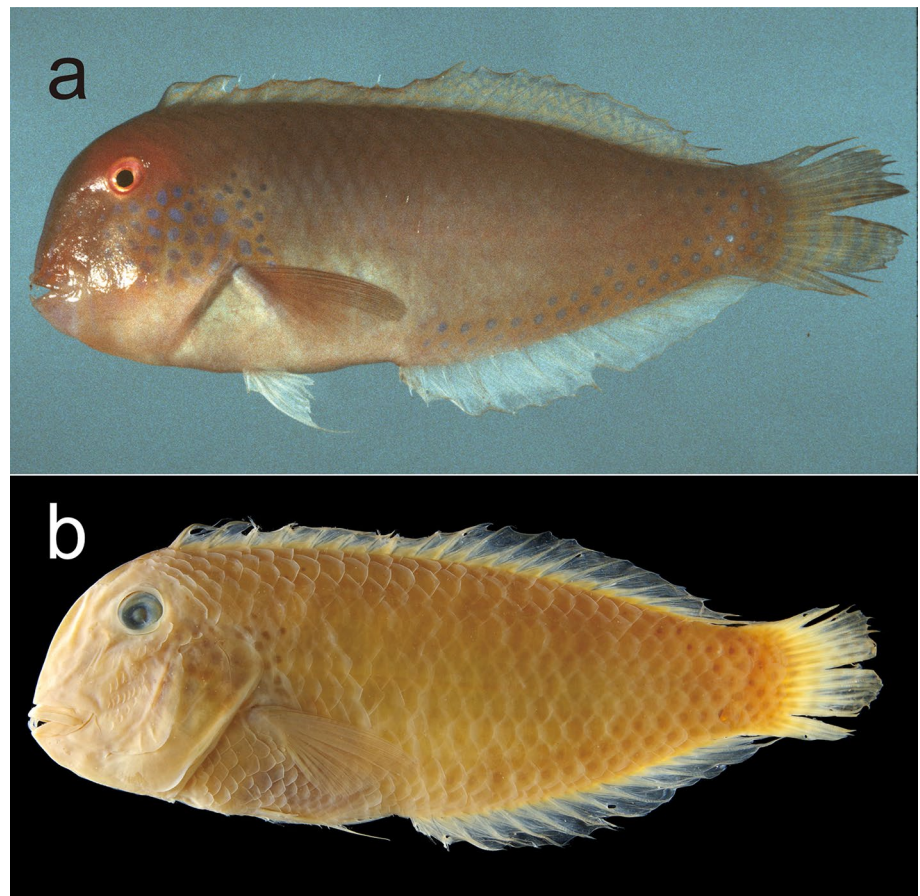


Fig. 4 Collection localities for specimens of *Iniistius jacksonensis* (circles) and *I. opalus* sp. nov. (stars), based on specimens examined in this study. Open symbols indicate holotype

adult coloration in sharing an indistinct orange patch behind the eye, several bars on the caudal fin, small blotches on the abdominal and caudal regions, and no blotches on the head. However, the former lacked narrow stripes, extending

Fig. 5 Photographs of *Iniistius opalus* sp. nov. (CSIRO CA 2974, holotype, 138 mm SL, north of Port Headland, Western Australia). **a** Fresh specimen; **b** preserved specimen



from the preopercle posterior margin to the pectoral-fin base. Such stripes may appear with growth. In contrast, the presence of blotches on the abdominal and caudal areas varied according to preservation conditions (see Figs. 1, 3a, b).

Kuiter (2012) provided underwater photographs of young individuals (ca. 18–68 mm SL) of *I. jacksonensis* from Sydney with extremely variable coloration. Unfortunately, no specimens < 100 mm SL were available during the present study.

Iniistius opalus sp. nov.

(Proposed English Standard Name: Opaline Razorfish) (Figs. 5–8; Tables 1, 2)

Xyrichtys jacksonensis (not of Waite): Gloerfelt-Tarp and Kailola 1984: 238, 349, unnumbered fig. (North West Cape to Timor Sea, Western Australia, Australia); Sainsbury et al. 1985: 262, 263, unnumbered fig. (Western Australia, Australia).

Xyrichtys sp. 2: Kuiter 2012: 376, unnumbered fig. (north-west of Western Australia, Australia).

Holotype. CSIRO CA 2974, 138 mm SL, north of Port Hedland, Western Australia, Australia, 19°31'–32'S,

118°34'–35'E, 36 m, demersal trawl, FRV *Soela*, 20 Aug. 1982.

Paratypes. 15 specimens, 112–161 mm SL (Australia). **Northern Territory:** NTM S. 13311-001 (2), 112–137 mm, North Anson Bay, Timor Sea, 12°58'S, 129°54'E, 18 m, 21 Nov. 1990. **Queensland:** CSIRO H 3913-01, 121 mm SL, west of Weipa, Gulf of Carpentaria, 12°31'–32'S, 141°28'E, 22 m, prawn trawl, FRV *Southern Surveyor*, 8 Mar. 1995 QM I. 34893 (2), 117–144 mm SL, Gulf of Carpentaria, 10°38'S, 141°27'E, 15 m, J. Johnson, 29 Nov. 1991. **Western Australia:** CSIRO CA 3728, 1601 mm SL, north of Dampier Archipelago, 19°45'–47'S, 116°33'–35'E, 60–64 m, demersal trawl, FRV *Soela*, 4 Dec. 1979; CSIRO H 4015-04, 146 mm SL, north of Cape Preston, Western Australia, 20°23'–25'S, 116°07'–08'E, 34 m, demersal trawl, FRV *Southern Surveyor*, 24 Aug 1995; CSIRO H 4050-02, 132 mm SL, west of Port Hedland, 20°13'S, 117°48'–50'E, 23–25 m, demersal trawl, FRV *Southern Surveyor*, 4 Sep. 1995; NSMT-P 126448, 148 mm SL, Western Australia, 20°13'S, 115°40'E, 50–56 m, RV *Tanshu-maru*, 9 May 1972; NTM S. 11690-020, 137 mm SL, west of King Sound, North West Shelf, 16°33'S, 121°29'E, 40–46 m, B. Russell, 17 Apr. 1985; WAM-P 25354-021 (5), 147–161 mm SL, Monte Bello Islands, 20°25'S, 115°30'E, trawl, 15 Apr. 1975.

Diagnosis. Dorsal-fin rays IX, 12, first two dorsal-fin spines short, their length similar to those of other spines of dorsal fin; anal-fin rays III, 12 (rarely 11 or 13); pectoral-fin rays 12; lateral line interrupted, pored lateral-line scales 18–20 + 4–5; scale rows below lateral line 9 (rarely 10); small scale below eye; vertical small 6–8 scale rows on cheek, each row well separated from adjacent rows. Central gill raker of upper limb of first gill arch with 4 branches; central gill raker of lower limb of first gill arch with single branch; body depth 33.5–39.2% of SL; head length 32.9–36.0% of SL; pre-pectoral-fin length 29.8–32.5% of SL; orbit diameter 6.1–7.3% of SL; last two dorsal-fin rays long; small blotches on body; distinct blotches scattered on opercle.

Description. Counts and measurements are given in Table 1.

Body compressed, extremely deep, depth greatest at pectoral-fin origin. Dorsal profile of snout nearly vertical, remaining profile of head before and above eye slightly curved. Fleshy anterior edge of head sharply compressed. Snout long. Eye small. Small scale below eye; 6 (6–8) vertical scale rows on cheek, each row well separated from adjacent rows, anterior cheek row reaching to vertical at posterior edge of upper lip, scale pockets deep. Teeth in jaws affixed to outer edge of bony ridge. Two pairs of thick well curved canine teeth at front of each jaw; 13 (13–15) small thick teeth posteriorly on each bony plate behind upper-jaw canines; 14 (14–15) conical teeth posteriorly on each bony plate behind lower-jaw canines. Tongue slender,

rounded, its upper surface covered with small papillae. Gill opening short. Gill rakers thick, short, longest gill raker on first arch about one-half length of longest gill filament; central gill raker of upper limb of first gill arch with 4 branches; central gill raker of lower limb of first gill arch with single branch. Preopercular margin smooth, extending dorsally beyond vertical through ventral margin of orbit. Anterior nostril with tiny aperture, overlain by flap from its anterodorsal edge; posterior nostril short, slightly oblique. Suborbital sensory canal with 5 (5–6) short branches, each ending with single pore.

Scales thin, cycloid, scale diameter at midpoint of body nearly equal to orbit diameter; axillary scale half size of scale at midbody. Lateral line interrupted; pored lateral-line scales with single tube; anterior series following dorsal contour of body; posterior series midlaterally on posterior region of body; 2 horizontal scale rows between last pored-scale of anterior series and first pored-scale of posterior series; 6.5 horizontal scale-rows on caudal peduncle.

All dorsal-, anal- and pelvic-fin soft rays branched. Dorsal- and anal-fin spines slender. First dorsal-fin spine extremely slender, flexible, tip connected by thin filament to tip of second dorsal-fin spine; membrane between second and third dorsal-fin spine incised attached to about lower third of third dorsal spine. Last dorsal-fin soft ray extending beyond vertical through caudal-fin base. Last anal-fin soft ray reaching caudal-fin base. Pectoral fins weakly rounded. Pelvic fins long, origin slightly posterior to vertical through origin of pectoral fin; first soft ray longest, tip reaching anus.

Color when fresh. Based on color photographs of type specimens (Figs. 5a, 6). Body brown or grayish-white with poorly defined yellow area from anterodorsal margin of orbit to pectoral-fin base. Head reddish-brown or bright purple. Eye red, edged with yellow, pupil black. Small milky-white blotches, less than orbit diameter, on anal- and caudal-fin bases; smaller blotches on midbody. Several milky-white (purplish red, or blue) blotches or bands on head from ventral margin of orbit to pectoral-fin base. Dorsal fin light brown with several irregular milky-white bars and blotches. Pectoral fin translucent. Pelvic and anal fin white basally, translucent distally. Caudal fin pale yellow, with five irregular milky-white bars.

Color of preserved specimens. Based on types, including holotype (Figs. 5b, 6). Body uniformly brown. Fins, except for caudal fin, translucent. Small blotches on head and nape, and anal-fin and caudal-fin bases (no blotches on body in specimens >ca. 110 mm SL, small blotches on head and body in specimens >ca. 145 mm SL). Caudal fin pale brown with several irregular brown bars (no bars in specimens >ca. 110 mm SL).

Distribution. Currently known only from northern Australia, recorded from Montebello Islands, Western Australia

Fig. 6 Fresh specimen of *Iniistius opalus* sp. nov., NSMT-P. 126448, 148 mm SL, Western Australia



Fig. 7 Preserved specimens of *Iniistius opalus* sp. nov. of different sizes. **a** QM I. 34893, 117 mm SL, Gulf of Carpentaria, Queensland; **b** NTM S. 13311-001, 121 mm, North Anson Bay, Timor Sea, Northern Territory; **c** CSIRO H 4050-02, 132 mm SL, west of Port Hedland, Western Australia; **d** WAM-P 25354-021, 156 mm SL, Monte Bello Islands, Western Australia

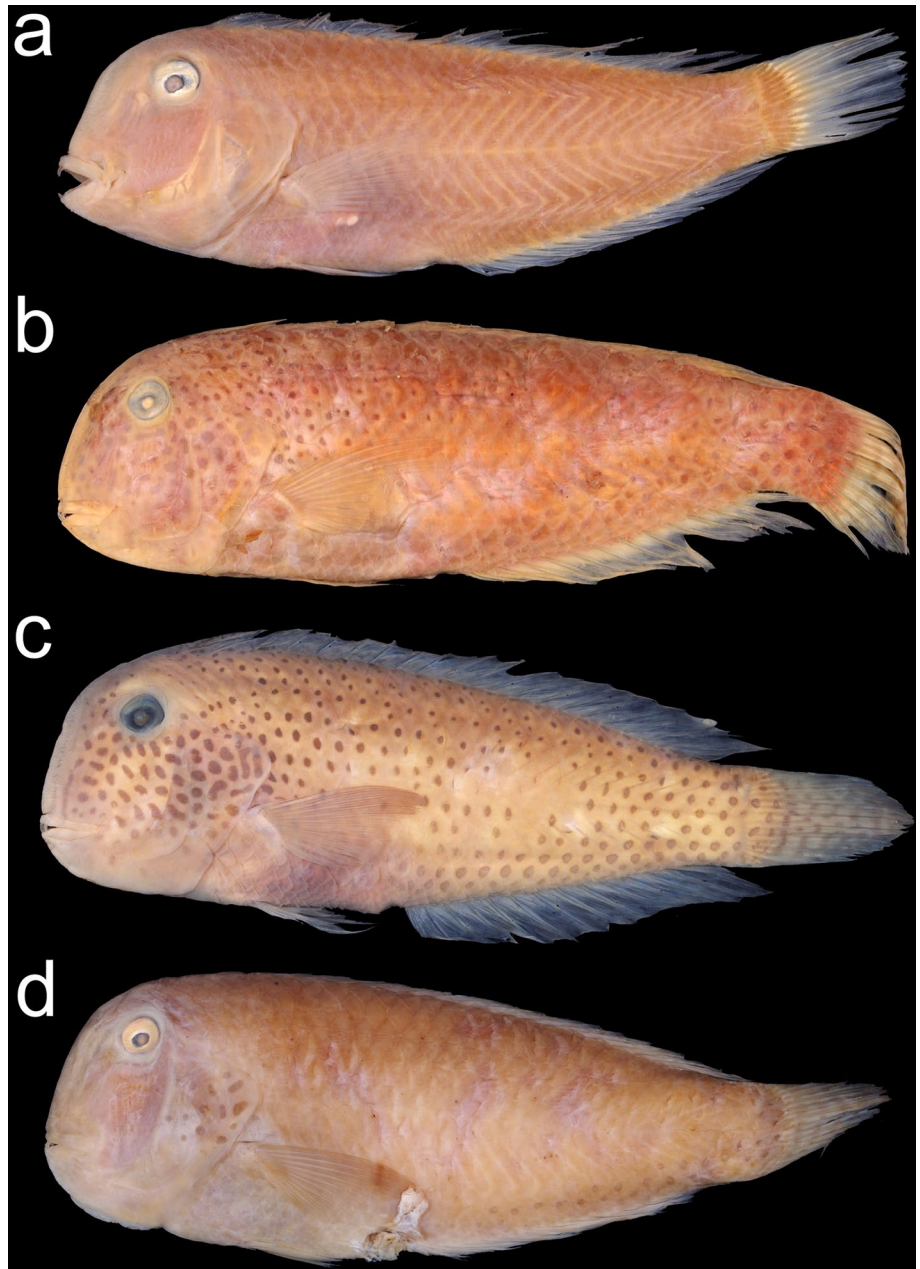


Table 1 Selected meristic and morphometric (expressed as percentage of standard length) values for *Iniistius jacksonensis* and *I. opalus* sp. nov.

	<i>I. jacksonensis</i>			<i>I. opalus</i> sp. nov.		
	Holotype	Non-types		Holotype	Paratypes	
	AMS A. 9956	(n = 9)		CSIRO CA 2974	(n = 15)	
Standard length (mm)	108	129–189	Mode	138	112–161	Mode
Dorsal-fin rays	IX, 12	IX, 12	IX, 12	IX, 12	IX, 12	IX, 12
Pectoral-fin rays	12	12	12	12	12	12
Pelvic-fin rays	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5
Anal-fin rays	III, 12	III, 12	III, 12	III, 12	III, 11–13	III, 12
Pored lateral-line scales (anterior + posterior series)	21 + 5	19–21 + 5–6	20 + 5	20 + 5	18–20 + 4–5	20 + 5
Scale rows above lateral line	5	4–5	5	5	4–6	5
Scale rows below lateral line	10	9–10	10	9	9–10	9
Gill rakers (upper + lower)	5 + 12	5–7 + 12	7 + 12	6 + 12	6–7 + 12	6 + 12
% SL			Mean			Mean
Body depth	33.6	35.8–41.5	37.8	37.6	33.5–39.2	36.7
Body width	8.1	10.1–12.1	11.3	12.2	9.1–13.5	11.0
Head length	29.6	30.4–32.1	31.2	36.0	32.9–36.0	34.3
Head width	7.2	9.7–11.3	10.3	10.5	8.1–10.7	9.8
Pre-dorsal-fin length	25.6	25.4–28.3	27.2	31.1	27.6–31.1	29.0
Pre-anal-fin length	51.4	49.4–55.9	53.8	53.0	52.8–57.5*	52.6
Pre-pectoral-fin length	26.5	27.4–29.9	28.5	32.5	29.8–32.5	31.2
Caudal-peduncle length	10.2	10.8–16.3	12.2	10.8	8.2–15.9	10.6
Caudal-peduncle depth	13.7	12.6–15.7	13.9	13.6	12.7–15.9	13.9
Dorsal-fin base length	74.7	69.7–76.4	72.5	77.6	69.2–78.2	73.8
Anal-fin base length	40.3	35.5–41.6	38.8	40.7	36.3–43.2	39.3
Upper-jaw length	7.8	8.4–10.0	9.5	10.7	8.7–11.7	10.0
Lower-jaw length	7.1	7.1–9.0	8.3	8.0	7.6–10.2	8.8
Snout length	14.7	14.9–18.2	17.2	19.0	16.6–19.0	17.7
Orbit diameter	5.5	5.0–6.8	5.8	6.8	6.1–7.3	6.8
Interorbital width	4.5	4.7–5.6	5.1	5.6	4.2–5.6	4.9
Postorbital length	13.6	13.9–16.2	14.9	17.7	14.9–18.4	16.8
Pre-pelvic-fin length	29.7	29.3–35.3	31.6	33.7	29.4–35.1	32.4
1st dorsal-fin spine length	10.7	9.9–14.3	11.9	9.8	8.1–14.2	11.3
2nd dorsal-fin spine length	11.7	9.6–12.9	11.6	8.5	8.0–13.5**	10.7
3rd dorsal-fin spine length	6.0	4.9–8.1	6.5	—	4.0–10.8	7.4
1st dorsal-fin ray length	11.1	9.2–12.1	10.0	10.1	8.2–13.0****	10.9
11th dorsal-fin ray length	15.2	15.6–18.4	16.8	15.7	13.6–16.0****	14.7
12th dorsal-fin ray length	14.6	15.1–18.3	16.4	14.3	12.2–15.1	13.7
1st anal-fin spine length	—	3.0–5.3	4.3	2.6	2.6–5.2	3.6
Pectoral-fin length	19.8	20.8–26.8	23.1	24.0	18.1–25.2	22.3
Pelvic-fin spine length	7.4	4.1–8.0	6.2	5.0	5.0–8.6	6.4
1st pelvic-fin ray length	19.5	6.8–22.9	19.1	18.9	12.1–20.9	18.3
Length between 1st DS and 2nd DS	3.3	3.7–4.8	4.2	5.3	3.2–5.7	4.4
Length between 2nd DS and 3rd DS	7.9	5.8–7.4	6.7	5.4	5.0–7.0*****	5.9
Length between 3rd DS and 4th DS	4.9	3.8–5.1	4.4	4.4	4.1–5.9	4.1
LD AVM of orbit and maxilla	9.7	10.9–17.5	13.6	11.5	11.5–14.5	12.9
LD AVM of orbit and preopercle	14.4	15.9–19.6	17.9	15.9	15.3–18.2	17.1
LD AVM of orbit and interopercle	17.5	19.1–25.4	22.2	19.9	19.2–22.7	21.2
Pectoral-fin base length	5.0	5.5–7.7	6.7	7.4	6.3–7.5	6.9
LD dorsal-fin origin and anal-fin origin	—	49.2–53.6	51.9	49.6	48.6–54.1	50.7
LD dorsal-fin origin and posterior margin of AB	80.9	75.2–83.1	78.5	78.0	76.2–81.5	79.0
LD posterior margin of DB and anal-fin origin	43.9	40.5–46.2	44.2	46.1	41.0–47.1	43.8
LD pectoral-fin origin and pelvic-fin origin	24.8	21.8–29.5	24.6	19.9	19.9–26.9	23.5

Table 1 (continued)

DS dorsal-fin spine, *LD a and b* least distance between a and b, *AVM* anteroventral margin, *DB* dorsal-fin base, *AB* anal-fin base

* Pre-anal-fin length, ** 2nd dorsal-fin spine length and ***11th dorsal-fin ray length: $n = 13$; ****1st dorsal-fin ray length: $n = 10$.
*****Length between 2nd DS and 3rd DS: $n = 12$

Table 2 Frequency distribution of selected meristics of *Iniistius jacksonensis* and *I. opalus* sp. nov.

	Anal-fin rays			Anterior series of pored lateral-line scales				Posterior series of pored lateral-line scales			
	III, 11	III, 12	III, 13	18	19	20	21	4	5	6	
<i>I. jacksonensis</i>	1	9			3	5	2		9	1	
<i>I. opalus</i> sp. nov.	1	12	2	1	2	11		3	10		
	Scale rows above lateral line			Scale rows below lateral line		Gill rakers on upper limb			Total gill rakers		
	4	5	6	9	10	5	6	7	17	18	19
<i>I. jacksonensis</i>	2	8		1	9	1	3	6	1	3	6
<i>I. opalus</i> sp. nov.	1	10	5	14	1		10	6		11	5

Bold, including holotype

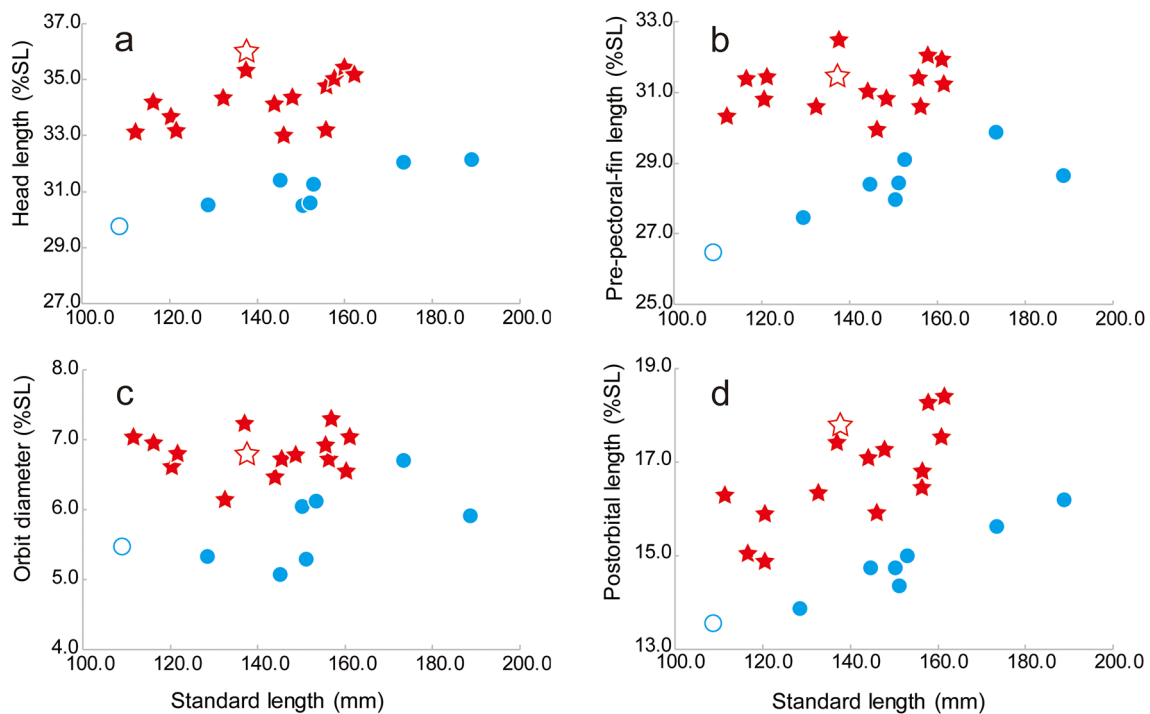


Fig. 8 Relationships of **a** head length; **b** pre-pectoral-fin length; **c** orbit diameter; **d** postorbital length to standard length (mm) in *Iniistius jacksonensis* (circles) and *I. opalus* sp. nov. (stars). Open symbols indicate holotype

east to Gulf of Carpentaria, Queensland (Fig. 4). The type specimens were collected at depths of 22–64 m.

Etymology. The specific name for the new species is from the Latin “opalus” meaning “opal”, referring to the numerous spots on the body.

Remarks. *Iniistius opalus* sp. nov. and *Iniistius jacksonensis* share the following characters: cheek with a broad band of small scale rows; a single small scale below eye; first two dorsal-fin spines short, their length similar to those of other spines of dorsal fin; central gill-raker of the

lower limb of first gill arch with single branch; significant body depth (33.6–41.5% SL in *I. jacksonensis*, 33.5–39.2% SL in *I. opalus* sp. nov.) in adults; and several small blotches on anal-fin base. However, the former is distinguished from *I. jacksonensis* by higher counts of scale rows below the lateral line [10 (rarely 9) vs. 9 (rarely 10) in the latter] and branches on the gill raker on the upper limb of first gill arch (4 vs. 2); greater head length [32.9–36.0% (mean 34.3%) vs. 29.6–32.1% (31.2%) SL, Table 1, Fig. 8a], pre-pectoral-fin length [29.8–32.5% (31.1%) of SL vs. 27.4–29.9% (28.5%); Table 1, Fig. 8b], orbit diameter [6.1–7.3% (6.8%) of SL vs. 5.0–6.8% (5.8%); Table 1, Fig. 8c] and postorbital length [14.9–18.4% (16.8%) of SL vs. 13.9–16.2% (14.9%); Table 1, Fig. 8d], and small blotches on head (vs. no blotches).

Preserved specimens of the new species revealed that small blotches, of a diameter less than the orbit diameter, on the head and body of specimens < 145 mm SL (Fig. 6b, c) disappear with growth, although blotches on the opercle and anal-fin base remain (Figs. 5b, 6d). However, four of eight small specimens (116.5–133.7 mm SL) examined lacked blotches on the anal-fin base (Fig. 6a), possibly related to preservation factors (Fig. 9).

An adult specimen reported by Gloerfelt-Tarp and Kailola (1984) as *I. jacksonensis* from Western Australia is herein re-identified as *I. opalus* sp. nov., based on the color photograph of that specimen. According to their reports, the new species has the color variation of blotches on body (purplish red or blue in Gloerfelt-Tarp and Kailola 1984; blue in Sainsbury et al. 1985).

Although endemic to Australia so far as is known, *I. opalus* sp. nov. and *I. jacksonensis* have disjunct distributions, the former being known from northwest of Western Australia to Torres Strait, and the latter from southeast Queensland to eastern New South Wales. A similar distributional pattern is shared by two species of waspfish, *Liocranium pleurostigma* and *L. praepositum*, and is regarded as speciation resulting from the terrestrial barrier once formed by Torres Strait (Motomura et al. 2008).

Acknowledgements I am especially grateful to M. McGrouther (AMS) for opportunities to examine specimens and providing information on the Australian record of *I. jacksonensis*, A. Graham (CSIRO) for opportunities to examine specimens and providing color photographs of the holotype of *I. opalus* sp. nov., A. Hay and S. Reader (AMS), A. Suzumoto, L. O'Hara, J. Randall and R. Pyle (BPBM), M. Nakae (NSMT), J. Johnson (QM), G. Moore and M. Allen (WAM) for providing opportunities to examine specimens, G. Hardy (Ngunguru, New Zealand) for reading the manuscript and providing help with English, and M. Gomon (NMV) and the anonymous reviewer for reviewing the manuscript and providing valuable comments. I also thank H. Motomura (KAUM), M. Gomon (NMV), M. Matsunuma (KUN), Y. Sakurai (Okinawa, Japan), M. Itou, Y. Haraguchi and M. Takayama, and students and other volunteers of KAUM, and H. Fukui and M. Fukui (Kagoshima, Japan) for their kind support throughout this study. This

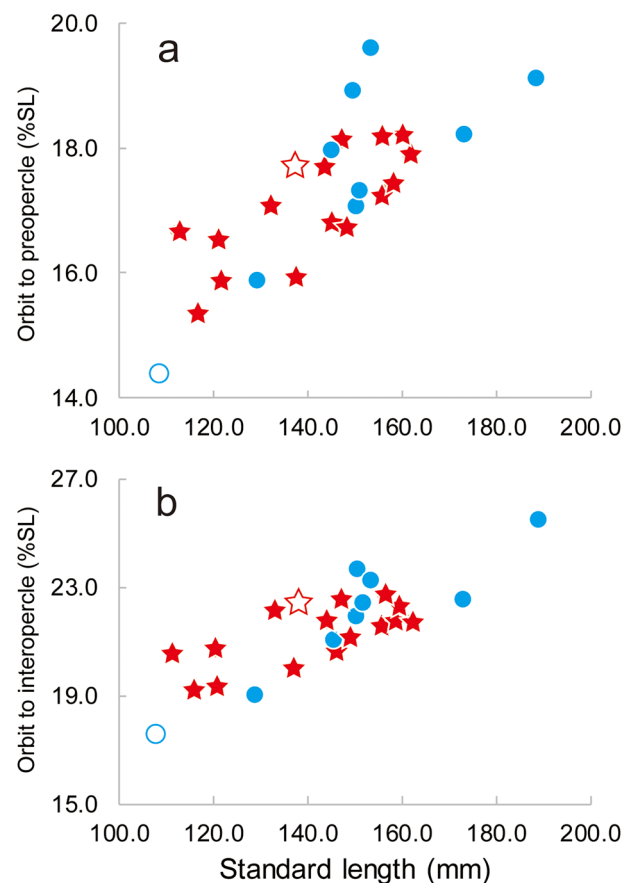


Fig. 9 Relationships of least distance between anteroventral margin of **a** orbit and preopercle, and **b** orbit and interopercle to standard length (mm) in *Iniistius jacksonensis* (circles) and *I. opalus* sp. nov. (stars). Open symbols indicate holotype

study is supported in part by a Grant-in-Aid from the Japan Society for the Promotion of Science for JSPS Fellows (DC2: 17J05261).

References

- Francis MP (1993) Checklist of the coastal fishes of Lord Howe, Norfolk, and Kermadec Islands, Southwest Pacific Ocean. *Pac Sci* 47:136–170
- Fukui Y (2017) Family Labridae. In: Motomura H, Alama UB, Muto N, Babaran RP, Ishikawa S (eds) Commercial and bycatch market fishes of Panay Island Republic of the Philippines. The Kagoshima University Museum, Kagoshima, University of the Philippines Visayas, Iloilo, and Research Institute for Humanity and Nature, Kyoto, pp 181–185
- Gill TN (1862) Catalogue of the fishes of Lower California in the Smithsonian Institution, collected by Mr. J. Xantus. *Proc Acad Nat Sci Phila* 14:140–151
- Gloerfelt-Tarp T, Kailola PJ (1984) Trawled fishes of southern Indonesia and northwestern Australia. Australian Development Assistance Bureau, Australia, Directorate General of Fisheries of Indonesia, Indonesia, and German Agency for Technical Cooperation, Eschborn

- Hutchins JB (2001) Check list of the fishes of Western Australia. Rec West Aust Mus Suppl 63:9–50
- Johnson JW (1999) Annotated checklist of the fishes of Moreton Bay, Queensland, Australia. Mem Qld Mus 43:709–762
- Kuiter RH (2012) Labrid fishes: wrasses. Aquatic photographs, Melbourne
- Motomura H, Last PR, Johnson JW (2008) Review of the waspfish genus *Liocranium* (Scorpaeniformes: Tetrarogidae), with restoration of *L. pleurostigma* (Weber). Zootaxa 1820:27–40
- Ramsay EP (1881) Description of a new labroid fish of the genus *Novacula*, from Port Jackson. Proc Linn Soc NSW 6:198–199
- Randall JE, Cornish AS (2000) *Xyrichtys trivittatus*, a new species of razorfish (Perciformes: Labridae) from Hong Kong and Taiwan. Zool Stud 39:18–22
- Sabaj MH (2016) Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Ver 6.5 (16 August 2016). American Society of Ichthyologist and Herpetologists, Washington, DC. <http://www.asih.org/>. Accessed 30 May 2018
- Sainsbury KJ, Kailola PJ, Leyland GG (1985) Continental fishes of northern and north-western Australia. Clouston and Hall and Peter Pownall Fisheries Information Service, Canberra
- Valenciennes A (1840) Labroïdes. In: Cuvier GL, Valenciennes A (eds) Histoire naturelle des poissons. Vol 14. Lavrault, Paris, pp 1–307
- Waite ER (1899) Scientific results of the trawling expedition of H. M. C. S. “Thetis”. Aust Mus Mem 4:3–128