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A New Species of the Scorpionfish Genus *Maxillicosta* from the Southeast Coast of Australia, with a Redescription of *M. whitleyi* (Scorpaeniformes: Neosebastidae)

HIROYUKI MOTOMURA, PETER R. LAST, AND MARTIN F. GOMON

A new species of scorpionfish, *Maxillicosta meridianus*, is described on the basis of 24 specimens collected from southeastern Australia at depths of 10–137 m. This species has previously been identified as *M. whitleyi*, but differs in having the following characters: central portion of inner ridge on ventral mandibular surface located on inner edge of dentary or closer to inner edge than to central ridge, no short ridge between posterior portions of inner and central ridges; 0–6 spinous points on anterior margin of nasal spine; 5–13 spinous points on surface of preocular spine; no spines or distinct ridges on lateral margin of occipital pit between tympanic spine and origin of parietal spine base; no ossified scale behind front edge of occipital pit between tympanic spines; dorsal surface of occipital pit smooth, without spines; two (rarely one or three) spinous points at tip of upper opercular spine; posterior margin of maxilla extending slightly beyond a vertical through posterior margin of pupil; and caudal fin usually without distinct markings in preserved specimens. Additionally, the two species significantly differ in eight meristic and six morphometric features. Morphological changes with growth and geographic variation are also discussed.

THE Neosebastidae Matsubara, 1943 (Scorpaeniformes), a scorpionfish family with antiequatorial distribution (*sensu* Randall, 1982, 1998), comprises two genera (Ishida, 1994; Motomura, 2004a), *Maxillicosta* Whitley, 1935 and *Neosebastes* Guichenot, 1867. The taxonomy of these genera has been studied in detail (*Maxillicosta* by Eschmeyer and Poss, 1976; *Neosebastes* by Motomura, 2004a), and both were redefined by Motomura (2004a).

Eschmeyer and Poss (1976) recognized five species in *Maxillicosta* (three from Australia, one from New Zealand [recently recorded from Australia by Motomura, Last, and White, 2005], and one from Juan Fernández), three of which they described as new. One of the three, *M. whitleyi*, was based on five specimens (holotype and four paratypes) collected from southern Queensland (type locality), New South Wales and South Australia, Australia. Since the original description, it has been regarded as a widely distributed species, ranging from Point Cartwright, Queensland to Spencer Gulf, South Australia, including Tasmania (Allen and Cross, 1989; Kuiter, 1993; Poss, 1994).

A careful examination of the types of *M. whitleyi* and a selection of specimens previously identified as *M. whitleyi* collected from localities throughout this range revealed two allopatric species: one (including the holotype and two paratypes of *M. whitleyi*) from southern Queensland to northeastern Victoria, and the other (including two paratypes of *M. whitleyi*) from southern Victoria and northern Tasmania to eastern South Australia. The southern taxon is described herein as a new species and compared in detail with *M. whitleyi*. Changes with growth in the morphology of both species and geographic variation in *M. whitleyi* are also discussed.

MATERIALS AND METHODS

Counts and measurements follow Motomura (2004a, b) with the following exceptions. Scales above and below the lateral line were counted vertically between the lateral line and the first dorsal-fin spine base and the first anal-fin spine base, respectively. Scales were also counted vertically between the lateral line and the sixth dorsal-fin spine base and the last dorsal-fin spine base. Predorsal scale rows are the number of rows between the first dorsal-fin spine base and the posterior margin of the occipital pit. Scale rows between the pelvic fins are counted between the last pelvic-fin soft-ray bases in ventral view. Head width is the straight-line distance between the posterior ends of the pterotic-spine bases. Interorbital width is the least bony width. Postoccipital pit length was measured from the origin of the first dorsal-fin spine to the posterior edge of the occipital pit. Maxilla depth is the distance between the two posterior corners. Standard and head lengths are expressed as SL and HL, respectively. Mean values for morphometric and meristic features having a range of values are enclosed by parentheses either with or following the range; those for meristic features are rounded off to whole numbers. Osteological

characters of the new species were observed by radiographs from the holotype and five of the paratypes. Sex and the absence of a swimbladder were confirmed from nine paratypes by dissection of the abdomen on the right side.

Terminology of head spines follows Motomura (2004a), except the spine at the base of the uppermost preopercular spine is termed the supplemental preopercular spine (Eschmeyer, 1965), and the coronal and pretympanic (as an extra spine) spines are as figured in Chen (1981:fig. 1) and Motomura et al. (2004:fig. 14b), respectively. Institutional codes follow Leviton et al. (1985).

Maxillicosta meridianus, new species

Southern Gurnard Perch

Figures 1, 2A–B, 3A, 4A, 5, 6, 7A, 8; Tables 1–3

Holotype.—CSIRO A 4252, 77.6 mm SL, Australia, Tasmania, Bass Strait, 39°27′S, 148°21′E, FRV COURAGEOUS, 10–20 m depth, trawl, 22 Nov. 1976.

Paratypes.—23 specimens, 32.4–78.8 mm SL, from southeastern Australia: AMS E. 988 (also a paratype of *M. whitleyi* and *M. scabriceps*), 65.9 mm SL, South Australia, 80 km south of Cape Wiles, RV ENDEAVOUR, ca. 137 m depth, 29 Aug. 1909. AMS I. 10404 (also a paratype of *M. whitleyi* and *M. scabriceps*), 66.9 mm SL, South Australia, off Flinders Island, RV ENDEAVOUR, ca. 68 m depth, 30 Aug. 1909. CSIRO A 4253, 70.9 mm SL, same data as holotype. CSIRO B 1253, 3:40.8–45.6 mm SL, Victoria, Bass Strait, 38°57′S, 146°51′E, FRV COURAGEOUS, 15 June 1976. CSIRO H 633-01, 51.1 mm SL, Tasmania, northeast of Ninth Island, 40°48′S, 147°16′E, RV MERINDAH PEARL, 44–46 m depth, 22 Aug. 1986. CSIRO H 4358-01, 52.8 mm SL, Tasmania, King Island, east of Naracoopa, 39°52′S, 144°20′E, RV MERINDAH PEARL, 33–35 m depth, 19 Sept. 1986. CSIRO T 1198, 4 (47.8–77.3 mm SL), Tasmania, Bass Strait. CSIRO T 1652, 2 (60.4–78.8 mm SL), Tasmania, Flinders Island. NMV A 2433, 2 (54.7–66.0 mm SL), Victoria, eastern Bass Strait, 20 km southeast of Port Albert, 38°43.04′S, 144°18.02′E, RV TANGAROA, 79 m depth, 18 Nov. 1981. NMV A 2678, 4 (32.4–56.0 mm SL), Victoria, Wilsons Promontory, 8 km south of South East Point, 39°12.54′S, 146°27.18′E, RV TANGAROA, 65 m depth, 18 Nov. 1981. NMV A 21820, 3 (62.8–68.9 mm SL), Victoria, Western Port, 38°22′S, 145°32′E, Straun Sutherland, 1 March 1984.

Diagnosis.—A species of *Maxillicosta* with the following combination of characters: 21–24 (22) pectoral-fin rays; 47–51 (49) scales in longitudinal series; 27–29 (28) pored lateral-line scales; 3 or 4 (3) scale rows between last pelvic-fin ray bases; 2 or 3 (3) scales above, 12–14 (13) below lateral line; 3–5 (4) scales between sixth dorsal-fin spine base and lateral line; 4 or 5 (5) scales between last dorsal-fin spine and lateral line; scales above lateral line behind head usually without a strong median ridge; central portion of inner ridge on ventral mandibular surface located on inner edge of dentary (Fig. 2A) or closer to inner edge than to central ridge (Fig. 2B), no short ridge between posterior portions of inner and central ridges (Fig. 2A–B); 0–6 spinous points on anterior margin of nasal spine, number decreasing with growth (Fig. 3A), 5–15 spinous points on entire nasal spine; 5–13 spinous points on surface of preocular spine; no spines or distinct ridges on lateral margin of occipital pit between tympanic spine and origin of parietal spine base (Fig. 4A); no ossified scale behind front edge of occipital pit between tympanic spines (Fig. 4A); dorsal surface of occipital pit smooth, without spines (Fig. 4A); 2 (rarely 1 or 3) spinous points at tip of upper opercular spine; posterior margin of maxilla extending slightly beyond a vertical through posterior margin of pupil; snout length 7.9–9.6 (8.6)% SL, upper-jaw length 19.1–22.2 (20.3)% SL, first anal-fin spine length 11.6–14.4 (13.1)% SL, second anal-fin spine length 18.4–22.5 (20.5)% SL, third anal-fin spine length 13.4–16.2 (14.7)% SL, and caudal-peduncle depth 7.8–9.0 (8.6)% SL (Fig. 6); body without reticulate color pattern; caudal fin usually without distinct melanin in preserved specimens (Fig. 7A).

Description.—Proportional measurements are presented in Table 1. Frequency distributions of selected meristic characters are in Tables 2–3. In the following account, values are given for the holotype, followed by ranges of values in paratypes, if differing from the holotype, enclosed by parentheses.

Dorsal fin with 13 spines; length of first spine 1.3 (1.4–1.9; mean 1.5) in that of second spine; fourth and fifth spines subequal, longest, greater than upper-jaw length; fifth to twelfth spines progressively shorter; length of twelfth spine 2.3 (2.1–1.4; mean 2.3) in that of last spine; membrane of spinous portion of dorsal fin strongly incised. Dorsal fin with seven soft rays; all rays branched; second (first or second) ray longest, its length less than length of longest dorsal-fin spine; posterior branch of last ray not joined by membrane to caudal peduncle. Anal fin with three spines; second spine longest, its length greater than orbit diameter; first spine 1.5

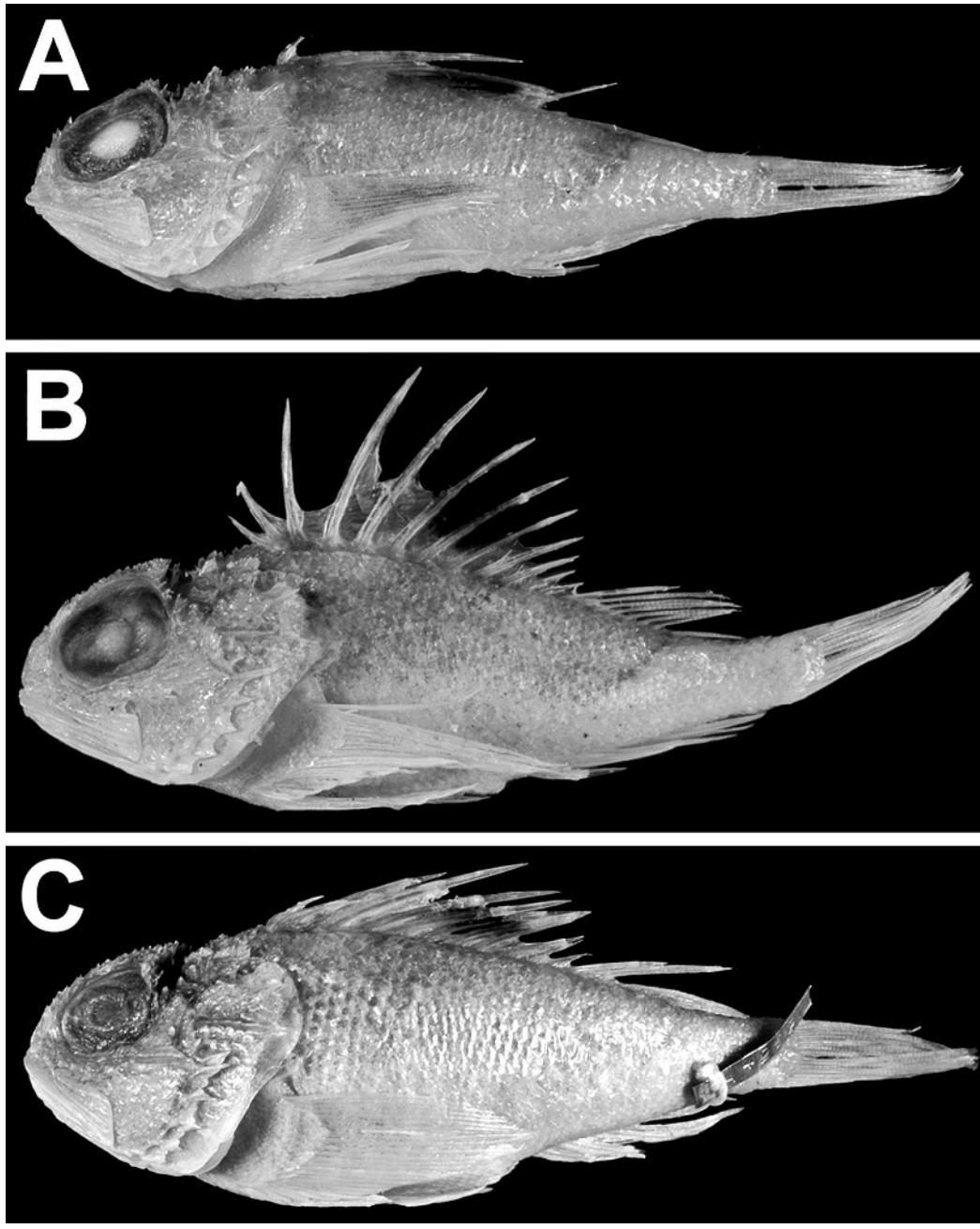

Fig. 1. *Maxillicosta meridianus*. (A) CSIRO B 1253, paratype, 40.8 mm SL; (B) NMV A 21820, paratype, 64.9 mm SL; (C) CSIRO A 4252, holotype, 77.6 mm SL.

(1.4–1.8; mean 1.6) in second spine, 1.6 (1.3–1.5; mean 1.4) in third spine; membrane of spinous portion of dorsal fin strongly incised. Anal fin with five soft rays; all soft rays branched; third (first to third) ray longest, its length shorter than (shorter than or subequal to) longest dorsal-fin soft ray length; posterior branch of last soft ray not joined by membrane to caudal peduncle. Pectoral fin with 23 rays on each side of body (21 to 24; mean 22; abnormally 17 rays on right side of body in a paratype), an uppermost ray and 14 lower rays unbranched, remaining rays branched (1–3 upper rays and 13–19 lower rays unbranched; number of branched rays increasing

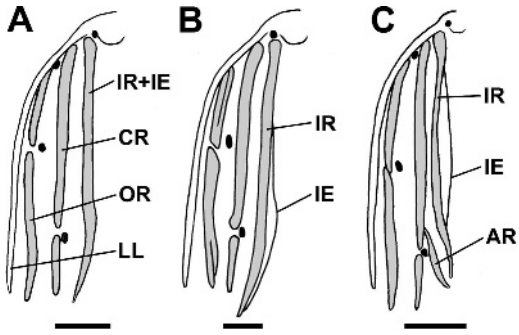

Fig. 2. Ventral view of right half of mandible in (A–B) *Maxillicosta meridianus* and (C) *M. whitleyi*. (A) CSIRO H 633-01, paratype, 51.1 mm SL; (B) CSIRO A 4252, holotype, 77.6 mm SL; (C) NMV A 16546, 62.7 mm SL. *IE*, inner edge of dentary; *IR*, inner ridge; *CR*, central ridge; *LL*, lower lip; *OR*, outer ridge; *AR*, accessory ridge. Bars = 2 mm.

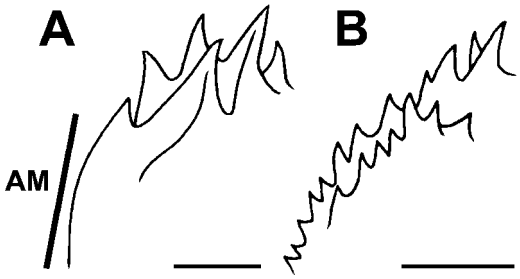

Fig. 3. Lateral view of left nasal spine showing typical condition in (A) *Maxillicosta meridianus* and (B) *M. whitleyi*. (A) CSIRO A 4252, holotype, 77.6 mm SL; (B) NMV A 16546, 62.7 mm SL. *AM*, anterior margin of nasal spine. Anterior to the left. Bars = 1 mm.

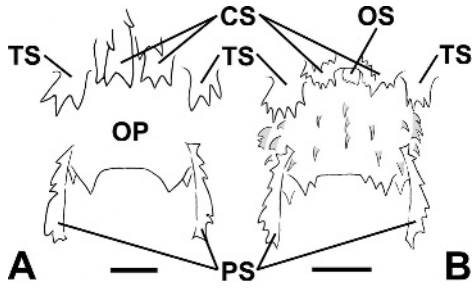

Fig. 4. Dorsal view of occipital pit region in (A) *Maxillicosta meridianus* and (B) *M. whitleyi*. (A) CSIRO A 4252, holotype, 77.6 mm SL; (B) NMV A 16546, 62.7 mm SL. *CS*, coronal spine; *OP*, occipital pit; *OS*, ossified scale; *PS*; parietal spine; *TS*, tympanic spine. Anterior at the top. Bars = 2 mm.

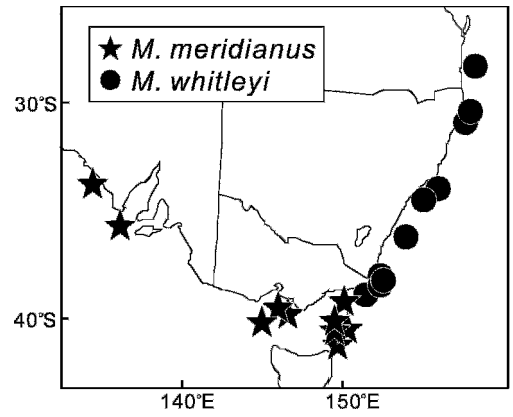

Fig. 5. Distribution of *Maxillicosta meridianus* (stars) and *M. whitleyi* (circles), based on specimens examined in this study.

with growth); eighth (eighth, rarely ninth) ray longest, shorter than head length; lower unbranched rays somewhat thickened; posterior margin of fin rounded. Pelvic fin with one spine and five soft rays, all soft rays branched; second ray longest, longer than upper jaw; last ray joined by membrane to abdomen for approximately one-third (one-third to one-sixth) its length. Caudal fin with 4 (4 or 5) unsegmented and seven segmented dorsal series of rays, 4 (4 or 5) unsegmented and 5 segmented ventral series of rays; posterior margin of fin slightly rounded. Caudal-peduncle depth 2.0 (1.8–2.5; mean 2.1) in caudal-peduncle length.

Scales in longitudinal series 48 (47–51; mean 49). Pored lateral-line scales 28 (27–29; mean 28). Scales above lateral line 2 (2 or 3; mean 3), below 14 (12–14; mean 13). Scale rows between sixth dorsal-fin spine base and lateral line 4 (2 to 4; mean 4); between last dorsal-fin spine base and lateral line 5 (4 or 5; mean 5). Predorsal scale rows 4 (3–5; mean 4). Gill rakers on upper limb 3 (3 or 4; mean 3), lower limb 8 (7–9; mean 8), including 1 (1 or 2; mean 1) raker on hypobranchial; total rakers 11 (10–12; mean 11); rakers relatively short and spinous, longest raker on first gill arch longer than gill filaments at angle of gill arch; fourth gill slit closed by membrane. Branchiostegal rays 7. Vertebrae 26. Swimbladder absent.

Body slightly compressed anteriorly, progressively more compressed posteriorly. Nape and anterior body not strongly arched. Body depth relatively shallow, less than head length, but greater than longest dorsal-fin spine. No papillae on head. A short rounded tentacle on posterior edge of low membranous tube associated with anterior nostril; length slightly more than (more than or subequal to) diameter of anterior nostril,

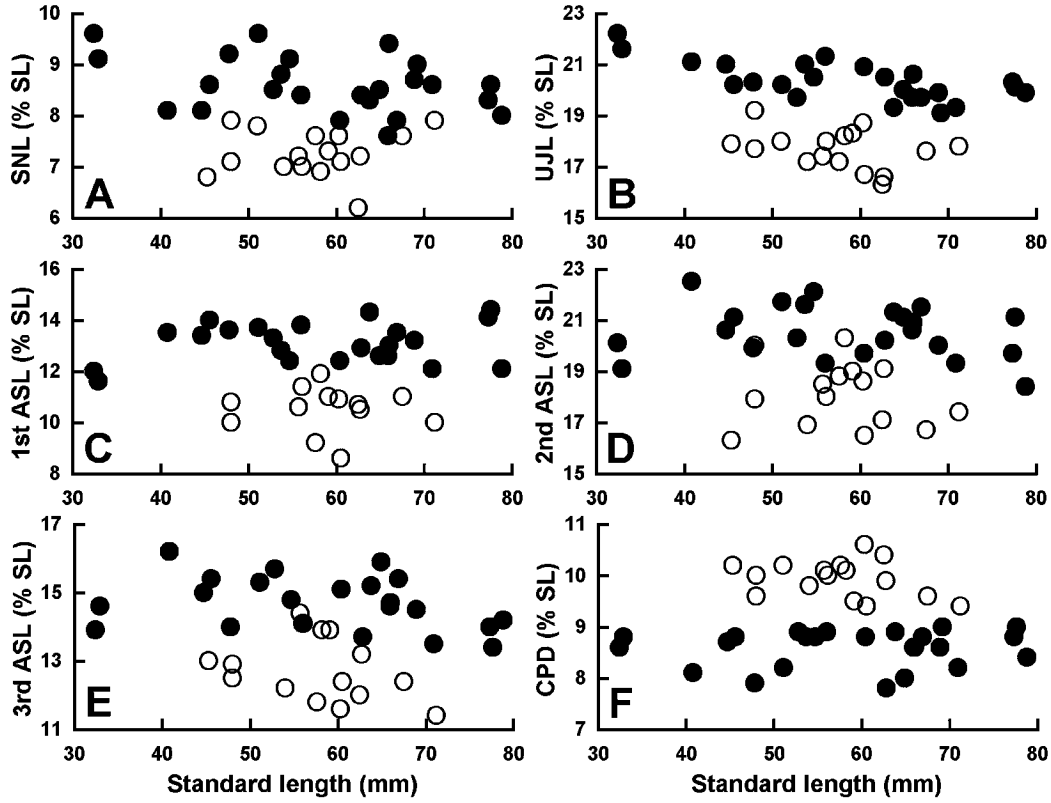

Fig. 6. Comparisons of (A) snout length, (B) upper-jaw length, (C) first anal-fin spine length, (D) second anal-fin spine length, (E) third anal-fin spine length, and (F) caudal-peduncle depth (% standard length) with standard length in *Maxillicosta meridianus* (closed circles) and *M. whitleyi* (open circles).

extending beyond posterior margin of posterior nostril when laid against snout. Small fleshy flaps dorsally on outer margin of eye between opaque and transparent portions of eye; flaps and tentacles otherwise absent from head, body, and fins.

Scales distinctly exposed posteriorly; posterior margin smooth or with soft points, forming a wavy edge. Scales covering cheek and an area surrounded by posterior margin of orbit, pterotic spine base, preopercular margin, and suborbital ridge; also covering upper two-thirds of opercle, but not on posterior half of upper opercular spine, opercular margin, or on lower opercular spine; other parts of head, including interorbital region, occipital pit, snout, eye membrane, maxilla, lips, and underside of lower jaw, free of exposed or embedded scales. Scales covering lateral surface of body, but not extending onto rays or membranes of median fins, except basal caudal fin; extending onto upper pectoral-fin base and base of soft pelvic-fin rays. Exposed cycloid scales covering pectoral-fin base and ventral surface of trunk, including inter-pelvic space; no scales entirely embedded. Posterior margin of scales on upper half of trunk, especially above lateral line, with soft points, forming a wavy edge; those on abdomen typically cycloid. Lateral surface of most scales without a median ridge or serrae, but some scales above lateral line behind head and some predorsal scales with a weak median ridge. Predorsal scales covering space between base of first dorsal-fin spine and a transverse line through anterior ends of nuchal spine bases in dorsal view; some scales with a strong wavy posterior margin.

Lateral line weakly sloping downward at tip of opercle. Sensory pores of cephalic lateralis system not prominent; very few pores on head. Three sensory pores on underside of each dentary in ventral view; first pore between anterior tips of central and outer ridges; second between central and outer ridges in ventral view and below space bordered by anterior margins of pupil and orbit in lateral view; third pore on posterior margin of dentary, between inner and

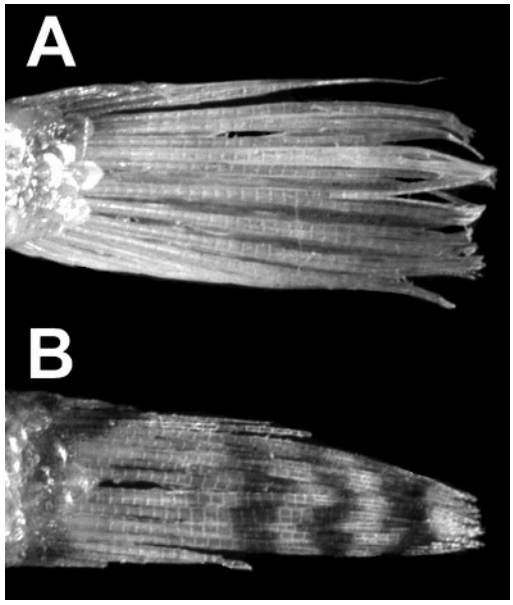

Fig. 7. Caudal-fin pigment patterns in preserved specimens of (A) *Maxillicosta meridianus* and (B) *M. whitleyi.* (A) NMV A 2678, paratype, 53.7 mm SL; (B) AMS I. 26023-003, 57.6 mm SL.

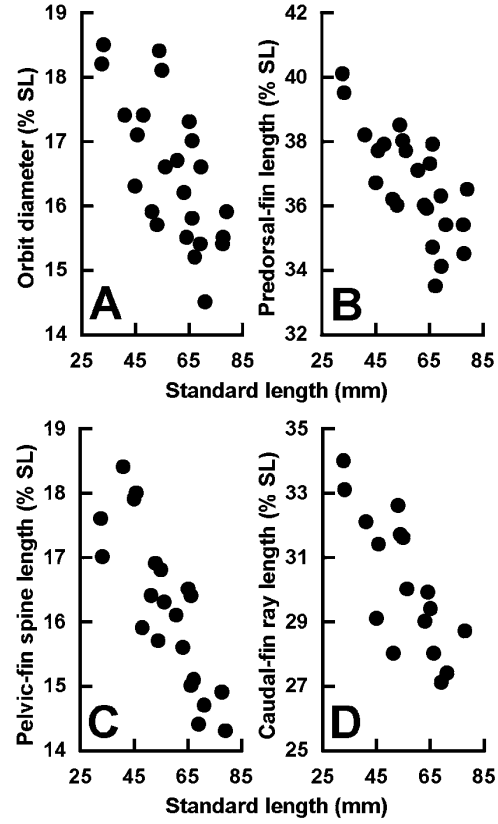

Fig. 8. Comparisons of (A) orbit diameter, (B) predorsal-fin length, (C) pelvic-fin spine length, and (D) caudal-fin ray length (% standard length) with standard length in *Maxillicosta meridianus.*

central ridges in ventral view. A small pore on each side of symphysial knob.

Mouth large, slightly oblique, forming an angle of about 20° (15–25°) to horizontal axis of head and body. Maxilla with 6 (4–7; usually 5 or 6) distinct longitudinal ridges, uppermost ridge on dorsal edge; posterior margin extending slightly beyond a vertical at posterior margin of pupil, but not reaching a vertical at posterior margin of orbit. Anteroventral surface of lower jaw with a symphysial knob. Width of symphysial gap separating premaxillary teeth bands slightly less than width of each band. Upper jaw with a band of short, incurved, conical teeth, tips of teeth not strongly pointed; about 10 (8–15) tooth rows anteriorly, tooth band narrowing posteriorly; width of tooth band more than twice that of lower jaw. Lower jaw with a band of short, slightly curved, conical teeth; most teeth slightly shorter than those of upper jaw. Vomer with 3 (3 or 4) rows of small teeth anteriorly, 5 (3–5) rows posteriorly, in a V-shaped patch. Palatine with about 5 or 6 tooth rows anteriorly; length of palatine plate much greater than width of vomerine plate. Underside of lower jaw with 3 distinct ridges in ventral view (Fig. 2A–B); inner ridge continuous, extending to lower edge of opercle; central ridge extending to lower edge of preopercle with a gap at posterior margin of dentary; outer ridge extending to lower edge of preopercle with anterior one-third of ridge separated by a gap; anterior part of inner ridge located on inner edge of dentary, posterior part of inner ridge closer to inner edge of dentary than central ridge (entire inner ridge located on edge of dentary in specimens less than ca. 60 mm SL; Fig. 2B).

Dorsal profile of snout steep, forming an angle of about 50° (45–50°) degrees to horizontal axis of head and body. Nasal spine with 6 (5–10) spinous points distally; anterior surface of spine smooth, without spinous points (with 1–6 points in smaller specimens; Fig. 3A); spine much longer than anterior nostril diameter. Ascending process of premaxilla slightly intruding into interorbital space; posterior margin just reaching level with anterior margin of orbit in dorsal view. Median interorbital ridge absent. Interorbital ridges moderately developed; separated by a deep channel; originating posterior to nasal spines and ending at anterior angular edge of occipital pit, then forming distinct coronal spines; not

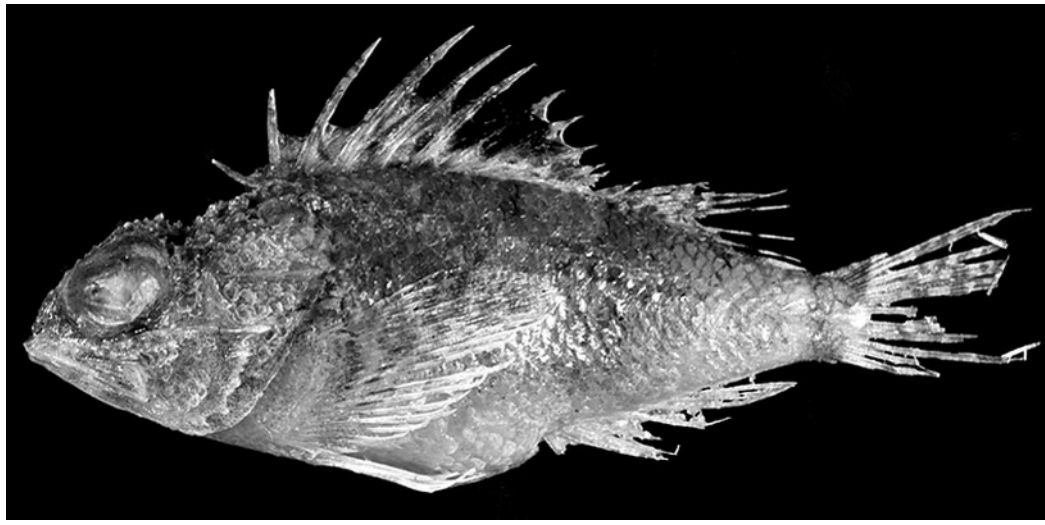

Fig. 9. *Maxillicosta meridianus,* AMS I. 23469-005, 51.0 mm SL.

conjoined; diverging anteriorly and posteriorly in dorsal view, distance between ridges narrowest slightly anterior to a vertical (slightly anterior to or at vertical) through center of eye. Interorbital space relatively shallow, about one-fifth (one-fifth to one-sixth) of orbit extending above dorsal profile of head. Coronal spine, formed from posterior end of interorbital ridge, well developed, with 5 (3–10) spinous points distally; length slightly greater than (greater than or subequal to) tympanic spine length. Preocular spine well developed; directed dorsoposteriorly; anterior and dorsal surface with 5 (3–8) distinct ridges and 7 (7–13) spinous points on ridges. Supraocular and postocular bones continuous, with 8 (7–12) ridges and 28 (18–39) spinous points on ridges. Tympanic spine well developed, flattened anteriorly and posteriorly, directed dorsally, with 3 (2–5; usually 3) spinous points; distal margin broader than (broader than and occasionally narrower than) base. Pretympanic spines absent. No spines between tympanic spines or between tympanic and parietal spines (Fig. 4A). Occipital pit very deep (deepest in largest specimens; nearly flat in specimens less than ca. 40 mm SL); surrounded laterally by tympanic spines and anterior one-third of parietal spine bases in dorsal view; length of pit subequal to width of pit; surface of pit smooth, without spines or ridges. Parietal spine serrated; anterior base curving into occipital pit; several small spines or spinous points around spine. Nuchal spine serrated; not joined with parietal spine at base; bases of nuchal and parietal spines subequal. Sphenotic with 4 (2–8) small spines. Postorbital with 11 (5–15) small spines; longest spine much shorter than longest sphenotic spine. Pterotic spine serrated; located just below parietal spine. Several spines and hardened scales in an area surrounded by parietal, pterotic, and posttemporal spines. Upper posttemporal with several small spines. Lower posttemporal spine serrated, level with midpoint between nuchal and pterotic spines. Supracleithral spine simple, without strong points, between posterior ends of nuchal and lower posttemporal spine bases. Cleithral spine flattened and pointed.

Lacrimal with numerous small sharp spines laterally; continuous with suborbital ridge; spines of lower margin reaching upper lip when mouth closed. Three suborbital ridges with numerous pointed spines; spines directed posteriorly. Space between ventral margin of eye and suborbital ridge very narrow. Suborbital pit absent. Preopercle with five spines; uppermost largest, lacking a supplemental preopercular spine on its base; uppermost to third (or uppermost and second or third) spines with a low median ridge; fourth and fifth (or third to fifth) spines without a median ridge; all spines directed posteriorly. Preopercular margin, between uppermost preopercular spine and upper end of preopercle, with 2 (rarely 1) rows of several small pointed spines. Upper opercular spine simple on left side, with 3 points on right side (2 or 3 points); with a low median ridge (with 1–3 median ridges), 3 (1–4) spinous points on ridge. Lower opercular spine simple, with a distinct median ridge and 4 (4–7) distinct spinous points on ridge. Space between upper and lower opercular

TABLE 1. SELECTED MORPHOMETRIC CHARACTERS FOR *Maxillicosta meridianus*, NEW SPECIES, EXPRESSED AS PERCENTAGES OF STANDARD AND HEAD LENGTHS. * also a paratype of *M. scabriceps* and *M. whitleyi*.

	Holotype	Paratypes			Mean
	CSIRO A 4252	AMS E. 988*	AMS I. 10404*	Other paratypes $n = 21$	$n = 24$
Standard length (mm)	77.6	65.9	66.9	32.4–78.8	
% standard length					
Body depth	35.7	34.3	31.5	30.6–35.4	32.9
Body width	26.2	24.6	23.8	19.2–26.8	23.3
Head length	42.9	41.3	42.0	40.6–47.8	43.3
Snout length	8.6	7.6	7.9	7.9–9.6	8.6
Orbit diameter	15.5	15.8	15.2	14.5–18.5	16.5
Interorbital width	5.0	4.9	4.5	4.1–5.6	4.8
Head width	17.9	17.3	17.2	16.4–19.1	17.4
Upper-jaw length	20.1	19.7	19.7	19.1–22.2	20.3
Maxilla depth	7.2	6.7	6.1	6.1–7.5	6.9
Postorbital length	20.0	18.7	19.4	18.4–21.0	19.9
Post-occipital pit length	7.9	7.1	7.2	6.4–9.1	7.8
Predorsal-fin length	34.5	34.7	33.5	34.1–40.1	36.7
Preanal-fin length	66.8	66.3	66.2	61.6–70.5	65.6
Prepelvic-fin length	37.9	36.1	35.7	37.7–47.5	39.2
1st dorsal-fin spine length	9.0	9.4	9.3	7.6–9.6	8.6
2nd dorsal-fin spine length	12.1	14.0	14.3	11.8–15.1	13.3
3rd dorsal-fin spine length	20.5	21.5	21.2	17.3–22.4	20.3
4th dorsal-fin spine length	27.2	26.6	25.3	23.7–29.3	26.3
5th dorsal-fin spine length	27.1	24.4	26.5	22.2–28.4	26.2
12th dorsal-fin spine length	6.6	—	7.2	5.5–8.8	6.8
13th dorsal-fin spine length	15.2	15.2	16.4	13.4–16.1	15.1
Longest dorsal-fin ray (1st or 2nd) length	21.0	—	24.7	19.9–24.7	21.3
1st anal-fin spine length	14.4	12.6	13.5	11.6–14.3	13.1
2nd anal-fin spine length	21.1	20.6	21.5	18.4–22.5	20.5
3rd anal-fin spine length	13.4	14.6	15.4	13.5–16.2	14.7
Longest anal-fin ray (1st to 3rd) length	19.5	20.6	23.0	17.5–22.5	20.4
Pectoral-fin ray length	33.0	31.4	34.5	30.5–38.3	33.5
Pelvic-fin spine length	14.9	16.4	15.1	14.3–18.4	16.1
Longest pelvic-fin ray (2nd) length	25.6	25.2	27.1	22.0–27.1	25.1
Caudal-fin length	28.7	—	—	27.1–34.0	30.2
Caudal-peduncle length	18.3	15.9	17.8	15.9–20.8	18.5
Caudal-peduncle depth	9.0	8.6	8.8	7.8–9.0	8.6
% head length					
Snout length	20.1	18.4	18.9	18.1–22.1	19.8
Orbit diameter	36.0	38.2	36.3	34.6–42.1	38.2
Interorbital width	11.7	11.8	10.7	9.5–13.9	11.2
Head width	41.7	41.9	40.9	38.9–42.3	40.5
Upper-jaw length	46.8	47.8	47.0	45.4–49.4	47.0
Maxilla depth	16.8	16.2	14.6	14.6–17.3	16.1
Postorbital length	46.5	45.2	46.3	42.3–49.3	46.4
Post-occipital pit length	18.3	17.3	17.1	15.2–20.7	18.1

spines without ridges (0–2 longitudinal ridges just above lower spine). No spines (0 in all but two paratypes that have 2 and 3) on distal margin of area between upper and lower opercular spines.

Origin of first dorsal-fin spine above first pored lateral-line scale. Posterior margin of opercular membrane reaching a vertical through fourth dorsal-fin spine base. Posterior tip of pectoral fin just reaching (just reaching or extending beyond) a vertical through third anal-fin spine base. Origin of pelvic-fin spine slightly anterior to (slightly anterior to or just below) origin of uppermost pectoral-fin ray. Posterior tip of depressed pelvic fin not reaching (not reaching, but extending beyond in small specimens) anus. Origin of first anal-fin spine slightly anterior to vertical through origin of last dorsal-fin spine.

TABLE 2. FREQUENCY OF SPINOUS POINTS ON SELECTED HEAD SPINES IN *Maxillicosta meridianus* AND *M. whitleyi*. [H] includes holotype; [1] see Fig. 3.

	Number of spinous points at tip of upper opercular spine				Number of spinous points on preocular spine														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	~	21
M. meridianus	4[H]	18	2		1	1	2[H]	4	4	4	3	3	2					
M. whitleyi		3	11[H]	2			1		2	1		2		2	3	4[H]		1

	Number of spinous points on anterior margin of nasal spine[1]																	
	0	1	2	3	4	5	6	7	8	9	10	11	12					
M. meridianus	15[H]	2	2	2	1	1	1											
M. whitleyi				1		1	2	2	2	1	2[H]	4	1					

Coloration in life at night.—(from underwater photographs taken in Victorian waters by R. H. Kuiter): Head and trunk brownish, strongly mottled with poorly-defined reddish brown or dark brown blotches; abdomen whitish. Three poorly-defined oblique dark brown or blackish saddles on body; first saddle extending from base of fifth to ninth dorsal-fin spines to behind upper part of pectoral-fin base; second extending from base of soft-rayed portion of dorsal fin to above spinous portion of anal fin; third through caudal peduncle encroaching on upper caudal-fin rays basally; first saddle widest, width subequal to orbital diameter; third saddle narrowest, width less than pupil diameter. Membrane of spinous portion of dorsal fin whitish with a dark brown or black blotch on outer margin of membrane extending from fifth to ninth dorsal-fin spines; anterior part reddish brown marginally. Membrane of soft-rayed portion of dorsal fin transparent with an indistinct brown band, width subequal to pupil diameter, midway up fin; pale brown spots scattered on rays. Pectoral-fin membrane transparent; rays white, upper rays with pale brown spots, lower rays without spots. Caudal-fin membrane transparent; rays whitish with pale brown spots. An underwater photograph of *M. meridianus* (as *M. whitleyi*) in Gomon et al. (1994:fig. 433).

Coloration of preserved specimens.—Long-preserved specimens, including holotype, with head, trunk, and fins uniformly brown or yellowish brown, except black eyes and large black blotch, larger than or subequal to orbit, on outer margins of membranes between fifth and ninth spines of dorsal fin. More recently preserved specimens, with head and trunk yellowish-white or brown dorsally, becoming whitish ventrally. Four poorly-defined oblique grey saddles on body; first saddle extending from bases of first and second dorsal-fin spines to cleithral spine beneath opercle; second extending from base of fifth to ninth (fifth to ninth, sixth to ninth, or sixth to eighth) spines of dorsal fin to behind upper part of pectoral-fin base; top of third between space just posterior to origin of soft-rayed portion of dorsal fin, ending just behind posterior end of soft-rayed portion and extending ventrally to above anal-fin spine base; fourth through caudal peduncle encroaching on basal ends of upper caudal-fin rays; second and third saddles widest, width subequal to orbital diameter; fourth saddle narrowest, width subequal to pupil diameter. No distinct black spots on head or trunk. Lips, underside of lower jaw, and inside mouth uniformly whitish. A large black blotch, larger than orbit, on outer margins of membranes

TABLE 3. FREQUENCY OF SELECTED FIN RAY AND SCALE VALUES IN *Maxillicosta meridianus* AND *M. whitleyi*. [H] includes holotype; [1] excludes a single malformed specimen of *M. meridianus* with 17 pectoral-fin rays on right side of body and 21 rays on left side.

	Pectoral-fin rays (one side/other side)[1]									
	19/20	20/20	20/21	21/21	21/22	22/22	22/23	23/23	23/24	24/24
M. meridianus				2	4	7	5	2[H]	2	1
M. whitleyi	1	2	2[H]	7	3	1				

	Scales in longitudinal series											
	40	41	42	43	44	45	46	47	48	49	50	51
M. meridianus								4	4[H]	8	6	2
M. whitleyi	1	2	5	2[H]	2	1	2	1				

	Pored lateral-line scales					Scale rows between last ray bases of pelvic fins			
	25	26	27	28	29	1	2	3	4
M. meridianus			3	13[H]	7			15[H]	9
M. whitleyi	4[H]	2	8	2		8[H]	7	1	

	Scales above/below lateral line								Scales between 6th/last dorsal spine bases and lateral line							
	2	3	/	10	11	12	13	14	2	3	4	5	/	3	4	5
M. meridianus	6[H]	18	/			4	16	4[H]		2	20[H]	2	/		5	19[H]
M. whitleyi	13	3[H]	/	1[H]	10	5			2	13[H]	1		/	5[H]	11	

between fifth and ninth spines of dorsal fin in both sexes. Membranes of dorsal, pectoral, and pelvic fins with few scattered pale gray spots. Anal and caudal fins white (caudal fin rarely with scattered pale gray spots, but not forming distinct stripes or bands).

Distribution.—Known from off the southeast coast of Australia where it ranges from coastal Victoria and northern Tasmania to eastern South Australia (Fig. 5).

Ecological notes.—All published underwater photographs of *M. meridianus* (as *M. whitleyi*) include a sandy substrate. Ecological observations are based on R. H. Kuiter (pers. comm.). Individuals bury completely in the sand during the day, but are fully exposed at night. *Maxillicosta meridianus* appears to prefer deeper sand channels, away from rubble or seagrasses, whereas *M. scabriceps*, the only species of the genus co-occurring with it in southeastern Australia, is more common inshore near or among sparse seagrass or rubble bits on sand flats.

Etymology.—The specific name *meridianus* is derived from the Latin for ''southern,'' in reference to the southern distribution of the species, relative to that of *M. whitleyi*, with which it has been confused.

***Maxillicosta whitleyi* Eschmeyer and Poss, 1976**
Whitley's Gurnard Perch
Figures 2C, 3B, 4B, 5, 6, 7B, 9; Tables 2–4

Maxillicosta whitleyi Eschmeyer and Poss, 1976:439, fig. 5 (type locality: off Southport, Queensland, Australia).

Holotype.—AMS IB. 4409, 56.1 mm SL, Australia, Queensland, off Southport, dredge, collection date unknown, J. Garrard.

Paratypes.—AMS IB. 4406, 48.0 mm SL, same data as holotype. AMS IB. 7023, 45.3 mm SL, Australia, New South Wales, off Port Stephens, trawl, B. Mitchell.

Non-type material.—13 specimens, 48.0–71.2 mm SL, from eastern Australia: AMS I. 16886-005, 2 (60.3–62.5 mm SL), Australian Capital Territory, Jervis Bay, D. Pollard, 22 Sept. 1971. AMS I. 23469-005, 51.0 mm SL, New South Wales, off Eden, 37°02–04′S, 150°03–04′E, FRV KAPALA, 73 m depth, prawn trawl, 12 Nov. 1982. AMS I. 5936-004, 67.5 mm SL, New South Wales, off Clarence River, 28°40′S, 152°32′E, FRV KAPALA, 55 m depth, 12 Oct. 1985. AMS I. 26023-003, 57.6 mm SL, New South Wales, off Green Cape, 37°18–22′S, 150°05′E, FRV KAPALA, 80–82 m depth, 22 Nov. 1984. AMS I. 26271-006, 59.1 mm SL, New South Wales, northeast of

TABLE 4. SELECTED MORPHOMETRIC CHARACTERS FOR *Maxillicosta whitleyi*, EXPRESSED AS PERCENTAGES OF STANDARD AND HEAD LENGTHS. * The two paratypes, AMS E. 988 and AMS I. 10404, are not conspecific with the holotype of *M. whitleyi* and are presented in Table 1.

	Holotype	Paratypes*		Non-types	Mean
	AMS IB. 4409	AMS IB. 4406	AMS IB. 7023	n = 13	n = 16
Standard length (mm)	56.1	48.0	45.3	48.0–71.2	
% standard length					
Body depth	31.9	35.0	33.8	30.8–35.7	33.5
Body width	23.2	22.5	23.8	23.0–26.5	24.3
Head length	42.6	44.4	41.7	40.0–42.9	41.6
Snout length	7.0	7.9	6.8	6.2–7.9	7.3
Orbit diameter	17.5	17.3	16.6	15.0–16.7	16.1
Interorbital width	4.5	4.4	4.6	3.7–4.7	4.3
Head width	16.6	17.5	15.9	15.3–17.2	16.3
Upper-jaw length	18.0	19.2	17.9	16.3–18.7	17.7
Maxilla depth	6.1	7.1	5.5	5.6–7.1	6.2
Postorbital length	19.4	20.2	18.1	18.4–20.8	19.4
Post-occipital pit length	8.6	9.4	6.6	6.9–8.0	7.6
Predorsal-fin length	36.0	38.3	33.6	33.3–35.3	34.6
Preanal-fin length	65.4	64.2	65.6	63.9–68.8	65.5
Prepelvic-fin length	38.3	37.3	39.5	35.5–40.6	38.0
1st dorsal-fin spine length	8.4	—	—	7.2–9.6	8.2
2nd dorsal-fin spine length	13.4	—	13.0	11.4–14.9	13.2
3rd dorsal-fin spine length	19.3	20.6	19.2	17.9–22.3	19.6
4th dorsal-fin spine length	25.3	27.3	25.4	23.2–27.3	25.2
5th dorsal-fin spine length	25.8	25.8	24.5	21.3–26.6	24.0
12th dorsal-fin spine length	7.0	7.3	6.8	6.9–9.6	7.7
13th dorsal-fin spine length	16.0	15.6	16.3	12.0–16.1	15.0
Longest dorsal-fin ray (1st or 2nd) length	—	21.0	—	19.4–22.5	21.0
1st anal-fin spine length	11.4	10.0	—	8.6–11.9	10.5
2nd anal-fin spine length	18.0	17.9	16.3	16.5–20.3	18.1
3rd anal-fin spine length	14.1	12.5	13.0	11.4–14.4	12.8
Longest anal-fin ray (1st to 3rd) length	19.8	—	—	17.8–19.9	18.8
Pectoral-fin ray length	33.9	34.4	—	30.5–35.2	33.1
Pelvic-fin spine length	16.4	16.3	—	14.6–17.5	16.1
Longest pelvic-fin ray (1st or 2nd) length	22.5	23.1	23.6	21.6–26.3	23.8
Caudal-fin length	—	—	—	26.7–29.4	27.9
Caudal-peduncle length	17.5	16.9	18.5	18.2–20.0	18.6
Caudal-peduncle depth	10.0	10.0	10.2	9.4–10.6	9.9
% head length					
Snout length	16.3	17.8	16.4	16.7–19.6	17.7
Orbit diameter	41.0	39.0	39.7	35.6–40.3	38.7
Interorbital width	10.5	9.9	11.1	8.9–11.5	10.2
Head width	38.9	39.4	38.1	37.0–41.8	39.2
Upper-jaw length	42.3	43.2	42.9	41.3–44.6	43.0
Maxilla depth	14.2	16.0	13.2	13.4–17.4	14.9
Postorbital length	45.6	45.5	43.4	44.5–48.4	46.6
Post-occipital pit length	20.1	21.1	15.9	16.0–20.0	18.2

Sandon Bluffs, 29°39′S, 153°24′E, FRV KAPALA, 10 Oct. 1985. AMS I. 26397-003, 1 of 2 (55.7 mm SL), New South Wales, Sydney, off Broken Bay, 33°36′S, 151°29′E, FRV KAPALA, 71 m depth, 10 Feb. 1986. CSIRO H 3531-02, 4 (48.0–71.2 mm SL), New South Wales, Disaster Bay, 37°17′S, 150°02′E, FRV SOUTHERN SURVEYOR, 41 m depth, 11 Aug. 1993. NMV A 16546, 2 (60.5–62.7 mm SL), Victoria, Gabo Island, 37°34′S, 149°55′E, seine, 26–30 July 1995, J. Turnley.

Diagnosis.—A species of *Maxillicosta* with the following combination of characters: 19–22 (21) pectoral-fin rays; 40–47 (42) scales in longitudinal series; 25–28 (27) pored lateral-line scales; 1–3 (1) scale rows between last pelvic-fin ray bases; 2

or 3 (2) scales above, 10–12 (11) below lateral line; 2–4 (3) scales between sixth dorsal-fin spine base and lateral line; 3 or 4 (4) scales between last dorsal-fin spine and lateral line; scales above lateral line behind head usually without a strong median ridge; central portion of inner ridge on ventral mandibular surface midway between inner edge of dentary and central ridge (Fig. 2C); an additional short oblique ridge (accessory ridge) between posterior portions of inner and central ridges on ventral mandibular surface (Fig. 2C); 3–12 spinous points on anterior margin of nasal spine (Fig. 3B), 9–19 spinous points on entire nasal spine; 7–21 spinous points on surface of preocular spine; numerous spines or distinct ridges on lateral margin of occipital pit between tympanic spine and origin of parietal spine base (Fig. 4B); a single ossified ctenoid scale behind front edge of occipital pit between tympanic spines (Fig. 4B); dorsal surface of occipital pit with several slender simple spines (Fig. 4B); 3 (rarely 2 or 4) spinous points at tip of upper opercular spine; posterior margin of maxilla not extending beyond a vertical through posterior margin of pupil; snout length 6.2–7.9 (7.3)% SL, upper-jaw length 16.3–19.2 (17.7)% SL, first anal-fin spine length 8.6–11.9 (10.5)% SL, second anal-fin spine length 16.3–20.3 (18.1)% SL, third anal-fin spine length 11.4–14.4 (12.8)% SL, and caudal-peduncle depth 9.4–10.6 (9.9)% SL (Fig. 6); body without reticulate color pattern; caudal fin usually with 3 or 4 vertical irregular narrow bands in preserved specimens (Fig. 7B).

Distribution.—Known from off the east coast of Australia where it ranges from southern Queensland to northeastern Victoria (Fig. 5). All specimens examined from Victoria (except off the northeastern tip), Tasmania, and South Australia that were initially misidentified as *M. whitleyi*, are *M. meridianus*.

Remarks.—Proportional measurements are presented in Table 4. Frequency distributions of selected meristic characters are in Tables 2–3. *Maxillicosta scabriceps* was described by Whitley (1935) on the basis of three specimens: the holotype, AMS IA. 21 (60.5 mm SL), and two paratypes, AMS E. 988 (65.9 mm SL) and AMS I. 10404 (66.9 mm SL). Subsequently, Eschmeyer and Poss (1976) described *M. whitleyi* from a holotype and four paratypes, the latter including both paratypes of *M. scabriceps*: holotype, AMS IB. 4409 (56.1 mm SL) and paratypes, AMS IB. 4406 (48.0 mm SL), AMS IB. 7023 (45.3 mm SL), AMS E. 988 and AMS I. 10404. The two paratypes featuring in both type series, AMS E. 988 and AMS I. 10404, represent a third species, described here as *M. meridianus*.

Discussion

As the type series of *M. whitleyi* includes specimens of *M. meridianus*, the key to the species of *Maxillicosta* provided by Eschmeyer and Poss (1976:435) was devised to encompass both. Comparisons of the combined species, *M. whitleyi* and *M. meridianus*, with other congeners by Eschmeyer and Poss (1976:435, 441) remain valid.

Maxillicosta meridianus can be distinguished from *M. whitleyi* by a variety of characters, including head spine and ridge structures, numbers of fin rays and scales, various proportional measurements, and coloration. The condition of spines and ridges in the occipital pit region is perhaps the most obvious suite of characters separating these species. In dorsal view, the lateral margin of the occipital pit between the tympanic spine base and the origin of the parietal spine base in *M. meridianus* lacks spines or distinct ridges (Fig. 4A). In *M. whitleyi*, the occipital pit has numerous distinct and sharp, but relatively short spines and/or distinct ridges (Fig. 4B). In addition, the dorsal surface of the occipital pit in *M. meridianus* is smooth, without spines (Fig. 4A), but *M. whitleyi* usually has several slender simple spines scattered in this area (Fig. 4B). *Maxillicosta whitleyi* also possesses a single ossified ctenoid scale at the front edge of the occipital pit between tympanic spines (Fig. 4B) that is absent in *M. meridianus* (Fig. 4A).

The condition of the ridges on the ventral mandibular surface also separates these species. As described above, the position of the inner ridge in *M. meridianus* changes with growth, but the central part of the inner ridge never extends beyond a midline between the inner edge of the dentary and the central ridge in ventral view (see Fig. 2A–B). In contrast, the central part of the inner ridge in *M. whitleyi* is midway between the inner edge and the central ridge or is closer to the central ridge than the inner ridge throughout life (see Fig. 2C). *Maxillicosta whitleyi* has an accessory ridge between the posterior portions of the inner and central ridges (Fig. 2C) that is missing in *M. meridianus* (Fig. 2A–B).

Maxillicosta meridianus has relatively few spinous points (mean 2.5 points in juveniles and 0.7 in adults) on the anterior margin of the nasal spine, compared to the number (mean 8.4) in *M. whitleyi* (Table 2). Ontogenetic changes are as presented above. Typical conditions of the nasal spine are illustrated in Figure 3. The numbers of spinous points at the tip of the upper opercular spine (1–3 with a strong mode of 2) and on the

surface of the preocular spine (5–13) in *M. meridianus*, both unaffected by growth, are also slightly less than those (2–4 with a strong mode of 3 and 7–21, respectively) in *M. whitleyi* (Table 2).

The pectoral-fin ray and some scale counts in *M. meridianus* also differs from those in *M. whitleyi* (Table 3). *Maxillicosta meridianus* has 21–24 (modally 22) pectoral-fin rays (vs. 19–22, modally 21 in the latter), 47–51 (49) scales in longitudinal series (vs. 40–47, 42), 27–29 (28) pored lateral-line scales (vs. 25–28, 27), 3 or 4 (3) scale rows between the last pelvic-fin ray bases (vs. 1–3, 1), 2 or 3 (3) scales above the lateral line (vs. 2 or 3, 2), 12–14 (13) scales below the lateral line (vs. 10–12, 11), 3–5 (4) scales between the sixth dorsal-fin spine base and the lateral line (vs. 2–4, 3), and 4 or 5 (5) scales between the last dorsal-fin spine and the lateral line (vs. 3 or 4, 4).

Of 32 measurements taken, *M. meridianus* and *M. whitleyi* have substantial differences in six relative to SL: snout length 7.9–9.6% SL, mean 8.6% in *M. meridianus* (vs. 6.2–7.9%, 7.3% in *M. whitleyi*; Tables 1, 4; Fig. 6A); upper-jaw length 19.1–22.2%, 20.3% (vs. 16.3–19.2%, 17.7%; Tables 1, 4; Fig. 6B); first anal-fin spine length 11.6–14.4%, 13.1% (vs. 8.6–11.9%, 10.5%; Tables 1, 4; Fig. 6C); second anal-fin spine length 18.4–22.5%, 20.5% (vs. 16.3–20.3%, 18.1%; Tables 1, 4; Fig. 6D); third anal-fin spine length 13.4–16.2%, 14.7% (vs. 11.4–14.4%, 12.8%; Tables 1, 4; Fig. 6E); and caudal-peduncle depth 7.8–9.0%, 8.6% (vs. 9.4–10.6%, 9.9%; Tables 1, 4; Fig. 6F). The posterior margin of the maxilla in *M. meridianus* extends slightly beyond a vertical through the posterior margin of the pupil, whereas it only rarely just reaches as far as the vertical in *M. whitleyi*. The dorsal-fin spines in *M. meridianus* also tend to be proportionally longer than those in *M. whitleyi* (see Tables 1, 4). Other minor morphometric differences between the two are noted in Tables 1, 4.

Preserved specimens of *M. meridianus* and *M. whitleyi* can be easily separated by body coloration, the former somewhat whitish and the latter blackish. The caudal fin in preserved specimens of *M. meridianus* lacks distinct melanin (Fig. 7A) although it occasionally has scattered very pale grayish pigments, whereas *M. whitleyi* usually has distinct melanin, forming 3 or 4 irregular narrow vertical bands (Fig. 7B).

Morphological changes with growth.—The examinations of specimens of *M. meridianus*, ranging in size from 32.4 to 78.8 mm SL, and specimens of *M. whitleyi* between 48.0 and 71.2 mm SL revealed the following morphological changes with growth. As documented for some other Scorpaenidae (Eschmeyer, 1965, 1969), the number of branched pectoral-fin rays in *M. meridianus* increases with growth. One to four pectoral-fin rays (between second and seventh rays) of all specimens examined less than 45.6 mm SL are branched, 6 or 7 rays (second to seventh or eighth rays) are branched in specimens between 47.8 and 66.0 mm, and 7 or 8 rays (second to eighth or ninth rays) are branched in specimens exceeding 68.9 mm. In contrast, although the number of the branched pectoral-fin rays in *M. whitleyi* varied from 6 to 10, the numbers did not correspond with size (e.g., 6 branched rays in a 51.0 mm specimen, 10 rays in a 54.0 mm specimen and 7 rays in a 71.2 mm specimen).

The ventral surface of the lower jaw of *M. meridianus* and *M. whitleyi* has three distinct longitudinal ridges on each side in ventral view (Fig. 2). In *M. meridianus*, the position of the inner ridge slightly changes with growth. The posterior portion of the inner ridge is located on the inner edge of the dentary in specimens usually less than ca. 60 mm SL (Fig. 2A), and the ridge is positioned progressively father away from the inner edge in ventral view (Fig. 2B) with an increase in size. At the same time, the anterior portion of the ridge remains on the inner edge of the dentary in all sizes (Fig. 2A, B). In contrast, the position of the ridge in *M. whitleyi* does not change with growth, and the central portion of the ridge is located about midway between the inner edge of the dentary and a central ridge on the underside of the lower jaw in ventral view (Fig. 2C). The occipital pit structure also changes with growth, as described for some other scorpionfishes (Motomura, Last, and Yearsley, 2005; Motomura, Paulin, and Stewart, 2005). A transverse edge at the rear of the pit becomes progressively more distinct (steeper) with growth in both species, and the pit becomes deeper.

The nasal spine is one of the most variable spines on the head in some scorpionfishes and undergoes substantial ontogenetic changes in species, like those of *Parapterois* (see Motomura, 2004c) and *Scorpaenopsis obtusa* (see Motomura and Shinohara, 2005). Despite this, it may be a reliable character for identification (e.g., *Scorpaenopsis neglecta*, Randall and Eschmeyer, 2002; Motomura et al., 2004). The number of spinous points on the nasal spine in *M. meridianus* tends to decrease with growth, although it increases with growth in species of *Parapterois* and *Scorpaenopsis* (Motomura, 2004c; Motomura and Shinohara, 2005). The numbers of spinous points on the anterior margin and top of the nasal spine (Fig. 3) in specimens of *M. meridianus*

smaller than 47.8 mm SL average 2.5 and 5.3, respectively, whereas those of specimens larger than 51.1 mm SL average 0.7 and 7.7, respectively. As with pectoral-fin rays, the number of spinous points on the nasal spine of *M. whitleyi*, varying from 3 to 12 on the anterior margin and from 2 to 9 on top, simply represents individual variation.

Analyses of 32 measurements revealed several dimensions in *M. meridianus* decreasing proportionally with growth. The most substantial are associated with orbital diameter and pre-dorsal fin, pelvic-fin spine, and caudal-fin ray lengths (Fig. 8A–D). Similar ontogenetic changes are present in *M. whitleyi*.

Geographic variation.—Among the specimens of *M. whitleyi* examined for this study, the holotype and a paratype from Queensland have an orbital diameter (17.3–17.5% SL) that is greater than that of the other 14 specimens, all from New South Wales and Victoria (15.0–16.7% SL, mean 15.8%). Although the orbital diameter changes proportionally with growth, this difference is substantial and outside what might be attributed to ontogenetic change. However, as it is the only substantial morphological difference observed (Table 4), the difference is regarded as geographic variation. Additional specimens from the northern part of this species' range are required for both morphological and molecular analyses to reveal the true nature of the relationships of northern and southern populations. No substantial geographic variation was found in *M. meridianus*.

Sexual dimorphism and dichromatism.—Some species of scorpionfishes have been identified as exhibiting sexual dimorphism and dichromatism with males of some having a black blotch on the posterior spinous portion of the dorsal fin that is missing in females (e.g., Randall and Eschmeyer, 2002; Motomura, Fricke, and Eschmeyer, 2005), and in others, males having an identifiably shorter upper jaw than females (Motomura, Paulin, and Stewart, 2005; Motomura, unpubl. data). Both sexes of *M. meridianus* have a black blotch on the spinous portion of the dorsal fin and similar proportional measurements. The species therefore is not considered to be sexually dimorphic or dichromatic. Of nine paratypes (NMV A 2433, A 2678, and A 21820, 32.4–68.9 mm SL) of *M. meridianus*, the smallest mature female measures 53.7 mm SL.

Material Examined

Maxillicosta scabriceps: AMS IA. 21, holotype, 60.5 mm SL, South Australia, Kangaroo Island, Kingscote. CSIRO A 705, 75.4 mm SL, Western Australia, Great Australian Bight, RV Commiles, 28 May 1951. CSIRO A 764, 60.9 mm SL, South Australia, Smoky Bay, 32°19′S, 133°49′E, 5 April 1953. CSIRO A 803, 51.8 mm SL, Western Australia, King George Sound, 35°03′S, 118°00′E, May 1951. CSIRO A 1698, 61.1 mm SL, Western Australia, Cockburn Sound, 32°12′S, 115°44′E, RV Lancelin, 25 March 1954. CSIRO H 573-2, 2 (78.7–80.4 mm SL), Western Australia, off Albany, 35°02′S, 117°53′E, RV Nornalup, 15–18 m depth, 4 March 1986.

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(HM) THE KAGOSHIMA UNIVERSITY MUSEUM, 1-21-30 KORIMOTO, KAGOSHIMA 890-0065, JAPAN; (PRL) CSIRO MARINE AND ATMOSPHERIC RESEARCH, G.P.O. BOX 1538, HOBART, TASMANIA 7001, AUSTRALIA; AND (MFG) ICHTHYOLOGY, MUSEUM VICTORIA, G.P.O. BOX 666E, MELBOURNE, VICTORIA 3001, AUSTRALIA. E-mail: (HM) motomura@kaum.kagoshima-u.ac.jp. Send reprint requests to HM. Submitted: 7 March 2005. Accepted: 15 March 2006. Section editor: D. Buth.