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XENISTHMUS BALIUS, A NEW SPECIES OF FISH FROM THE PERSIAN GULF (GOBIOIDEI: XENISTHMIDAE)

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Abstract.—*Xenisthmus balius* is described from nine specimens from Jana Island, Saudi Arabia. It is distinguished from other xenisthmids in having the following characters in combination: dorsal-fin rays VI + I,13; anterior rim of posterior nostril raised, without well-developed membranous flap; scales of body mainly cycloid; head and body pale, with reticulate, brown mottling dorsally.

The Xenisthmidae are a family of small (mostly less than 25 mm SL, and all less than 40 mm SL), sand-diving fishes that live in sand patches adjacent to coral reefs or reef rubble throughout the Indo-Pacific. Several synapomorphies distinguish xenisthmids from other gobioid fishes and support monophyly of the family: lower lip with uninterrupted, free ventral margin; basibranchial 2 absent; premaxillary ascending processes greatly reduced; rostral cartilage ossified; and hypobranchial 3 reduced to small cartilage nubbin, or absent (Springer 1983, 1988; Gill & Hoese 1993). The family includes five genera: *Allomicrodesmus* Schultz, *Paraxenisthmus* Gill & Hoese, *Rotuma* Springer, *Tyson* Springer, and *Xenisthmus* Snyder (of which *Gignimentum* Whitley, *Luzoneleotris* Herre, *Platycephalops* Smith, and *Kraemericus* Schultz are synonyms). *Xenisthmus* species are distinguished from other xenisthmids by a single synapomorphy, third branchiostegal ray with an expanded proximal head, and by the following combination of symplesiomorphies: first dorsal-fin spines 6; scales present on body; and palatine teeth absent (Gill & Hoese 1993). Recent fieldwork by the second author and associates in the Persian Gulf has resulted in the discovery of a distinctive new *Xenisthmus* species, described herein.

Materials and Methods

Measurements were made with dial calipers, recorded to the nearest 0.1 mm. All measurements to the snout tip were made to the mid-anterior tip of the snout. Standard length (SL) was measured from the snout tip to the middle of the caudal-fin base. Predorsal, preanal and prepelvic lengths were measured from the snout tip to the base of the anteriormost spine of the relevant fin. Head length was measured from the snout tip to the dorsal edge of the gill opening. Head width is the broadest measurement between the posterior edges of the preopercles. Body width was measured at the pectoral-fin base. Snout length was measured over the shortest distance from the snout tip to the orbital rim, without compressing the fleshy edge of the latter. Orbit diameter was measured as the horizontal width of the eyeball. Bony interorbital width was the least measurement. Caudal peduncle length was measured from the base of the posteriormost anal-fin ray to the ventral edge of the caudal peduncle at the vertical through the posterior edge of the lower hypural plate. Caudal peduncle depth was measured obliquely between the bases of the posteriormost anal- and dorsal-fin rays. Pectoral-fin base depth was the vertical depth of the fleshy lobe. Measurements of

fin spines and rays excluded any filamentous membranes. Pectoral-fin length was measured as the length of the longest ray. Caudal-fin length was measured as the length of the ventralmost ray on the upper hypural plate.

The last ray in the anal- and second-dorsal fins is divided at its base and was counted as a single ray. "Scales in lateral series" was counted from the upper edge of the pectoral-fin base along the midside of the body to the posterior edge of the hypural plate. The pattern of interdigitation of first-dorsal-fin proximal pterygiophores between neural spines is given as a dorsal-fin pterygiophore formula following Birdsong et al. (1988:175). Gill-raker counts include all elements on the outer face of the first arch; the angle raker is included in the lower-limb (second) count. Osteological details were determined from radiographs and a cleared and stained paratype (USNM 326758). Institutional codes follow Leviton et al. (1985). Counts and morphometric values are given first for the holotype, followed, where different, by ranges or frequency distributions for the paratypes. Frequency distributions are presented in the form "x fy," where "x" is the count and "f" indicates that the following value, "y," is its frequency. Where counts were recorded bilaterally from the holotype, both counts are given and separated from each other by a slash; the first count presented is the left count.

Xenisthmus balius, new species
Figs. 1–3

Holotype.—BPBM 30458, 25.5 mm SL female, Persian Gulf, Saudi Arabia, northeast side of Jana Island, base of dropoff in 15 m, J. E. Randall, A. B. Tarr and J. E. Burfhard, 15 Jun 1984.

Paratypes.—BPBM 33308, 26.4 mm SL male, 29.0 mm SL female, Persian Gulf, Saudi Arabia, west side of Jana Island, reef flat, sand and rubble with small patches of mostly dead coral, 1.5 m, J. E. Randall, L. J. McCarthy, B. E. Stanaland and A. B. Tarr, 13 Sep 1985; AMNH 97301, 29.4 mm SL female, Persian Gulf, Saudi Arabia, southeast side of Jana Island, base of dropoff in 17 m, J. E. Randall, L. J. McCarthy, B. E. Stanaland and A. B. Tarr, 13 Sep 1985; AMS I.34236-001, 23.2 mm SL male, collected with AMNH 97301; BMNH 1993.9.25:1, 19.1 mm SL male, collected with AMNH 97301; BPBM 33353, 3, 18.0–31.0 mm SL females, collected with AMNH 97301; USNM 326758, 26.1 mm SL male (subsequently cleared and stained), collected with AMNH 97301.

Diagnosis.—A species of *Xenisthmus* with the following combination of characters: dorsal-fin rays VI + I,13; anterior rim of posterior nostril raised, without well-developed flap; scales of body mainly cycloid; head and body pale, with reticulate, brown mottling dorsally.

Description.—Dorsal-fin rays VI + I,13, all segmented rays branched; first dorsal-fin pterygiophore formula 3-22110; anal-fin rays I,12 (I,12 f7; I,13 f1), all segmented rays branched; pectoral-fin rays 17/16 (16 f2; 17 f14), upper 1/1 (1 f15; 2 f1) and lower 1/1 (0 f1; 1 f14; 2 f1) rays unbranched; pelvic-fin rays I,5, inner ray unbranched; segmented caudal-fin rays 9 + 8; branched caudal-fin rays 7 + 7 (6–8 + 6–7 = 12–15); upper unsegmented caudal-fin rays 8 (7 f1; 8 f5; 9 f2); lower unsegmented caudal-fin rays 8 (7 f3; 8 f4; 9 f1); scales in lateral series 70/67 (60 f1; 61 f2; 62 f2; 63 f3; 64 f2; 65 f4; 66 f1; 68 f1); scales in transverse series counted anterodorsally from anal-fin origin 21/22 (20 f3; 21 f6; 22 f7); scales in transverse series counted posterodorsally from anal-fin origin 22/21 (20 f5; 21 f7; 22 f4); circumpeduncular scales 36 (35 f1; 36 f6; 37 f1); predorsal scales 20 (16 f3; 17 f2; 18 f2; 19 f1); gill rakers 3 + 11 (3–4 + 9–12 = 13–16); pseudobranch lobes 5 (4 f3; 5 f5); vertebrae 10 + 16; epurals 2.

As thousandths of SL: head length 235 (213–246); predorsal length 333 (310–344); prepelvic length 227 (211–241); preanal

Fig. 1. Right lateral view (reversed) of *Xenisthmus balius,* holotype, BPBM 30458, 25.5 mm SL female, Jana I., Saudi Arabia, Persian Gulf; scales omitted.

length 569 (534–571); first dorsal-fin origin to second dorsal-fin origin 188 (183–207); second dorsal-fin base length 361 (328–375); anal-fin base length 271 (284–309); pectoral-fin base depth 71 (68–79); first dorsal-fin origin to pelvic-fin origin 165 (159–178); second dorsal-fin origin to anal-fin origin 133 (129–156); snout length 35 (38–44); orbit diameter 47 (44–61); head width 133 (129–148); body width 118 (117–148); bony interorbital width 20 (19–24); snout tip to retroarticular tip 98 (91–99); caudal peduncle length 149 (147–171); caudal peduncle depth 98 (108–119); length of first spine of first dorsal fin 78 (58–89); length of third spine of first dorsal fin 98 (72–94); length of sixth spine of first dorsal fin 67 (52–89); length of spine of second dorsal fin 78 (74–91); length of first segmented ray of second dorsal fin 94 (84–106); length of last segmented ray of second dorsal fin 110 (82–123); anal-fin spine length 55 (48–73); length of first segmented anal-fin ray 90 (71–100); length of last segmented anal-fin ray 106 (94–121); pectoral fin length 192 (158–211); pelvic-fin spine length 39 (33–53); fourth segmented pelvic-fin ray length 173 (161–192); caudal-fin length 184 (170–207).

Body covered with small, cycloid scales (a few, irregularly distributed ctenoid scales present on caudal peduncle of some specimens); ventral contour of body full scaled, except for narrow area beneath branchiostegal membranes; predorsal scales extending anteriorly to or slightly posterior to vertical through posterior edge of preopercle (Fig. 2); no scales on operculum or cheek; cycloid scales present on pectoral-fin base; narrow band of scales on fleshy portion of caudal-fin base, these usually cycloid, but sometimes with several, irregularly distributed ctenoid scales; no scales on dorsal- or anal-fin bases.

Distribution of sensory pores and superficial neuromasts on head as shown in Fig. 2; lower lip fleshy and protruding, with uninterrupted, free ventral margin; anterior nostril in short tube; posterior nostril with raised rim, without prominent membranous flap anteriorly (Fig. 3A) (small flap present in only one 29.0 mm SL paratype); tongue weakly indented anteriorly; gill opening extending anteriorly to about midway between verticals through posterior edge of preopercle and posterior edge of eye (Fig. 2); female urogenital papilla flattened and trapezoid, broader anteriorly, with multiple fleshy lobes posteriorly surrounding wide gonopore (Fig. 3C); male urogenital papilla

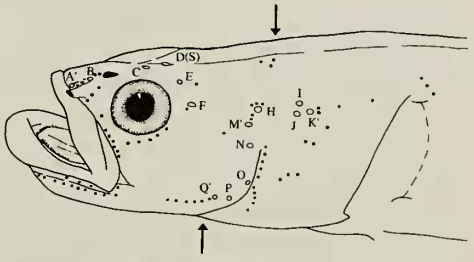

Fig. 2. Right lateral view (reversed) of head of *Xenisthmus balius,* holotype, BPBM 30458, 25.5 mm SL, showing distributions of superficial neuromasts and lateralis pores. Letter codes for lateralis pores follow Akihito (1984); left components of paired pores and neuromasts not shown. Upper arrow indicates anterior extent of median predorsal scales; lower arrow indicates anterior extent of gill opening.

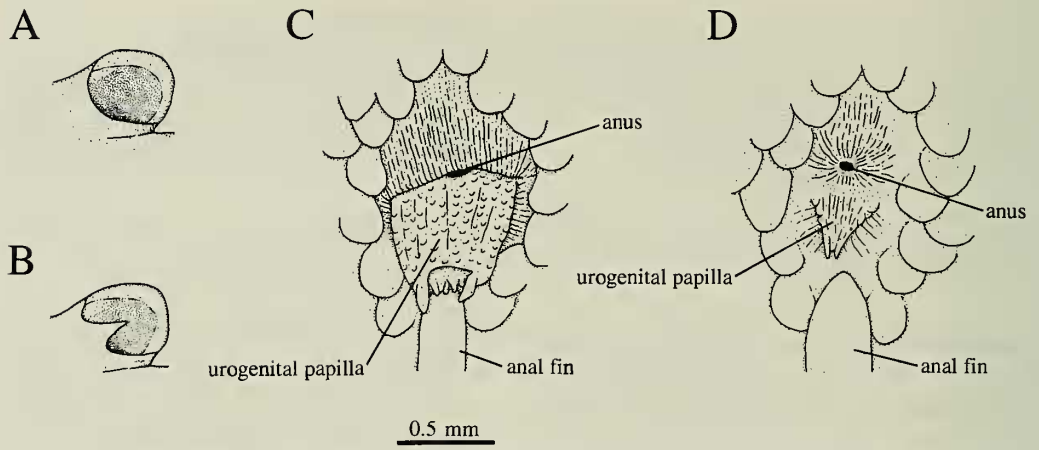

Fig. 3. A–B, diagrammatic representation of right posterior nostrils in dorsomedial view of *Xenisthmus* species without (A) and with (B) well-developed membranous flaps; anterior is to left. C–D, ventral view of urogenital papillae of (C) female, BPBM 30458, 25.5 mm SL holotype, and (D) male, BPBM 33308, 26.4 mm SL paratype of *Xenisthmus balius,* both drawn to same scale; anterior is to top.

moderately flattened and triangular, pointed posteriorly, with small lobe posteriorly on either side of gonopore (Fig. 3D).

Upper jaw with two or three (anteriorly) or two (posteriorly) rows of small, conical teeth, the outer-row teeth largest and slightly curved; lower jaw with three (anteriorly) or two (posteriorly) rows of small, conical teeth, the outer-row teeth largest and slightly curved; vomer, palatines and tongue edentate.

Preserved coloration.—Head and body pale yellow to pale brown with reticulate mottling of irregular, brown to dark grey-brown melanophores, these darkest on mid-side; three short, brown to dark grey-grown bars extending from eye, one from mid-anterior part of orbital rim to mid-side of upper lip, one from below mid-ventral part of orbital rim to behind posterior edge of maxilla, and one from posteroventral part of orbital rim to middle of cheek; mid-side of lower lip and adjacent inner part of lower jaw brown to dark grey-brown; upper part of pectoral-fin base with irregular cluster of large, brown to dark grey-brown melanophores beneath and immediately behind operculum, sometimes with additional cluster on ventral part of fin, and more-posterior, smaller cluster near bases of upper few rays; short dark grey-brown bar of melanophores on caudal-fin base; first dorsal fin hyaline with cluster of brown to dark grey-brown melanophores on middle of all or most spines, sometimes with cluster more distally; second dorsal fin hyaline with cluster of brown melanophores between bases of each ray, a cluster of brown melanophores on middle of each ray, and an additional one or two rows of melanophores on each ray; anal fin hyaline, sometimes with clusters of brown melanophores between ray bases and on middle of each ray; caudal fin hyaline with one or two large, irregular, dark grey-brown to dark grey melanophores on bases of lowermost two rays on upper hypural plate, often with a few small clusters of brown melanophores arranged in slightly concave or reticulate columns on remainder of fin; pectoral fins hyaline, with irregular patch of brown to dark grey-brown melanophores basally on upper half of fin, sometimes with additional cluster on ventral half of fin; pelvic fins hyaline.

Live coloration (based on a color photograph by L. J. McCarthy of BPBM 33308, 29.0 mm SL female, when freshly dead).—Similar to preserved coloration, except

ground coloration of head and body pale pinkish brown, becoming white ventrally, with dark grey-brown and dark grey markings on head, body and fins dark grey to black.

Etymology.—The specific epithet is from the Greek 'balios', meaning spotted or dappled, and alludes to the distinctive coloration of the species.

Remarks.—*Xenisthmus balius* closely resembles *X. chapmani* (Schultz 1966) from Espiritu Santos, Vanuatu (New Hebrides), in having mostly cycloid scales, and relatively high numbers of segmented dorsal- and anal-fin rays. It differs from the holotype and only known specimen of *X. chapmani* in having fewer segmented dorsal- and anal-fin rays (13 and 12–13 [usually 12], respectively, versus 14 and 13 for *X. chapmani*), fewer vertebrae (10 + 16 versus 10 + 17) and a different first dorsal-fin pterygiophore formula (3-22110 versus 3-12210), and in lacking well-developed membranous flaps on the posterior nostrils (see Fig. 3A, B). *Xenisthmus balius* also closely resembles an undescribed *Xenisthmus* species from the Red Sea (to be described by the first author and D. F. Hoese) in lacking well-developed membranous flaps on the posterior nostrils, and in having relatively high numbers of segmented dorsal- and anal-fin rays, relatively few ctenoid scales, and a more-or-less mottled body coloration. The Red Sea species differs from *X. balius* in having more segmented rays in the second dorsal and anal fins (15 and 14, respectively), and in having fewer head pores (e.g., 3 versus 5 preopercular pores (Fig. 2, pores M′, N, O, P, Q′); 1 versus 2 nasal pores (Fig. 2, pores A′, B)).

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