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Hetereleotris exilis, a New Goby (Teleostei, Perciformes, Gobiidae) from the Ryukyu Islands, Japan

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Abstract A new species of the gobiid fish, *Hetereleotris exilis*, is described based on a single female specimen (22.1 mm SL) collected at the depth of 53 m of off Nagan'nu Island, Okinawa Group of the Ryukyu Islands, Japan. It is unique within the genus in having very slender body (depth at anal-fin origin 11.9% of standard length), and characterized by the following: VI-I, 12 dorsal-fin rays; I, 11 anal-fin rays; 16 pectoral-fin rays; I, 5 pelvic-fin rays; innermost (=fifth) segmented pelvic-fin ray unbranched, long, subequal to preceding ray in length; scales cycloid, restricted on posterior part of body (ca. 14–15 longitudinal scales); no head sensory-canal pores.
Key words : *Hetereleotris exilis*, New species, Gobiidae, Gobiinae, Japan.

Gobies of the genus *Hetereleotris* Bleeker, 1874 are small-sized (up to ca. 50 mm SL) bottom dwellers with cryptic habit, typically found in shallow coastal marine waters in the Indo-West Pacific. *Hetereleotris* belongs to the gobiid subfamily Gobiinae (*sensu* Pezold, 1993), and is distinguished from the other gobiine genera in having the following combination of characters (Akihito and Meguro, 1981; Hoese, 1986): first gill slit closed by membrane from inner surface of gill cover to half or more of lower limb of first gill arch; pelvic fins entirely separated one another, without frenum and connecting membrane between innermost rays [except for a single species *Hetereotris zanzibarensis* (Smith, 1958), which often has pelvic fins fused into a cup-shaped disc]; posterior naris with an elevated rim or opening at tip of a short tube; a single-lobed mental frenum, followed by a pair of short longitudinal rows of sensory papillae; transverse pattern of sensory papillae on cheek; 10+17=27 vertebrae; dorsal-fin pterygiophore formula ("P-V" of Akihito, 1984) 3/II II I I 0/9.

Hoese and Larson (2005) proposed that *Pascua* Randall, 2005, described for a single species *Pascua caudilinea* Randall, 2005 from the Easter Islands, was a junior synonym of *Hetereleotris*. One-year later, Randall (2006) refuted the Hoese and Larson's suggestion, and recognized 3 species within *Pascua*, viz. *P. caudilinea*, *Pascua readerae* (Hoese and Larson, 2005) and *Pascua sticta* (Hoese and Larson, 2005), latter 2 of which have been described as the species of *Hetereleotris* by Hoese and Larson (2005) from the South Pacific. These 3 *Pascua*-type species share many features with the typical *Hetereleotris*, but are readily distinguished from the latter by having: modified basicaudal scales with enlarged cteni; flattened and elongate urogenital papilla of males; simple pore-like posterior naris (or with only a slightly elevated margin anteriorly); and much reduced sensory-papillae rows on head (Hoese and Larson, 2005; Randall, 2006). All of these features exclusive of urogenital papilla are, nevertheless, appeared as intra-generic variations in some Indo-Pacific gobiin genera; namely, similar modification of basicaudal scales is found in some species of *Cabillus* Smith, 1959 (see Greenfield and Randall, 2004), and similar intra-generic variations of sensory-papillae arrangement and condition of posterior naris are found in *Priolepis* Valenciennes *in* Cuvier and Valenciennes, 1837 and *Trimma* Jordan and Seale, 1906 (see Winterbottom and Burrige, 1992, 1993). On

the other hand, as pointed out by Hoese and Larson (2005), shape of male urogenital papilla of *Pascua* resembles a part of *Eviota* Jenkins, 1903 (rather than typical *Hetereleotris*). Basic configuration of sensory-papillae rows on cheek in *Pascua*, e.g., sensory papillae row *b* short and close to preopercular margin, also resembles that of *Eviota* (vs. row *b* well apart from preopercular margin in *Hetereleotris*). Further analysis on the interrelationships between species of *Hetereleotris*, *Pascua* and the other gobiine genera including *Eviota* is needed to evaluate the validity of *Pascua*, but that work is beyond the scope of this paper.

Following the Randall's (2006) concept of generic limit provisionally, *Hetereleotris* comprises 14 species (Akihito and Meguro, 1981; Hoese, 1986; Gill, 1998) in addition to the new species described here: *Hetereleotris apora* (Hoese and Winterbottom, 1979); *Hetereleotris bipunctata* Tortonese, 1976; *Hetereleotris caminata* (Smith, 1958); *Hetereleotris diademata* (Rüppell, 1830); *Hetereleotris georgegilli* Gill, 1998; *H. kenyae* Smith, 1958; *Hetereleotris margaretae* Hoese, 1986; *Hetereleotris nebulofasciata* (Smith, 1958); *Hetereleotris poecila* (Fowler, 1946); *Hetereleotris tentaculata* (Smith, 1958); *Hetereleotris vinsoni* Hoese, 1986; *Hetereleotris vulgaris* (Kluzinger, 1871); *H. zanzibarensis*; *Hetereleotris zonata* (Fowler, 1934).

During the biological survey in the Ryukyu Archipelago made by R/V *Toyoshio-maru* on May 2004, a single specimen of unnamed species of *Hetereleotris* was dredged at the depth of 53 m of off Nagan'nu Island, Okinawa Group of Ryukyu Islands, Japan. The species, herein described as new, is readily distinguished from the congeners by the combination of cephalic sensory systems, meristic counts, shape of body, squamation, and coloration.

Materials and Methods

The specimen examined is deposited in the fish collection of the Department of Zoology, National Museum of Nature and Science, Tokyo (NSMT-P).

All fish lengths given are standard lengths (SL). Measurements were made point-to-point with calipers under the dissecting microscope to the nearest 0.01 mm. The methods for measurements followed those of Hubbs and Lagler (1958), with exceptions given below (the snout tip refers to the mid-anteriormost point of the upper lip): interorbital width was the least width of bony interorbital space; jaw length was measured between the snout tip and the posteriormost point of lip; head width and depth were measured at preopercular margin; body depth was measured in 2 ways, the first at the first dorsal-fin origin, and the second at the anal-fin origin; nape width was measured between dorsalmost margins of gill openings; preanal and prepelvic lengths were measured from the snout tip to the origin of each fin; pectoral-fin length was measured from the base to the tip of the longest ray; pelvic-fin length was measured between the base of pelvic-fin spine and the distal tip of the longest segmented ray; caudal-fin length was measured from the base to the tip of the middle caudal-fin ray. The methods of counts followed Akihito (1984), except for the following: gill rakers including all rudiments were counted on the outer side of first arch; count of pseudobranchial filaments included all rudiments. In order to confirm scales on body, the holotype was stained by Alizarin Red (after taking photographs for making Fig. 1). Scales and paired-fin rays were counted on both sides. Osteological features were observed from radiographs. The methods of Akihito (1984) were used in describing the pattern of the interdigitation of the dorsal-fin pterygiophores between the neural spines ("P-V"). Cephalic sensory papillae were observed on the specimen stained with cyanine blue, and notations on them follow Miller (1986). All photographs and illustrations were made by the author.

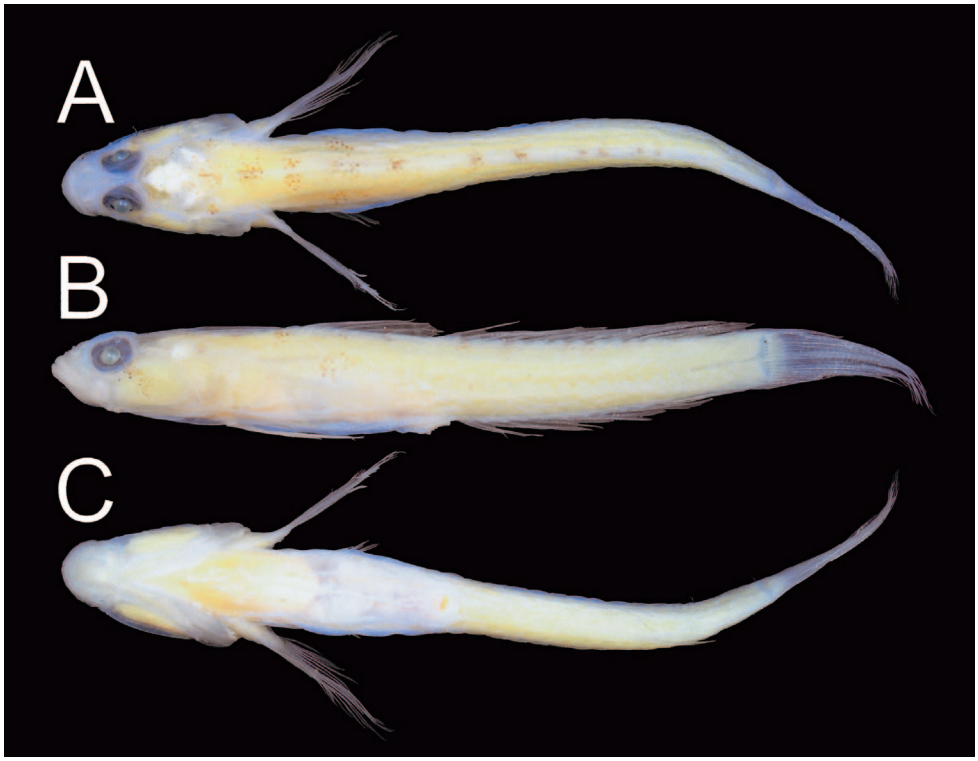

Fig. 1. Dorsal (top), lateral (middle) and ventral (bottom) views of *Hetereleotris exilis* sp. nov., NSMT-P 94885, holotype, female, 22.1 mm SL, off Nagan'nu Island, Okinawa Group of Ryukyu Islands, Japan.

Hetereleotris exilis sp. nov.

[New Japanese name: Sasagaki-haze]

(Figs. 1–3)

Holotype. NSMT-P 94885, female, 22.1 mm SL, off Nagan'nu Island, Okinawa Group of the Ryukyu Islands, Japan (26°14.63′N, 127°31.78′E), 53 m depth, 22 May 2004, R/V *Toyoshio-maru*.

Diagnosis. *Hetereleotris exilis* differs from the congeners in having the following combination of characters: VI-I, 12 dorsal-fin rays; I, 11 anal-fin rays; I, 5 pelvic-fin rays; innermost (=fifth) segmented pelvic-fin ray unbranched, long, subequal to preceding ray in length; body elongate, body depth at anal-fin origin 11.9% of SL; scales cycloid, restricted on posterior part of body (ca. 14–15 longitudinal scales); no sensory canals and associated pores on head.

Description. Dorsal-fin rays VI-I, 12; anal-fin rays I, 11; pectoral-fin rays 16/16; pelvic-fin rays I, 5/I, 5; segmented caudal-fin rays 9+8, including 8+7 branched rays; dorsal unsegmented caudal-fin rays 3; ventral unsegmented caudal-fin rays 4; longitudinal scales approximately 14/15; predorsal scales 0; gill rakers 2+0; vertebrae 10+17=27; P-V 3/II II I I 0/9; epural 1; anal-fin pterygiophores anterior to first haemal spine 2.

The following measurements are % of SL: head length 27.1; head width 15.4; head depth 12.7; snout length 6.0; eye diameter 6.2; interorbital width 1.1; nape width 12.5; jaw length 10.1; body depth at origin of first dorsal fin 14.7; body depth at origin of anal fin 11.9; body width 14.4; predorsal length 35.5; prepelvic length 26.7; preanal length 57.3; caudal-peduncle length 16.4; caudal-peduncle depth 8.9; length of first dorsal-fin base 18.2; length of second dorsal-fin base 33.1; length of anal-fin base 28.7; pectoral-fin length 22.7; pelvic-fin length 20.2; length of first

spine of first dorsal fin 10.6; length of second spine of first dorsal fin 11.8; length of third spine of first dorsal fin 12.2; length of fourth spine of first dorsal fin 11.4; length of spine of second dorsal fin 11.0; length of first segmented ray of second dorsal fin 14.0; length of longest (=ninth) segmented ray of second dorsal fin 16.2; length of anal-fin spine 7.9; length of first segmented ray of anal fin 11.3; length of longest (=tenth) segmented ray of anal fin 15.0; length of pelvic-fin spine 5.9; length of first segmented ray of pelvic fin 9.8; length of fourth segmented ray of pelvic fin 19.0; length of fifth segmented ray of pelvic fin 18.7; caudal-fin length 24.3.

Body elongate and compressed. Head depressed, its depth 82.0% of width. Snout short, its length subequal and slightly shorter than eye diameter; snout does not protrude beyond upper lip. Eye dorsolateral, relatively small, its diameter 23.6% of head length; interorbital space narrow, its width narrower than pupil diameter and 4.1% of head length. No cutaneous ridge along dorsal midline of nape. Gape oblique, forming an angle of about 35 degrees with body axis. Lower jaw slightly projecting beyond upper jaw; posterior end of jaws reaching to below middle (left side) or anterior margin (right side) of pupil; jaw length 37.1% of head length. Anterior and posterior nasal nares at tip of a short tube in each; no fleshy flap at tip of narial tubes; posterior narial tube closer to eye than anterior narial tube. Tip of tongue near rounded and very weak trilobate, free from floor of mouth. Posteroventral margin of lower lip interrupted at symphysis. Mental frenum weakly developed, forming small bump just behind lower-jaw synphysis. Gill opening narrow, restricted on base of pectoral fin. No fleshy projections on lateral wing of shoulder girdle. No bony projections along posterior margin of preopercle. First gill slit largely closed by membrane, i.e., ventral arm of first gill arch entirely continuous to inner surface of hyoid arch via thin membrane; gill rakers on outer surface of first gill arch greatly reduced, only 2 minute papilla-like rakers on dorsal arm. Caudal peduncle moderately slender, its depth 54.0% of caudal-peduncle length. First dorsal fin slightly lower than second dorsal fin; first dorsal fin close to, but not connected to, second dorsal fin by membrane; third spine of first dorsal fin longest (103.0% of preceding spine in length); first dorsal fin just reaching posteriorly to base of spine of second dorsal fin when adpressed; all dorsal-fin spines slender and flexible, but not filamentous; all segmented rays of second dorsal fin branched; ninth segmented ray of second dorsal fin longest; second dorsal fin just reaching to a vertical through caudal-fin base when adpressed. Origin of anal fin slightly behind a vertical with base of first segmented ray of second dorsal fin; height of anal fin slightly lower than second dorsal fin; anal-fin spine slender and flexible; all segmented anal-fin rays branched; tenth segmented ray of anal fin longest; anal fin not reaching to a vertical through caudal-fin base when adpressed. Caudal fin rounded, almost symmetrical dorsoventrally; caudal fin slightly shorter than head, i.e., its length 89.6% of head length. Pectoral fin near lanceolate, not reaching posteriorly to a vertical line through posterior end of base of first dorsal fin or anus; all pectoral-fin rays branched. Origin of pelvic fin far anterior to a vertical line through origin of first dorsal fin; pelvic fins entirely separated one another, without frenum and connected membrane between innermost segmented rays; all segmented pelvic-fin rays branched, except for innermost (=fifth) ray unbranched; fourth and fifth segmented rays subequal in length; pelvic fin not reaching posteriorly to anus when adpressed. Urogenital papilla short and rounded.

All scales cycloid; scaled area restricted on posterior part of body (Fig. 2), extending forward to a vertical lines through interspaces between bases of fifth and sixth (left side) or third and fourth (right side) segmented rays of second dorsal fin; anterior few scales non-imbricate and slightly embedded; scales on mid-lateral part of posterior half of caudal peduncle largest, subequal to pupil in size; head and the other part of body naked.

All teeth on jaws unicuspid; upper jaw with 4 rows of teeth anteriorly, narrowing to single row

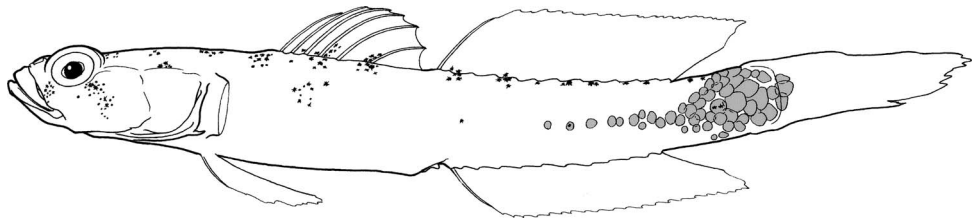

Fig. 2. Schematic illustration of lateral view of *Hetereleotris exilis* sp. nov. (NSMT-P 94885, holotype, female, 22.1 mm SL), showing scaled area (shaded) and pigmented pattern on head and body. Pectoral fin and segmented rays of all other fins are omitted. Note that many of scales were rubbed off, and recovered based on the scale pockets in this drawing.

posteriorly; teeth on anterolateral part of outermost row largest, distinctly larger than teeth on inner rows; lower jaw with 4 rows of teeth anteriorly, narrowing to single row posteriorly; teeth on anterolateral part of outermost row largest; no enlarged, distinct canine-like teeth on jaws; no teeth on vomer or palatine.

Cephalic sensory systems are illustrated in Fig. 3. No sensory canals and associated pores on head. Distinct (but, comparing the congeners, somewhat reduced) transverse pattern of sensory papillae rows on cheek; 4 transverse rows of sensory papillae below eye, posteriormost one (=row *4*) longest; row *b* short, close to row *4*; row *d* reduced and broadly interrupted between end of jaws and mid-cheek, its posterior part comprising 2 papillae; rows *e* and *i* uniserial (i.e., not containing transverse rows) in each; a pair of short longitudinal rows of sensory papillae just behind chin (=row *f*).

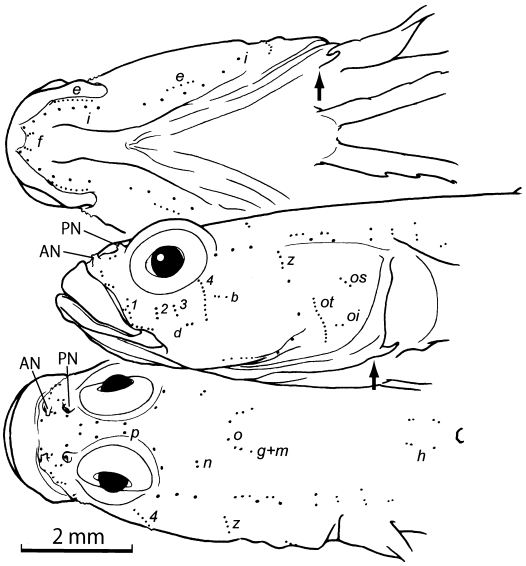

Fig. 3. Schematic illustration of ventral (top), lateral (middle) and dorsal (bottom) views of head of *Hetereleotris exilis* sp. nov. (NSMT-P 94885, holotype, female, 22.1 mm SL), showing cephalic sensory papillae (dots). AN and PN, anterior and posterior nares, respectively. Arrows show position where gill membrane is attached to body. Note that the sensory-papillae row *3* on left side of this specimen appears to be missing, and, in the middle figure, recovered the condition based on that on right side.

Coloration. Coloration when alive or fresh is unknown. Color in 70% alcohol is as follows: ground color of head and body pale yellow; 2 radiated dusky bars from ventral margin of eye, viz., one between eye and posterior part of upper jaw, and the other between eye and middle of cheek; a patch of melanophores (about size of eye) mid-lateral body below anterior part of base of first dorsal fin; a mid-lateral series of ca. 5 faint minute patches of melanophores (comprising some melanophores in each) on tail, the last of which located at end of hypural plates (that of left side almost faded); 4 saddle-like patches of melanophores on occipital region and nape; 2 and 6 small saddle-like dusky spots along bases of first and second dorsal fins, respectively; 2 faint, small saddle-like dusky blotches on caudal peduncle; dorsal fins almost transparent, except for single to several basal melanophores just above saddle-like blotches along dorsal-fin bases; anal, caudal and pelvic fins transparent; pectoral

fin almost transparent, except for single (right side) or 2 (left side) melanophores at around base of fifth of sixth ray.

Distribution and habitat. The new species *Hetereleotris exilis* is known only by the holotype, dredged at a depth of 53 m of off Nagan'nu Island, Okinawa Group of the Ryukyu Islands, Japan. No habitat data is available.

Comparison. The new species *Hetereleotris exilis* clearly belongs to *Heterelereotris*, having all diagnostic features listed above. Within the genus, *H. exilis* is unique by having its elongate body, i.e., body depth at anal-fin origin 11.9% of SL vs. 13.9% or more of SL in the other congeners (Smith, 1958; Hoese and Winterbottom, 1979; Hoese, 1986; Gill, 1998).

Four species of *Hetereleotris* are known lacking head sensory canals and associated pores in addition to *Hetereleotris exilis*, viz. *H. apora*, *H. bipunctata*, *H. diademata* and *H. margaretae*. Of these, *H. apora* has ctenoid scales on caudal peduncle (vs. all scales cycloid in *H. exilis*), with 4–5 longitudinal scales (vs. ca. 14–15); additionally, *H. apora* differs from *H. exilis* in having 10–11 segmented dorsal-fin rays (vs. 12), 9–10 anal-fin rays (vs. 11), no or a rudimentary fifth segmented ray of pelvic fin (vs. fifth segmented ray of pelvic fin well developed), 2 posteriorly-directed pointed spines on posterior margin of opercle (vs. no such spines). *Hetereleotris bipunctata* has 40–52 longitudinal scales (vs. ca. 14–15), usually 13 segmented dorsal-fin rays (vs. 12), usually 12 anal-fin rays (vs. 11), 15 pectoral-fin rays (vs. 16), and a large humeral black spot (vs. humeral spot absent). *Hetereleotris diadema* lacks scales on body (vs. scales present), and has a dark spot or faint band at end of caudal peduncle (vs. no dark markings at end of caudal peduncle), a dark spot dorsally at end of caudal peduncle (vs. absent), and 4–5 transverse papillae rows under lower jaw (vs. no transverse papillae rows under lower jaw). *Hetereleotris margaretae* has 28–30 longitudinal scales (vs. ca. 14–15), 11 segmented dorsal-fin rays (vs. 12), 10 segmented anal-fin rays (vs. 11), 17 pectoral-fin rays (vs. 16), a pupil-sized dark brown spot above posterior end of operculum (vs. absent), and banded pattern of body (vs. absent). All these data on species of *Hetereleotris* referred to above are from Hoese (1986), exclusive of those on *H. exilis*.

Other than *Hetereleotris exilis*, only a single species, *H. poecila*, is known from the West Pacific. *Hetereleotris poecila* is a densely-pigmented, relatively deep bodied species (vs. body slender and very weakly pigmented in *H. exilis*), and, also, easily distinguished from *H. exilis* by the following features (Akihito and Meguro, 1981; Hoese, 1986): 9–10 segmented dorsal-fin rays (vs. 12 in *H. exilis*); 8–9 segmented anal-fin rays (vs. 11); body broadly scaled, 32–35 longitudinal scales (vs. scales restricted on posterior part of body, ca. 14–15 longitudinal scales); uppermost 2 rays of pectoral fin largely free from fin membrane (vs. no free pectoral-fin rays); cephalic sensory canal with pores B′, C (unpaired), D (unpaired), E, F and H′ (vs. sensory canals and associated pores absent). *Hetereleotris poecila* is a littoral species as in many other congeners, found in very shallow rocky shore at the depths of 0.2–5.0 m (Suzuki *et al.*, 2009).

Remarks. The new species *Hetereleotris exilis* is known only from the holotype, dredged at 53 m depth. The other congeners have been collected from much shallower waters at the depths of 0–12 m (Hoese, 1986; Gill, 1998; Suzuki *et al.*, 2009).

The holotype of *Hetereleotris exilis* is mature female, with numerous developed eggs in the ovary.

Etymology. The new specific name, *exilis* (a Latin word, meaning "slender"), refers to its slender body. The Japanese vernacular is a combination of the Japanese words "Sasagaki", indicating the finely-sliced pieces of vegetables (e.g., burdock), commonly used in the Japanese cuisines, and "Haze", meaning "a goby", in reference to its slender body.

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