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Stiphodon martenstyni, a new species of freshwater goby from Sri Lanka (Teleostei: Gobiidae: Sicydiini)

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Abstract

Stiphodon martenstyni, new species, is described on the basis of a single specimen collected in Sri Lanka. It is the second species of *Stiphodon* to be described from streams entering the eastern Indian Ocean. *Stiphodon martenstyni*, new species, differs from all other species by a combination of characters that includes distinctly elongate sensory papillae on the head, 10 fairly large cycloid scales in predorsal midline, 45 tridentic teeth to right of symphysis in upper jaw, a ring-like ridge of tissue around anus, and coloration. Aspects of amphidromy concerning *Stiphodon* suggest species are as adapted to the planktonic larval environment, as adults are to stream environments. Success and duration of the plankton phase may play an important role in the geographical distribution of sicydiine gobies and the rarity of some species.

KEYWORDS: *Stiphodon*, new species, freshwater goby, amphidromy, Sri Lanka.

Introduction

The freshwater gobies of Sri Lanka are both interesting and unusual in having more in common with the freshwater gobies of Indonesia than with those of India. Historically freshwater gobies from Sri Lanka have been poorly documented, but recent work has brought about a greater understanding of these animals.

Most freshwater gobies from Sri Lanka were acknowledged in Pethiyagoda (1991), but as is often the case identifications of gobioid fishes may not be accurate due to resource information being outdated, incorrect, or simply unavailable. The goby listed as *Awaous grammepomus* (Bleeker, 1849) is actually *A. melanocephalus* (Bleeker, 1849), a species found in freshwater streams from

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Sri Lanka through Indonesia to the Solomon Islands and northward through the Philippines to the Ryukyu Islands of Japan. The goby not mentioned but illustrated and identified as *Oxyurichthys macropterus* (Duncker, 1912) is actually *Oligolepis acutipinnis* (Valenciennes, 1837), a species found in fresh and brackish waters throughout the tropical Indo-Pacific. One species that is known to occur in the fresh and brackish waters of Sri Lanka is *Stenogobius malabaricus* (Day, 1865), was omitted from the book.

Included in Pethiyagoda (1991) are three sicydiine gobies identified as *Sicyopterus griseus* (Day, 1878), *S. halei* (Day, 1888) and *Sicyopus jonklaasi* Klausewitz & Henrich, 1986. All three species live in clear, swift mountain streams with hard rocky bottoms, and all reported to be very rare.

Stiphodon Weber, 1895 is a genus of sicydiine goby known from the Indian Ocean by only two stream-living species: *S. ornatus* Meinken, 1974 from western Sumatra, Indonesia and *S. martenstyni*, new species, known by a single specimen from Sri Lanka, collected together with *Sicyopus jonklaasi*. *Stiphodon* may be more widely distributed in the eastern Indian Ocean than is currently known, but freshwater collecting efforts have been poor over most of this region.

The majority of sicydiine gobies have small geographical distributions with most known species coming from insular habitats. Much more understanding of their life history is needed in order to enact prudent conservation measures. One of the most important aspects to consider is amphidromy (McDowell, 1992a, 1992b), which remains one of the least studied aspect of sicydiine natural history. Amphidromy in sicydiine gobies is a specialized form of diadromy in which adults live and spawn in freshwater streams, the males guarding the eggs. Upon hatching, fry are passively swept out to sea with stream currents and become part of the plankton layer. Larval fry are probably as adapted to the marine environment as adults are to freshwater streams. In view of amphidromy appearing to be specialized to a species level in this group, I discuss some relevant aspects.

Material and methods

Methods and abbreviations follow those in Watson (1995). All counts taken from the right side. Material examined preserved in the Forschungsinstitut Senckenberg, Frankfurt (SMF); and collection of Maurice Kottelat, Cornol, Switzerland (CMK). Abbreviations for the cephalic sensory pore system follow Akihito (1986).

Comparative material of *S. ornatus* from Sumatra, Indonesia: CMK 4568, female (34.9), Sungai Lundang, km 39, road from Padang; 29 Nov. 1984, P. G. Bianco & M. Kottelat; CMK 5979, 2 males, 1 female, (28.4-36.1), Teluk Bungus ca. 10 km south of Padang (16 km by road); 24 Apr. 1988, F. Schäffer et al.; CMK 5985, female (35.3), Air Runding, ca. 10 km north northeast of Air Bungis; 24 Apr. 1988, F. Schäffer et al.; SMF 12493, 2 males (37.4-39.4), SMF 12494, 4 females (24.7-42.0), Sumatra; 1973, V. Etzel; SMF 17914, male (31.4), SMF 17932, female (30.4), north of Padang; Nov. 1971, V. Etzel.

The new species is compared in text and tabular information with *S. ornatus*.

Stiphodon martenstyni, new species
(Figures 1-3)

Holotype. SMF 27049, male (33.9); Sri Lanka: Atweltota: Kalu River basin; Jan. 1981, R. Jonklaas & A. van den Nieuwenhuizen.

Diagnosis
Nine rays in second dorsal fin. Fifteen pectoral rays. Scales in lateral series 34. Ten cycloid scales in predorsal midline. Forty-five tricuspid teeth in upper jaw. Cutaneous sensory papillae over head elongate. Upper lip crenulated. Ridge of tissue forming a ring around anus.

Description
Dorsal fin VI-I, 9; the first dorsal fin slightly higher than the second, the fins not touching basally, spines not filamentous. Anal fin I, 10, directly opposite second dorsal fin. Pectoral fin with 15 rays, the lowest ray simple. Caudal fin with 14 branched rays, its posterior margin rounded. Scales in lateral series 34, extending from dorsal to pectoral base, laterally ctenoid from caudal peduncle, extending ventral to first dorsal fin, becoming cycloid posterior to pectoral base; scales posterior to hypural base mostly ctenoid, a few cycloid. Scales in transverse series backwards 9; in transverse series forward 14. Predorsal midline with 10 cycloid scales; 9 scales in zigzag series. Belly with cycloid scales posteriorly, not extending close to pelvic disk. Head, breast and pectoral base naked. Upper jaw teeth tricuspid, each cusp sharply pointed, 45 teeth to right of symphysis. Lower jaw with 4 conical teeth to right of symphysis. Upper lip crenulated with tiny fimbriate projections. Cephalic sensory pore system A, B, C, D, F, H, K, L, M and O, pore D singular, all others paired, the oculoscapular canal divided into anterior and posterior canals between pores H and K. Cutaneous sensory papillae well developed laterally on head, each papilla distinctly elongate, appearing as a short rod. Anus with a ridge of tissue around it forming a ring.

Coloration. In preservative, background of body light brown. Six slightly dusky blotches along midline ventral to first dorsal fin extending posteriorly to caudal peduncle. Four slightly dusky saddles over dorsum, 3 at second dorsal fin and 1 on caudal peduncle. Body laterally with scattered blackish pigment. Belly mostly whitish with some blackish pigment posteriorly. Background of head light brown. Snout dusky. Upper lip blackish anteriorly, dusky posteriorly. Cheek with some blackish pigment. Opercle with a dusky blotch close to preopercle. Gular region, lower jaw ventrally, and branchiostegal membrane with fine blackish pigment not appearing dusky. Breast dusky. First dorsal fin: spines 5 and 6 with dusky blotches, the remaining spines and membrane slightly dusky. Second dorsal fin spine and rays with 4 or 5 dusky blotches, the membrane dusky. Caudal fin with dusky blotch at central base, 9 slightly dusky zigzag like bars on membrane between branched rays, dorsally the margin mostly translucent with a few dusky blotches on the procurrent rays, ventrally the margin slightly dusky with a few dusky blotches on procurrent rays. Anal fin rays and spine with few scattered blackish patches of pigment, the membrane dusky, its distal margin free of

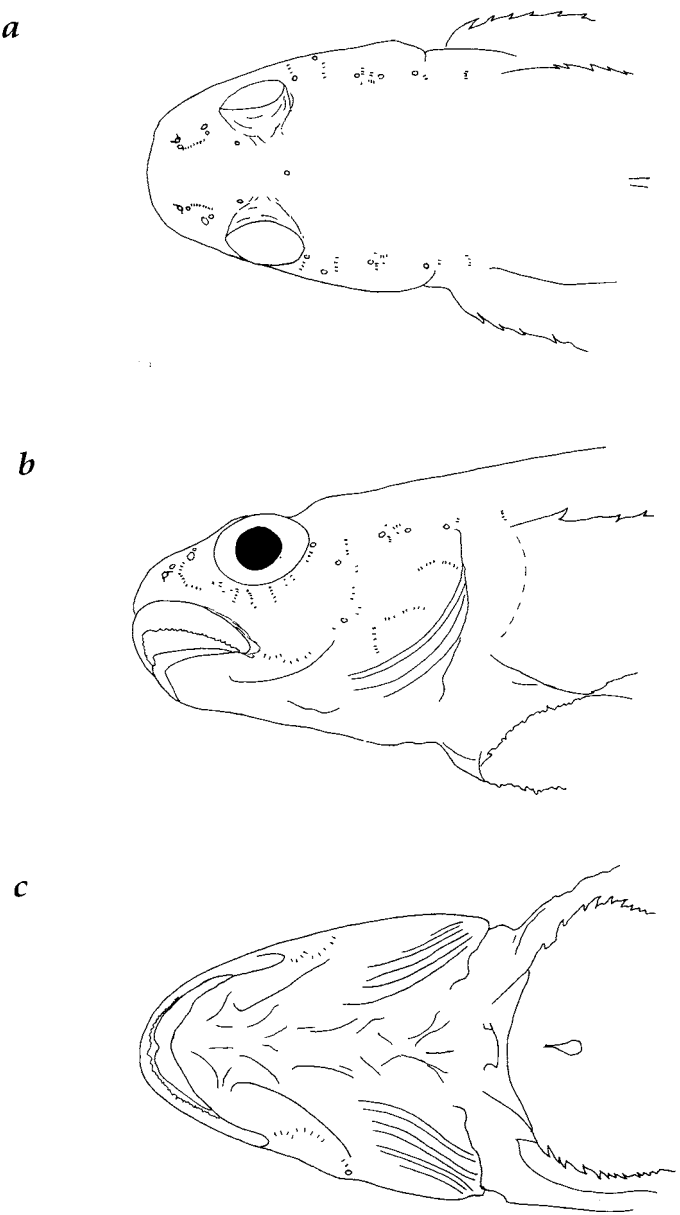

Figure 1. Diagrammatic illustration of head of *Stiphodon martenstyni* showing cephalic sensory pore system and cutaneous sensory papillae; *a*, dorsal view, *b*, lateral view, *c*, ventral view.

Table 1. Scale counts in *Stiphodon martenstyni* and *S. ornatus*.

	lateral series				
	32	33	34	35	36
S. martenstyni			1		
S. ornatus	1	-	6	4	1

	transverse back	
	9	10
S. martenstyni	1	
S. ornatus	2	8

	transverse forward			
	12	13	14	15
S. martenstyni			1	
S. ornatus	2	3	3	2

	predorsal midline					
	10	11	12	13	14	15
S. martenstyni	1					
S. ornatus		1	2	4	3	2

Table 2. Upper jaw teeth in *Stiphodon martenstyni* and *S. ornatus*.

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
S. martenstyni																									1
S. ornatus	1	-	-	-	-	-	-	1	-	-	1	-	-	2	2	-	-	1	1	-	-	1			

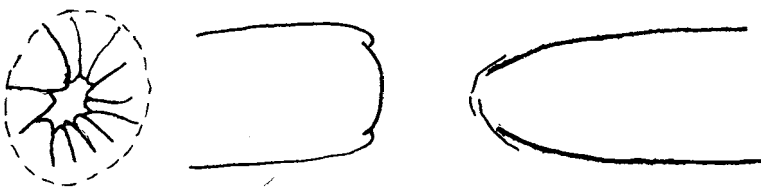

Figure 2. Diagrammatic illustration of urogenital papilla in male of *Stiphodon martenstyni*; 1. anus, 2. urogenital papilla, 3. anal fin.

Table 3. Morphometrics in *Stiphodon martenstyni* and *S. ornatus*.

	predorsal length				
	33	34	35	36	37
S. martenstyni			1		
S. ornatus	2	2	2	2	2

	preanal length							
	51	52	53	54	55	56	57	58
S. martenstyni			1					
S. ornatus	2	1	-	3	1	2	-	1

	head length					
	20	21	22	23	23	24
S. martenstyni			1			
S. ornatus	3	2	2	2	-	1

	jaw length				
	6	7	8	9	10
S. martenstyni				1	
S. ornatus	1	1	5	2	1

	caudal peduncle length							
	18	19	20	21	22	23	24	25
S. martenstyni								1
S. ornatus	1	1	1	1	3	2	1	

	caudal peduncle depth			
	10	11	12	13
S. martenstyni		1		
S. ornatus	3	5	1	1

	body depth in males	
	13	14
S. martenstyni		1
S. ornatus	1	

Continued...

	second dorsal fin length																	
	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
male *S. martenstyni*									1									
males *S. ornatus*									1	1	-	-	-	-	-	-	-	1
females *S. ornatus*	2	-	-	2	2	1												

	anal fin length											
	34	35	36	37	38	39	40	41	42	43	44	45
male *S. martenstyni*								1				
males *S. ornatus*								1	1	-	-	1
females *S. ornatus*	2	3	1	1								

	caudal fin length										
	20	21	22	23	24	25	26	27	28	29	30
male *S. martenstyni*					1						
males *S. ornatus*								1	1	-	1
females *S. ornatus*	1	-	-	-	2	2	-	-	-	1	

pigment. Pelvic disk translucent except for a dusky ring prominent on rays and spines, not on frenum. Pectoral fin slightly dusky on membrane between medial rays, basally rays and membrane dusky. Pectoral base slightly dusky.

Though not certain, color in life may be a bright blue (Pethiyagoda, pers. comm., 1997).

Ecology and distribution

Stiphodon martenstyni was collected in a swift, clear mountain stream together with *Sicyopus jonklaasi*. The species is known only from southwestern Sri Lanka.

Affinities

Stiphodon martenstyni appears closest to *S. ornatus* based on the elongate, transversely arranged sensory papillae. In all other species of *Stiphodon* the sensory papillae appear rounded, sometimes set in a shallow pit or oval. *Stiphodon martenstyni* differs from *S. ornatus* in color pattern, in having fewer predorsal scales, in having more upper jaw teeth, and a ring-like ridge of tissue around the anus.

Etymology

The new species is named in memory of Cedric Martenstyn, one of the many unfortunate victims of Sri Lanka's civil war. As a dedicated naturalist (Pethiyagoda, 1991), his interest will be greatly missed.

Discussion

Like other sicydiine gobies *Stiphodon martenstyni* is probably amphidromous (McDowell,1992a, 1992b). While juveniles and adults live exclusively in fresh

Figure 3. *Stiphodon martenstyni*, Sri Lanka, SMF 27049, holotype, male, 33.9 mm SL.

water, adults reproduce in fresh water, the eggs being cared for by males. Eggs in all sicydiine gobies studied usually hatch in about 24 hours (Erdman, 1961, 1986; Beyer, 1989) at which time the fry passively drift downstream and out to sea where they become part of the plankton layer. The time spent out at sea as planktonic fry is unknown. The returning fry can be likened to surfers: that is, when fry are able to detect freshwater on the ocean surface through favorable current they ride the crest of waves to their new home. This follows a similar scenario presented in Erdman (1961) for *Sicydium* Valenciennes, 1837 from Puerto Rico.

Rarity of species in *Stiphodon* is not unusual. *Stiphodon allen* Watson, 1996 is endangered and known by a single specimen collected in northeastern Queensland, Australia where considerable effort has been made to locate additional specimens (Allen, pers. comm., 1997). It is not known from any other locality and is the only species of *Stiphodon* not collected from an insular habitat. *Stiphodon discotorquatus* Watson, 1995 is known from the islands of Rurutu and Tubuai, Tubuai Islands, French Polynesia, where it is appears to be rare.

Endemism and rarity do not necessarily go together. *Stiphodon tuivi* Watson, 1995 is known only from the Marquesas Islands, French Polynesia, where it is very abundant. The same is true of *S. larson* Watson, 1996 known only from the Gogol River system in northern New Guinea. It is unknown why *S. larson* is present only in the Gogol River or why *S. semoni* Weber, 1895 is unknown from it and yet relatively abundant to the east and west of it.

Rarity of some sicydiine gobies may be linked to the length of time that larval fry are able to spend at sea. More common species with wide distributions such as *S. elegans* (Steindachner, 1880) and *S. semoni* have what I consider to be a derived characteristic, an ability for the fry to spend months out to sea living in the plankton layer. The duration out at sea may not be fixed, with fry needing as little as a month at sea and able to transform to post-larval fry upon contact with fresh water, or their duration may be protracted, causing them to spend several months at sea before either perishing or entering fresh water. Duration between spawning and returning post larval fry can be three or four months in *Sicydium* (Erdman, 1961, 1986) and appears to be just as long in *Sicyopterus stimpsoni* Gill, 1860 (pers. observ.) from the Hawaiian Islands.

Fry of rare species (*S. martenstyni, S. allen, S. discotorquatus*) may be less adapted to long periods of time in the oceanic plankton layer, but the actual period remains unknown. Further, spawning may be linked to times when fry have an advantage pertaining to favorable ocean currents taking them out to the main planktonic feeding ground, returning with favorable currents back to freshwater streams. *Stiphodon allen* may be limited to streams entering the Great Barrier Reef region, with the reef limiting the distribution of planktonic larvae; or it may be specifically adapted to this particular environment.

Stiphodon larson may have only a short planktonic phase that it completes within the main estuary of the Gogol River. The natural pressures that make it an endemic to the Gogol may play an important role in keeping *S. semoni* out, although these remains unknown. Estuarine amphidromy is suspected in *Lentipes watsoni* Allen, 1997 from southern New Guinea where it lives in swift streams in the headwaters of an estuarine river 95 km upstream from the sea.

Stiphodon tuivi probably has a long larval phase, but is limited in its ability to disperse because ocean currents tend to sweep fry towards North America, a very hostile environment for a tropical rainforest goby.

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