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Notes on Geographic Distribution

Record of the genus *Sicydium Valenciennes*, 1837 (Gobiidae, Sicydiinae) from Brazil and extent of distribution of *S. punctatum* Perugia, 1896

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Abstract: *Sicydium punctatum*, previously known from Panamá, Caribbean islands, and coastal drainages of Venezuela, has a distribution that extends up to coastal drainages of Bahia state, Brazil. The genus *Sicydium* is formally recorded for Brazilian freshwaters. Comparisons are made between *S. punctatum* and other species of the genus based on data from the literature and presented here.

Sicydiines form a monophyletic group within the family Gobiidae (Parenti and Maciolek 1993; Keith *et al*. 2011), composed of nine monophyletic genera and approximately 90 species, distributed in the Indo-Pacific area, the Caribbean region, West Africa, western and eastern Mexico and Central America, Ecuador and Venezuela (Lyons, 2005; Keith *et al*. 2011). The Sicydiinae species are amphidromous; they spawn in freshwater and their newly hatched larvae head for the ocean where they undergo a planktonic phase before returning to freshwater to develop and reproduce (Lyons, 2005; Keith *et al*. 2011). *Sicydium* Valenciennes, 1837 is the sister group of *Sicyopterus* Gill, 1861 (Keith *et al*. 2011) and differs from the latter by having the upper lip with a lateral cleft near each corner of the mouth (*vs*. in the middle of the lateral side), lower lip with a fleshy lobe located dorsolaterally near each corner of the mouth (*vs*. lobe absent), lower lip bordered ventrally by a wide band of small papillae cells (*vs*. narrow band of papillae cells), row of premaxillary teeth curved anteriorly (*vs*. teeth extending anteriorly straightforward), and anterior teeth of the premaxilla equal in size to the subsequent (*vs*. anterior teeth smaller in size than the subsequent). For other characters, see Akihito and Meguro (1979) and Harrison (1993).

The taxonomy of the species of the genus *Sicydium* is very confusing. Seventeen species are recognized: six of which occur in the West Atlantic (Central America, Caribbean region, and Venezuela), seven in the eastern Pacific (Central America, Mexico, Colombia, and Ecuador), and three in West Africa (Liberia, Gulf of Guinea, Islands of Bioko, São Tomé, Príncipe, Bagaloo, Ivory Coast, Cameroon, and Congo). The species of *Sicydium* from the West Atlantic are: *S. adelum* Bussing, 1996 (Costa Rica); *S. buscki* Evermann and Clark, 1906 and *S. gilberti* Watson, 2000 (Dominican Republic and Puerto Rico); *S. gymnogaster* Ogilvie-Grant, 1884 (Mexico and Honduras); *S. plumieri* (Bloch, 1786) (Greater and Lesser Antilles and Panama); and *S. punctatum* Perugia, 1896 (Greater and Lesser Antilles, Panama, and Venezuela) (Kullander, 2003). A review of the gobies from the collection of the Museu de Ciências e Tecnologia - PUCRS showed that three lots from a coastal river in Bahia, previously identified as *Gobiosoma* sp. and *Gobionellus* sp., are in fact *S. punctatum*. This species had been found in 2009 by LEM, ACAS, MFGB, and Rodrigo Caires (unpublished data) in two coastal rivers in the state of Bahia. We formally report the occurrence of the genus and species in Brazil (Figures 1-3).

The material examined is deposited in the fish collection of the Museu de Ciências e Tecnologia- PUCRS (MCP) and Museu de Zoologia da Universidade Estadual de Feira de Santana (MZFS) under the following catalog numbers: MCP 42111, 2 females, 47.0 and 55.6 mm SL, and one male, 55.6 mm SL; MCP 43874, 2 females, 53.6 and 59.3 mm SL; and MCP 42113, 16 females, 31.5-41.7 mm SL (one 38.3 mm SL c&s), and 5 males 33.0-46.5 mm SL (one 34.4 mm SL c&s). The first two lots are from the Contas River (14°17'00" S, 039°12'00" W) and the third from the Pau Brasil River (São José Farm), Contas River drainage (14°19'00" S 039°01'00" W), all from Taboquinhas, Itacará, Bahia, collected on April 3, 2001 by Rogério L. Teixeira. MZFS 10004, 5, 50,6-60,8 mm SL from the Cachoeira Grande River in the Reserva Ecológica of Michelin, Igrapiuna, Bahia (13°45'S 39°09'W).

The measurements (Table 1) and counts (Table 2) follow Watson (1995) and Miller and Stefanni (2001). The nomenclature of pores follows Akihito and Meguro (1979). Proportional measurements are expressed as percent of standard length (SL) and dial calipers were used to take all measurements to the nearest 0.1 mm. Two specimens cleared and stained (c&s) were prepared according to the

method of Taylor and van Dyke (1985) for further analysis of the dentition. Range of meristic characters of our specimens is followed by the range given by Watson (2000) in brackets. The data for the other species included in the text were obtained from the following authors: Ogilvie-Grant (1884), Boulenger (1899), Heller and Snodgrass (1903), Regan (1906, 1914), Meek (1907), Eigenmann (1918), Brock (1942), Harrison (1993), Bussing (1996), Watson (2000), and Pezold *et al*. (2006).

Sicydium punctatum was described from the Caribbean Isle of Martinique, and its known distribution includes the Greater and Lesser Antilles, Venezuela, and Caribbean slope of Panama (Watson, 2000). Watson (2000) in his review of the species of *Sicydium* from the Dominican region pointed out that *S. punctatum* differs from other species of the same area (*S. buscki*, *S. plumieri* and *S. gilberti*) by showing " the upper jaw teeth tricuspid, lateral cusps rounded, medial cusp pointed, preopercular pores almost always M and O, pore N almost always absent, predorsal midline mostly naked with few scales anterior to first dorsal fin, belly usually naked, few cycloid scales may be present close to anus. Zigzag series of scales on caudal peduncle usually 12-13 (range 11-15)." The specimens examined herein are in agreement in regard to all these characters. However, the examined males (Figure 2) lacked the three or four filamentous spines, in contrast to the specimens examined by Watson.

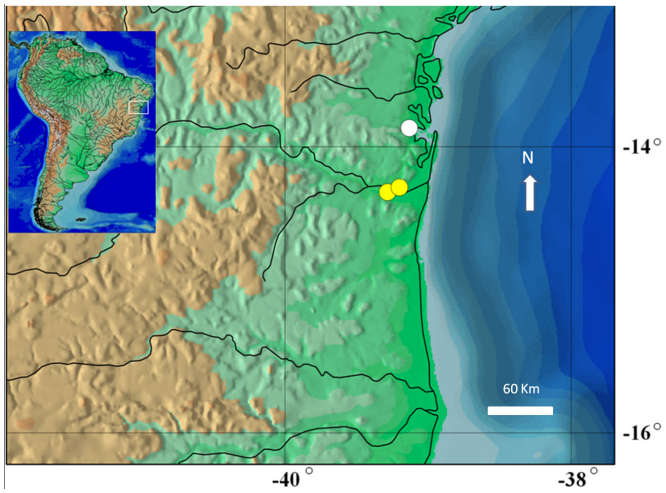

Figure 1. Localities of the records of *Sicydium punctatum* in Contas River drainage (yellow circle) and Cachoeira Grande River (white circle), Bahia state, Brazil.

In addition to the species treated in Watson (2000), the following species occur on the Atlantic slope of Central America: *S. adelum* and *S. gymnogaster*. *Sicydium punctatum* is distinguished from these species by the smaller number of scales in longitudinal series, 47-53 [48-63] (*vs* 61-68 in *S. adelum*, 60-74 and in *S. gymnogaster*), fewer teeth in the upper jaw, 31-36 [31-60] (*vs.* 61-78 in *S. adelum*). Among the species of the Pacific coast of Mexico and Central America, *S. punctatum* differs by the following features: presence of tricuspid teeth in the upper jaw and by the absence of two dark longitudinal stripes on the body (*vs.* teeth bicuspide in *S. altum* and *S. fayae* and the presence of two dark stripes in the former, truncated teeth in *S. hildebrandi*, and unicuspid teeth in adults of *S. cocoensis*); belly naked (*vs.*

Table 1. Measurements of *Sicydium punctatum*. n=number of specimens (from MCP collection only), SD=standard deviation

MEASUREMENTS	RANGE				
	N	MIN	MAX	MEAN	SD
Standard length (mm)	13	29.5	59.3	42.1	9.695
percents of Standard length					
Body depth at anal fin origin	13	13.0	16.2	14.8	0.978
Body depth at pelvic disc origin	13	13.2	15.5	14.5	0.697
Body width at anal fin origin	13	11.5	15.9	13.4	1.435
Predorsal length	13	31.1	38.2	35.5	1.821
Distance from snout to origin of second dorsal fin	13	57.2	61.1	59.0	1.184
Preanal length	13	56.4	61.3	59.0	1.718
Distance from snout to pelvic disc origin	13	16.6	21.2	18.6	1.459
Distance from snout to anus	13	54.9	58.7	56.4	1.263
Pelvic disc length	13	12.9	19.4	15.1	2.038
First Dorsal fin base	13	15.9	25.0	20.2	2.506
Second Dorsal fin base	13	23.5	28.5	26.6	1.583
Caudal peduncle depth	13	9.6	11.8	10.5	0.760
Caudal peduncle length	13	18.4	23.6	21.1	1.590
Anal fin base	13	20.3	25.4	22.9	1.509
Caudal fin length	12	17.5	24.7	21.1	2.117
Pectoral fin length	13	18.5	23.0	20.5	1.565
Head length	13	19.8	23.9	21.9	1.077
percents of head length					
Head width	13	69.2	82.9	76.9	4.198
Head depth	13	57.0	68.8	64.2	4.002
Snout length	13	35.4	51.3	42.0	5.063
Jaw length	13	41.0	53.2	46.4	3.749
Eye diameter	13	20.7	30.9	24.8	3.365
Cheek depth	13	24.4	42.3	29.9	4.766
Postorbital length	13	43.2	53.8	47.7	3.182
Interorbital width	13	23.7	38.0	31.1	4.023

belly scaled in *S. salvini*, *S. condotense*, *S. hildebrandi*, and *S. multipunctatum*); caudal fin dusky without marks (*vs.* caudal fin with two bars in *S. condotense*); number of scales in longitudinal series, 47-53 [48-63] (*vs.* 60-71 in *S. salvini*, 85 in *S. multipunctatum*, 76 in *S. hildebrandi*, 70-76 in *S. rosenbergi*, and 80-106 in *S. fayae*).

Finally, *Sicydium punctatum* differs from species of the genus inhabiting the West African coast by having tricuspid teeth in upper jaw and belly naked (*vs*. unicuspid teeth and belly scaled in *S. brevifilei* and *S. bustamantei*) and absence of dark bands on head (*vs.* 2 or 3 oblique bands of dark pigmentation on suborbital and preopercular regions of the head in *S. crenilabrum*).

Watson (2000) has recorded *S. punctatum* for Delta Amacuro, Venezuela, from specimens in the post larval stage. This is the easternmost record of the species allowing us to hypothesize that the species during its planktonic stage of life reaches the northeastern coast of Brazil. The difficulty of capturing adults of *Sicydium* and lack of reference to collections may have caused the gap in the occurrence of the species. Other hypotheses may explain this record: (i) disjunct biogeographic distribution and (ii) introduction of the species by ballast water. The introduction of the exotic blenny *Omobranchus punctatus* in the Todos os Santos Bay by ballast water (Gerhardinger *et al*. 2006) was probably due to the presence of the Port of Aratu, where, docked ships from different areas such as the Indian Ocean, Pacific and Caribbean. The introduction of this species in close proximity to the occurrence of *Sycidium punctatum* increases the possibility of introduction by ballast water.

It is important to note that knowledge of the various stages of the life style of the amphidromous species is crucial for its management and conservation (Keith, 2003), concluding that the importance of the coastal rivers of Bahia in the biology and ecology of *S. punctatum* deserves to be investigated.

Table 2. Count frequencies of the specimens examined of *Sicydium punctatum* (from MCP collection only). First dorsal fin spines, VI, second dorsal fin rays, I+10, and branched caudal rays, 13, were invariable.

Anal fin	I+9	I+10					
	1	14					
Pectoral fin rays	16	17	18	19			
	2	4	5	4			
Scales in lateral series	47	48	49	50	51	52	53
	2	3	1	3	1	2	1
Transverse series back	13	14	15	16	17	18	
	1	4	2	4	1	1	
Transverse series forward	12	15	16	18	19		
	1	3	5	3	1		
Zigzag scales series	12	13	15				
	6	7	1				
Scales around peduncle	23	24	25	26			
	6	3	2	2			
Upper jaw teeth (left side)	31	33	34	35	36	40	
	1	1	2	3	3	1	

Figure 2. *Sicydium punctatum*, Brazil, Bahia. Top-lateral view; bottom-ventral view: MCP 42113, male, 46.5 mm SL; Pau Brasil River, Contas River drainage.

Figure 3. *Sicydium punctatum*, Brazil, Bahia. Top-lateral view; bottom-ventral view: MCP 43874, female, 59.3 mm SL; Contas River.

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