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Redescription of *Apristurus sibogae*, and Its Taxonomic Relationships (Lamniformes, Scyliorhinidae)

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Abstract The holotype and only existing specimen of *Apristurus sibogae* was surveyed and was found to be very fragile, breaking down into several pieces, and strongly contracted. As the species is still only poorly known, the holotype was redescribed, reassessing the proportion of the contracted holotype. It was concluded that *A. sibogae* is very similar to Japanese *A. platyrhynchus*, but that it represents a distinct species, characterized by a short snout, posterior 1st and 2nd dorsal fins and a narrow interorbital region.

Apristurus sibogae (Weber, 1913) was originally described on an immature female specimen caught from the waters of Makassar Strait, Indonesia. Since then, no additional specimens of this species have been reported, and the holotype is the only known specimen of *A. sibogae*.

Recently, I examined the holotype of this species deposited in Zoologisch Museum, Universiteit van Amsterdam (ZMA). The holotype has been said to be in a poor condition, and it is now very fragile, beginning to break down into several pieces. In addition, the type specimen is strongly deformed by contraction.

The original description of Weber (1913) is simple without any figures. Fowler (1941) gave an English translation of the original description. Recently, Springer (1979) and Compagno (1984) examined the type specimen and gave a close description, but they only described the contracted state of the holotype. Considering the extremely poor and contracted condition of the type specimen, the true characters of the species may be lost in the near future. Therefore, the morphological study of the type specimen and discussion of its taxonomic relationships are now urgently needed.

The purposes of the present paper are to redescribe the holotype of *A. sibogae*, reassessing its proportions, and to discuss its taxonomic relation to other species.

Method of reassessment in measurements

Measurements were taken according to Bigelow and Schroeder (1948).

Weber (1913) gave some measurements of the type specimen, and the contraction rates for body parts can be obtained by comparison of Weber's measurements with the measurements of the present state. Measurements which were not given in the original description were estimated by the method mentioned below. The snout length before the mouth, for example, is now 17.6 mm, but as the contraction rate for snout length is 22.0 (present state)/27.0 (original state) or 0.81, the original length of the snout before the mouth can be calculated back to 21.7 mm. The length from the snout tip to the 1st gill opening was estimated as follows. This length can be divided into the snout length and the length from the anterior margin of the eye to the 1st gill opening. The snout length given by Weber is 27.0 mm. The latter length must be calculated, using the length of the present state and the contraction rate. The contraction rate of this region from the eye to the 5th gill opening is calculated as 42.5—22.0 (present state)/55.0—27.0 (original state), or 0.73. Then, the length from the anterior margin of the eye to the 1st gill opening in the present state (13.0 mm) can be estimated to have been 17.8 mm. From above, the length from the snout tip to the 1st gill opening can be calculated back as 27.0+17.8=44.8 mm. Following such procedures, other important measurements were estimated and are shown in Table 1.

Apristurus sibogae (Weber, 1913)
(Figs. 1, 2)

Holotype. *Scyliorhinus sibogae* Weber, 1913: 595,

Table 1. Measurements (mm), proportional measurements (%TL, in parentheses) and counts of the holotype of *Apristurus sibogae* and specimens of *A. platyrhynchus*.

	Holotype of *Apristurus sibogae*				*A. platyrhynchus*
	Weber (1913)	Present	Contraction rate	Reassessed measurements	31 specimens
Total length	228.0	212.0	[0.93]	228.0	280.0–800.0
Snout tip to:					
anterior nostril		8.2		10.1 (4.4)	(4.3–6.0)
posterior nostril		13.5		16.7 (7.3)	(6.1–8.6)
mouth		17.6		21.7 (9.5)	(7.6–11.4)
eye	27.0	22.0	0.81	27.0 (11.8)	(8.5–12.0)
1st gill opening		35.0		44.8 (19.6)	(15.3–20.0)
5th gill opening	55.0	42.5	0.77	55.0 (24.1)	(19.7–25.2)
1st dorsal origin		101.0		115.3 (50.6)	(47.5–51.5)
2nd dorsal origin		127.0		141.8 (62.2)	(56.6–63.8)
anal origin		104.0		118.3 (51.9)	(48.4–53.0)
lower caudal origin		140.0		155.1 (68.0)	(65.7–70.7)
pelvic origin		76.0		98.5 (39.3)	(35.6–40.8)
pectoral origin		41.0		53.0 (23.2)	(19.6–24.0)
cloaca	102.0	88.0	0.86	102.0 (44.7)	(39.1–44.8)
Body height	20.0	16.6	0.83	20.0 (8.8)	
Head width	31.0	24.6	0.79	31.0 (13.6)	(10.2–13.5)
Horizontal diameter of eye	8.0	3.4	0.43	8.0 (3.5)	(2.7–3.7)
Mouth width		19.0			(6.5–9.8)
Internostril width	9.0	8.4	0.93	9.0 (3.9)	(2.9–4.3)
Interorbital width	13.0	12.4	0.95	13.0 (5.7)	(4.8–7.5)
Interspace between:					
1st and 2nd dorsal fins		16.0		16.3 (7.1)	(4.2–10.0)
pelvic and caudal fins		47.0		48.0 (21.2)	(21.3–25.8)
nostril to mouth	5.0			5.0 (2.2)	(1.4–2.2)
Distance between:					
origins of paired fins		34.5		35.6 (15.6)	(14.5–19.0)
First dorsal fin:					
vertical height		3.5			
base length		7.6		7.8 (3.4)	(2.8–4.8)
Second dorsal fin:					
vertical height		5.6			
base length		15.7		16.0 (7.0)	(4.3–6.8)
Anal fin:					
vertical height		8.2			
base length	40.0	36.0	0.90	40.0 (17.5)	(16.2–19.6)
Caudal fin:					
lower caudal origin to tip		71.5		73.0 (32.0)	(29.7–33.5)
Pelvic fin:					
base length	21.0	17.4	0.83	21.0 (9.2)	
Pectoral fin:					
outer margin		21.0			
inner margin		8.3			
base length		18.0			
Teeth:					
upper		70			64–85
lower		70			68–85
Monospondylous vertebrae		35			33–40

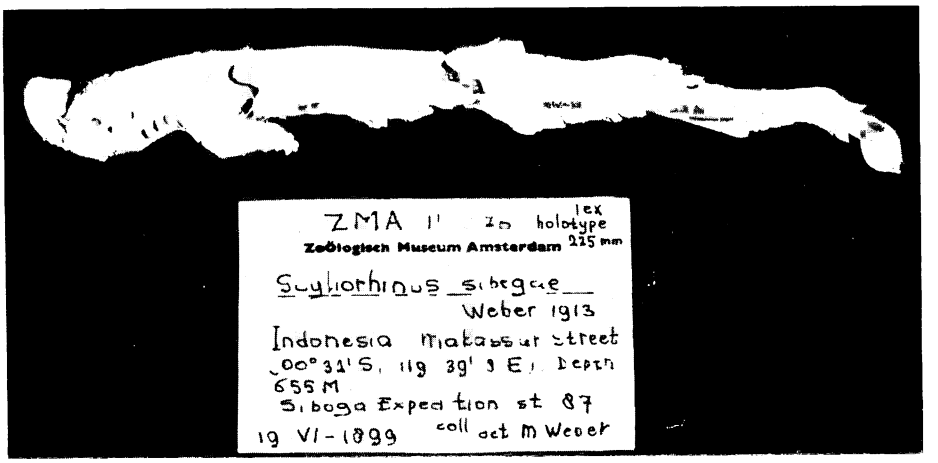

Fig. 1. Holotype of *Apristurus sibogae* (ZMA 111076).

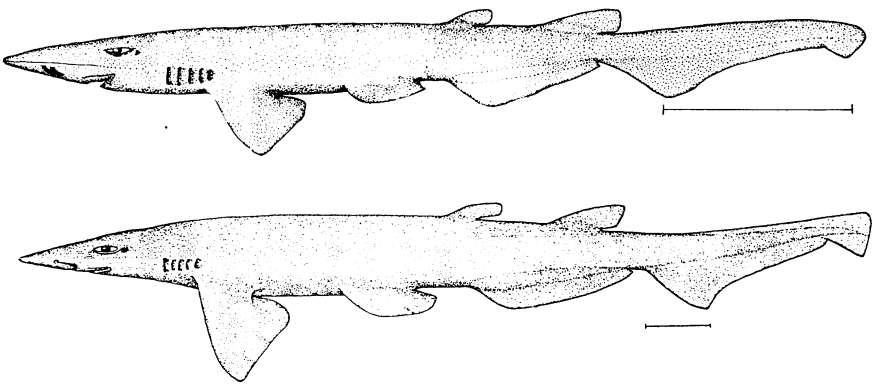

Fig. 2. Holotype of *Apristurus sibogae* (ZMA 111076) and *A. platyrhynchus*. Above: *A. sibogae* (reconstructed). Below: *A. platyrhynchus* (from Nakaya, 1975). Scales are 50 mm.

ZMA 111076, immature female, 212.0 mm TL, caught at 0°31′S, 119°39.8′E (Makassar Strait, Indonesia), from 655 m in depth on June 19, 1899.

Description of the holotype. The characters in italics are those considered to have been possessed by the specimen originally; those in roman type describe the specimen in its present condition.

Head transversely cut dorsally, apparently shrunken and strongly deformed (*strongly flattened*, according to Weber). *Body very slender*; depth of trunk greater than its width; *caudal axis nearly straight*. Snout thick and relatively short (*in spatula-form*, according to Weber, *very flat and relatively long*). *Snout before nostril longer than eye diameter, snout before posterior nostril about 2 times eye diameter*; snout tip rounded. Eye very small and rounded, but apparently deformed (*moderate and slender*); eye diameter about equal to length of 3rd gill opening, but shrunken to less than half of original size (*longer than 3rd gill opening and equal to internostril width*). Interorbital space wide and rather flat (*wider than snout length before nostril, but narrower than snout length before posterior nostril*). *Spiracle behind eye and a little lower than eye level. Gill openings small, 4th and 5th gill openings above pectoral base*, according to Weber. Distance between eye and 1st gill opening equal to that from 1st to 5th gill opening (*shorter than the latter*). *Nostrils oblique. Well developed labial folds on both jaws; upper one reaching beyond middle between mouth corner and posterior margin of nostril.* Head at gill region squeezed and shrunken. *Pectoral fin relatively large and wide; length of base about equal to interspace between bases of pectoral and pelvic fins; inner margin short and about half of pectoral*

base. Distance between pectoral and pelvic fins short; distance between origins equal to length from snout tip to 1st gill opening (*equal to length from snout tip to spiracle*); interspace between bases of pectoral and pelvic fins about equal to snout length before mouth (*about equal to snout length before posterior nostril*). *Pelvic fin small, origin apparently before middle of body, its base shorter than snout*, according to Weber. *Dorsal fins brush-shaped*; *1st dorsal fin much smaller than 2nd dorsal fin*, according to Weber. First dorsal origin a little before middle of body (*at middle of body*), *apparently behind pelvic base* (*somewhat behind cloaca*, according to Weber) *and a little before anal origin*; posterior end of 1st dorsal base above anal base (*1st dorsal fin ending above anterior 2/5 of anal base*, according to Weber); *height about half of that of 2nd dorsal fin*; length of free rear margin longer than its height. *Second dorsal fin originating above posterior 3/5* (*4/5*, according to Weber) of anal base; base ending a little behind posterior end of anal base (*ending at posterior end of anal base*, according to Weber); free rear margin a little longer than height of 2nd dorsal fin. *Distance between posterior ends of 1st and 2nd dorsal bases a little shorter than anal base length, or about equal to distance between origins of pectoral and pelvic fins. Anal fin low and long based*; *its base originating a little behind 1st dorsal origin*; base length slightly longer than length from snout tip to 1st gill opening (*about equal to the latter*, according to Weber, or *a little shorter than the latter*); *height about equal to caudal peduncle height*; *highest point of anal fin located at about anterior 1/3 of the fin*; *free rear margin very short. Caudal fin separate from anal fin only by a notch*; *anterior lower lobe as high as anal fin*, according to Weber.

Jaw teeth slender and three to five cusped on both jaws (Fig. 3).

Dermal denticles scraped off from most part of body, but *those on lateral sides of body above pelvic fin tricuspid, and slightly overlapping.*

Color white on body, inside of mouth greyish (*body slightly reddish white*, according to Weber).

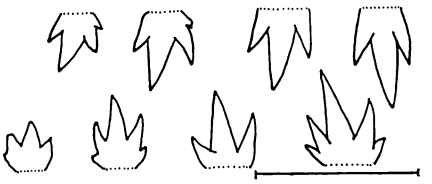

Fig. 3. Right teeth of the holotype of *Apristurus sibogae* (ZMA 111076). Above (from right to left): 2nd, 10th, 20th and 30th upper teeth. Below (from right to left): 5th, 14th, 20th and 30th lower teeth. Scale is 1 mm.

Taxonomic discussion

The holotype and only existing specimen of *A. sibogae* is now in a very poor condition. The snout region has been transversely cut on the dorsal side, and the body has been broken into two pieces between the pelvic and anal fins. In addition, the body is now extremely fragile and easily breakable (Fig. 1).

Springer (1979) noted that the "eye opening very small, its length about one-half the least distance between nasal apertures. . . ." This is true in its present condition of the type specimen. According to the original description, however, the eye diameter was about the same as the least distance between the nasal apertures. Compagno (1984) also mentioned the extremely small eyes (1.7% TL) as one of the diagnostic characters of *A. sibogae*. However, Weber (1913) measured 8.0 mm for the eye diameter, which is 3.4% of the total length. My measurement for the eye was 3.4 mm (1.6% TL), which is almost the same as that by Compagno. These facts mean that the eye had shrunken less than half of the original size. In addition, Compagno showed a rounded eye, which is true in the present condition of the type specimen. It is, however, unusual for a species of the genus *Apristurus* to have such rounded eyes, and all the other species of the genus and even of the family Scyliorhinidae have slender eyes. This also suggests that the eyes of the holotype are strongly deformed by the contraction and/or by some other mechanical forces. In fact, the dorsal region of the snout is broken transversely and the snout is bent strongly upward. Comparison of the present measurements with the original measurements by Weber (Table 1) indicates that the body before the cloaca has become shortened to be about 80 percent of the original length, and that the posterior half of the body behind the cloaca remains relatively constant (Contraction rate for the region behind the cloaca is 0.98). Springer (1979) and Compagno (1984) gave figures and descriptions of the contracted type specimen, which will lead to misun-

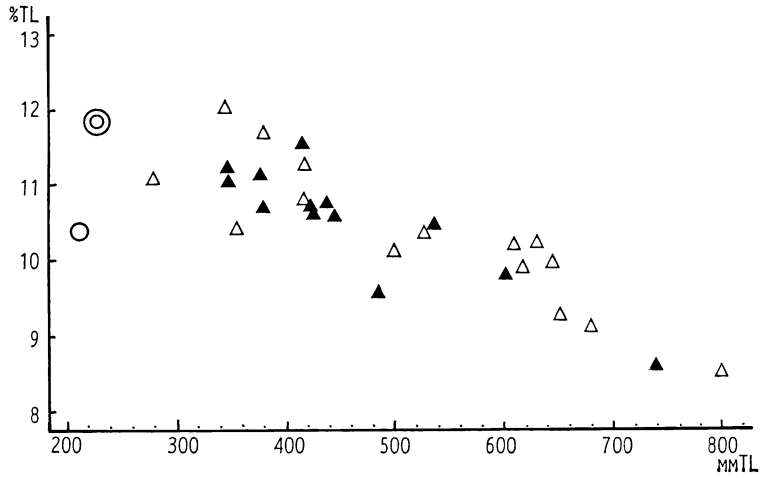

Fig. 4. Ontogenetic changes of the snout length in *Apristurus sibogae* (circles) and *A. platyrhynchus* (triangles). The double circle indicates the datum by Weber and the single circle is that of the present contracted state. Closed symbols are males and open symbols are females.

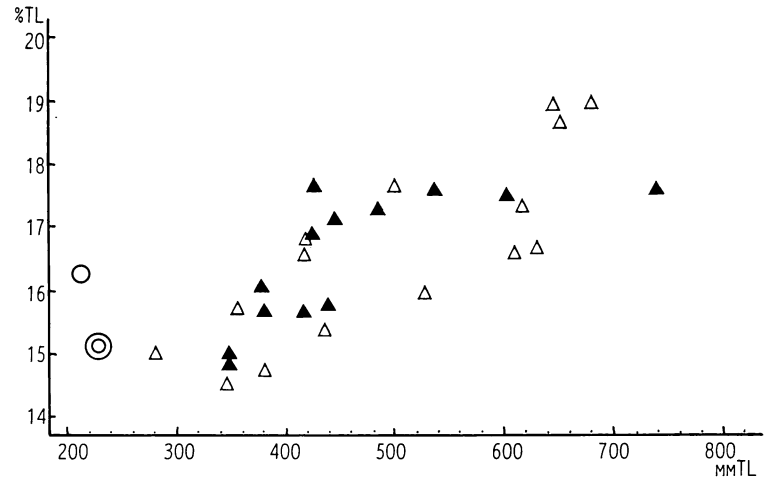

Fig. 5. Ontogenetic changes of the distance between origins of pectoral and pelvic fins in *Apristurus sibogae* (circles) and *A. platyrhynchus* (triangles). The double circle indicates the reassessed datum and the single circle is that of the present contracted state. Closed symbols are males and open symbols are females.

derstanding of the species.

Considering its fragility, and the poor descriptions and figures previously made, it is urgently necessary to make a proper description of the type specimen and to discuss its taxonomic relationships. Therefore, I tried to reconstruct the original morphology of the type specimen, reassessing the proportional measurements, on the basis of my interpretation of the now contracted holotype. The reassessed characters are described above and its reconstructed state is shown in Fig. 2. The type specimen is considered to have had a longer head region and more slender eyes than it has now, but the fin relations do not seem to have altered, because the posterior half of the body has rather remained proportionally unchanged.

The reconstructed morphology of the type specimen shows that *A. sibogae* is characterized among the species of the genus by a relatively short snout, short interspace between pectoral

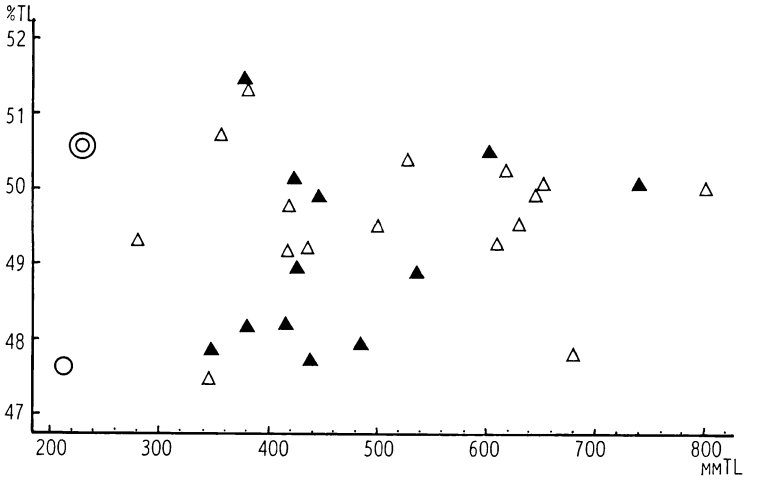

Fig. 6. Ontogenetic changes of the distance from snout tip to 1st dorsal origin in *Apristurus sibogae* (circles) and *A. platyrhynchus* (triangles). The double circle indicates the reassessed datum and the single circle is that of the present contracted state. Closed symbols are males and open symbols are females.

and pelvic fins, posteriorly located 1st dorsal fin which is much smaller than the 2nd one, long-based anal fin and relatively many teeth on the jaws. These characters are commonly possessed by Japanese *A. platyrhynchus*. As shown in Nakaya (1988a, b), the relative length of the snout acutely shortens with growth in the species of this genus and, though the snout length of *A. sibogae* given by Weber is nearly 12% of the total length, it fits well on the line of the tendency seen in *A. platyrhynchus* (Fig. 4). The distance between the origins of the pectoral and the pelvic fins has a tendency to increase with growth. The reasssessed proportional measurement of *A. sibogae* fits well on the line of *A. platyrhynchus* (Fig. 5). The first dorsal origin of *A. sibogae* is located at about the same position as that of *A. platyrhynchus* (Fig. 6). The number of vertical rows of teeth does not change ontogenetically (Nakaya, 1988a, b) in the species of this genus, and that of *A. sibogae* is included within the range of *A. platyrhynchus* (Fig. 7). Most of the other characters also fit those of *A. platyrhynchus* including the number of the monospondylous vertebrae. However, there are characters which do not fit those of *A. platyrhynchus*. The snout length before the nostrils in *A. sibogae* seems to be a little shorter than in *A. platyrhynchus*, when its ontogenetic tendency in *A. platyrhynchus* is considered (Fig. 8). The ontogenetic change of

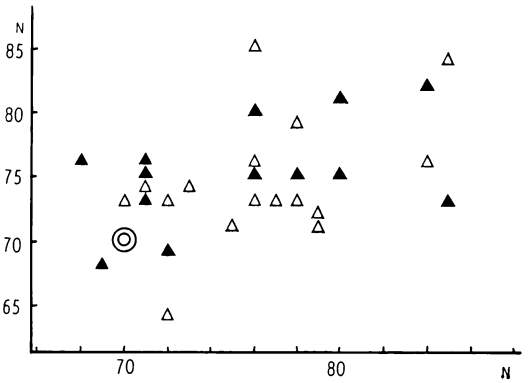

Fig. 7. Interrelation of the number of vetical rows of teeth on upper (y axis) and lower (x axis) jaws in *Apristurus sibogae* (double circle) and *A. platyrhynchus* (triangles). Closed symbols are males and open symbols are females.

the interorbital width (Fig. 9) suggests that 220–230 mm specimens of *A. platyrhynchus* are expected to have an interorbital width of nearly 7% TL or more, but the interorbital width of *A. sibogae* is only 5.7% TL according to Weber's original data. Posterior end of the 2nd dorsal base is located apparently before that of the anal base in all examined *A. platyrhynchus*, but they are opposite in position in *A. sibogae* (Fig. 2).

As far as the current taxonomic information of *Apristurus* species is concerned, the differences

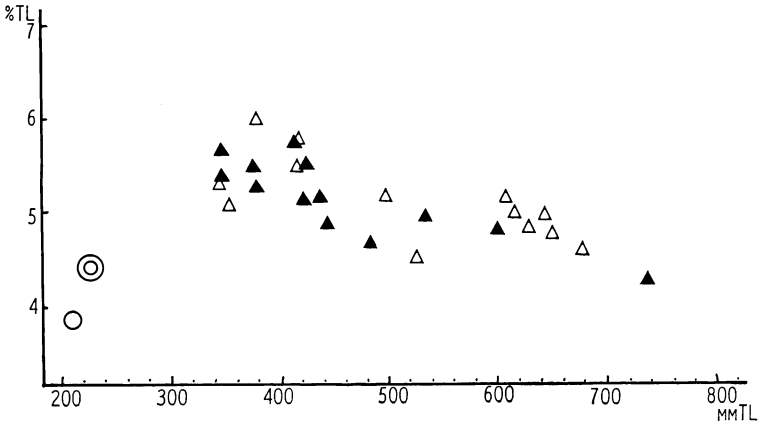

Fig. 8. Ontogenetic changes of the snout length before anterior nostrils in *Apristurus sibogae* (circles) and *A. platyrhynchus* (triangles). The double circle indicates the reassessed datum and the single circle is that of the present contracted state. Closed symbols are males and open symbols are females.

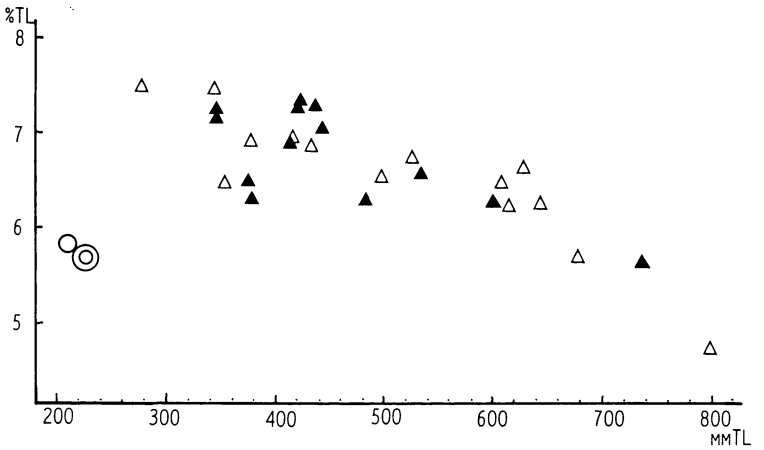

Fig. 9. Ontogenetic changes of interorbital width in *Apristurus sibogae* (circles) and *A. platyrhynchus* (triangles). The double circle indicates the datum by Weber and the single circle is that of the presnt contracted state. Closed symbols are males and open symbols are females.

in the snout length before the nostril, the interorbital width and the 2nd dorsal-anal fin relation seem to be enough to separate the species.

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Apristurus sibogae の再記載と分類学的考察

仲谷一宏

Apristurus sibogae (Weber, 1913) はインドネシア，マカッサル海峡で採集された1個体の雌若小標本に基づいて記載された．近年著者は本種の知られている唯一の標本でもある完模式標本を調査し，当該標本は現在全体が極めてもろくなって壊れやすく，しかも収縮変形が著しいことを知った．本種については，Weber (1913) の簡単な原記載以後，何回か模式標本の記載がなされているが，これらはいずれも収縮し，変形した状態をそのまま記載しており，種の特徴が誤って述べられている．極めて脆弱な状態にある模式標本およびその不十分で誤った記載を考えると，近い将来本種の正確な特徴が失われてしまう恐れが強い．そこで，Weber の測定値と現在の測定値を比較し，収縮率を求めることにより，本種の完模式標本を復元し，再記載することを試みた．その結果，*A. sibogae* は短い吻，短い腹部，後方に始まる第1背鰭，第2背鰭よりかなり小さい第1背鰭，歯数，腹椎骨数などの形質で日本のヘラザメ *A. platyrhynchus* に極めて近似しているが，両眼間隔，第2背鰭と臀鰭の位置関係などに差異がみられ，これらは現在のところ種的な差異と判断された．

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