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Squaliolus aliae, a Dalatiid Shark Distinct from *S. laticaudus*

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The dalatiid shark genus *Squaliolus* Smith et Radcliffe, 1912, which included three nominal species, was revised by Seigel et al. (1977) making the genus monotypic. Seigel et al. concluded that the diagnostic characters of *S. sarmenti* Noronha, 1926 (type locality: Madeira) and *S. aliae* Teng, 1959 (type locality: Taiwan) fall within the range of individual variation of *S. laticaudus* Smith et Radcliffe, 1912 (typs locality: Philippines) which is widely distributed in the three major oceans. Subsequent study of *Squaliolus* specimens by us (Uyeno and Sasaki, 1983, and present data) confirms the synonymy of *S. sarmenti* with *S. laticaudus*, but differs from Seigel et al. in recognizing *S. aliae* as a distinct species.

Materials and methods

All measurements are straight line (point to point) because of the small size of the specimens and the greater precision that this method gives. Total length (TL) is the distance from the tip of the snout to the distal end of the caudal fin; snout length is taken from the tip of the snout to the anterior rim of the orbit; eye diameter is the maximum horizontal eye diameter; interorbital width is taken dorsally above the eye-centers.

Specimens examined are deposited in the following institutions, abbreviated as in Leviton et al. (1985): BSKU, FMNH, FSFL, HUMZ, KSHS, NSMT, TFRI, and USNM.

Squaliolus laticaudus, 12 specimens, 3 males (146–187 mm TL) and 9 females (91–259 mm TL). USNM 70259 (holotype), 146 mm, ♂, *Albatross* station 5268, Batangas Bay, Luzon, Philippine Is., 13°42′N, 120°57′15″E, 0–311 m, 8 Jun. 1908; FMNH 58862 (holotype of *S. sarmenti*), 200 mm, ♀, Madeira, 0–1500 m, Sep. 1923; BSKU 26340, 187 mm, ♂, BSKU 26342, 218 mm, ♀, Okinawa Trough, 25°40.07′N, 123°52.07′E, 315–370 m, 20 Jan. 1978; BSKU 26588, 259 mm, ♀, Okinawa Trough, 26°33.03′N, 125°04.00′E, 295–385 m, 24 Jan. 1978; BSKU 42280 (embryo of BSKU 26588), 91 mm, ♀; FSFL-L915, 230 mm, ♀, East China Sea, 30°10.09′N, 128°44.06′E, 912 m, 29 Feb. 1975; HUMZ 74973, 259 mm, ♀, Kyushu-Palau Ridge, 26°14.01′N, 135°45.08′E, 355 m, 29 Jan. 1978; HUMZ 74975, 232 mm, ♀, HUMZ 74976, 199 mm, ♀, Kyushu-Palau Ridge, 26°13.05′N, 135°46.00′E, 360 m, 11 Feb. 1978; HUMZ 95249, 250 mm, ♀, East China Sea, 28°31.09′N, 128°11.00′E, 475–650 m, 5 Nov. 1981; NSMT-P 40026, 182 mm, ♂, off Suriname, 7°38′N, 53°56′W, 400 m, 17 Jun. 1979.

Squaliolus aliae, 35 specimens, 13 males (98–219 mm TL) and 22 females (91–204 mm TL). TFRI 3837 (holotype), 181 mm, ♀, off Tung-Kang, Taiwan, ca. 330 m, 23 Sep. 1958; USNM 76679 (paratype of *S. laticaudus*), 108 mm, ♀, *Albatross* station 5297, Batangas Bay, Luzon, Philippine Is., 24 Jul. 1909; FSFL-L915, 138 mm, ♀, East China Sea, 30°10.09′N, 128°44.06′E, 912 m, 29 Feb. 1975; KSHS 18116, 196 mm, ♀, KSHS 18117, 219 mm, ♀, off Ashizuri-misaki, Kochi Pref., Japan, 1979; NSMT-P 23913, 183 mm, ♂, NSMT-P 23914, 131 mm, ♂, NSMT-P 23915, 200 mm, ♂, NSMT-P 23916, 203 mm, ♂, NSMT-P 23917, 175 mm, ♂, NSMT-P 23918, 187 mm, ♂, NSMT-P 23919, 142 mm, ♂, NSMT-P 23920, 115 mm, ♂, NSMT-P 23921, 110 mm, ♂, NSMT-P 23922, 204 mm, ♂, NSMT-P 23923, 95 mm, ♂, NSMT-P 23924, 186 mm, ♂, NSMT-P 23925, 91 mm, ♂, NSMT-P 23926, 203 mm, ♀, NSMT-P 23927, 184 mm, ♀, NSMT-P 23928, 181 mm, ♀, NSMT-P 23929, 167 mm, ♀, NSMT-P 23930, 194 mm, ♀, NSMT-P 23931, 150 mm, ♀, NSMT-P 23932, 202 mm, ♀, NSMT-P 23933, 210 mm, ♀, NSMT-P 23934, 211 mm, ♀, NSMT-P 23935, 175 mm, ♀, NSMT-P 23936, 153 mm, ♀, NSMT-P 23937, 135 mm, ♀, NSMT-P 23938, 131 mm, ♀, NSMT-P 23939, 107 mm, ♀, NSMT-P 23940, 98 mm, ♀, NSMT-P 23941, 106 mm, ♀, NSMT-P 23942, 120 mm, ♀, all from off Aira, Suruga Bay, Japan, 100–200 m, 16 May 1973.

Results

As Seigel et al. (1977) demonstrated, no significant differences are found in the proportional dimensions and external morphology used for separation of the species by Noronha (1926) and Teng (1959). Despite this, however, we can clearly recognize two forms of sharks within the genus (Fig. 1): sharks with large eyes (*S. laticaudus*: "oome-kobitozame, big eye dwarf shark" of Abe and Minoshima, 1971) and those with small eyes (*S. aliae*: "tsuranaga-kobitozame, dwarf shark with long face or head" of Abe, 1962). Eye diameter is 61.0–81.7% of snout length ($\bar{x}$= 71.4%), 73.4–85.6% of interorbital width ($\bar{x}$= 78.4%) in *S. laticaudus*; eye diameter is 42.6–

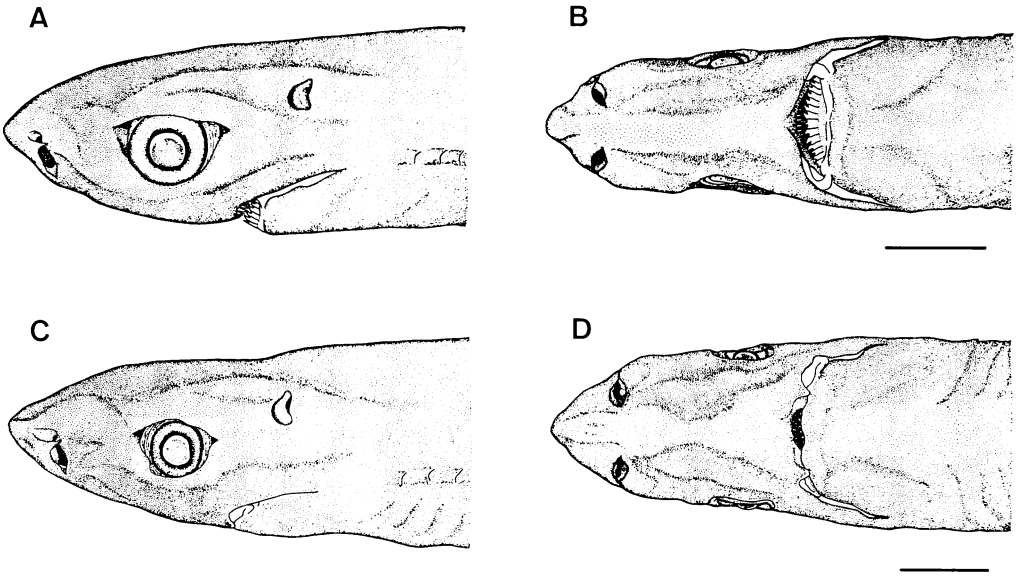

Fig. 1. Lateral and ventral views of the head of *Squaliolus laticaudus* (A, B; HUMZ 74976, 199 mm TL) and *S. aliae* (C, D; NSMT-P 23933, 210 mm TL). Bars 10 mm.

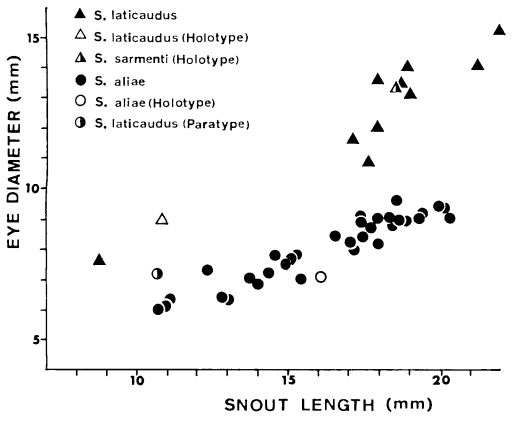

Fig. 2. Relationship between the eye diameter and snout length in two *Squaliolus* species.

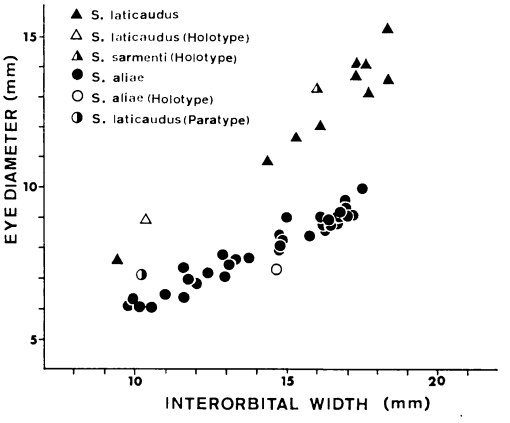

Fig. 3. Relationship between the eye diameter and interorbital width in two *Squaliolus* species.

66.4% of snout length ($\bar{x}$=49.9%), 46.3–69.6% of interorbital width ($\bar{x}$=56.5%) in *S. aliae* (Figs. 2, 3). These two morphometrics do not overlap in the specimens of comparable size throughout embryos and newly-born to fully matured ones. We believe that the striking difference in eye-size is alone sufficient to conclude that *S. aliae* is valid.

Moreover, we can offer two other characters which usually separate these two species: the upper margin of the orbit is nearly straight in *S. laticaudus* (Fig. 1A), but is chevron shaped in *S. aliae* (Fig. 1C); the lip of the upper jaw lacks papillae in *S. laticaudus* (Fig. 1B), but has a pair of papillae in *S. aliae* (Fig. 1D). In most cases, identification may be easily performed based only on these characters.

All the differences stated above are apparently independent of growth and sex. We find sexual dimorphism only in the relative position of the pelvic fin. In *S. aliae*, the distance from the upper end of the pectoral base to the origin of the

pelvic base is 28.5–37.4% TL ($\bar{x}$=33.8%) in males and 33.7–41.8% ($\bar{x}$=36.7%) in females; the distance from the end of the pelvic base to the origin of the lower caudal lobe is 15.9–18.4% TL ($\bar{x}$=17.0%) in males and 12.9–16.3% ($\bar{x}$=14.8%) in females. Covariance on the least-square linear regressions shows that the differences between the sexes are statistically significant. This indicates the tendency for males to have slightly shorter abdomens and longer caudal peduncles than females, possibly to allow space for the claspers. Alternatively, the females may have longer abdomens to contain their more massive reproductive systems. Hubbs et al. (1967) suggested that this sexual dimorphism may well be a common characteristic of sharks. In *S. laticaudus*, comparison between the sexes is not possible because the number of specimens collected was too small.

Re-examination of the type specimens of *S. laticaudus* reveals that they include two species. The holotype is definitely *S. laticaudus*, but the paratype (USNM 76679) is clearly identifiable as *S. aliae* because of its small eye, the upper margin of its orbit chevron shaped, and the presence of a pair of papillae on the lip of the upper jaw. The holotype of *S. sarmenti* well agrees with that of *S. laticaudus*.

Known distribution of *S. aliae* is restricted to the waters of Japan (Sagami Bay, Suruga Bay, off Kochi, and the East China Sea), Taiwan, and Philippines. Judging from our material and literature (Abe, 1962; Abe and Minoshima, 1971), *S. laticaudus* and *S. aliae* are sympatric in these waters.

Key to the species of *Squaliolus*

1a. Eye diameter 73–86% of interorbital width, 61–82% of snout length; upper margin of orbit nearly straight (rarely chevron shaped); lip of upper jaw always without papillae ..... *S. laticaudus*

1b. Eye diameter 46–70% of interorbital width (mostly less than 60%), 43–66% of snout length (usually about 50%, rarely more than 60% in young smaller than 120 mm TL); upper margin of orbit always chevron shaped; lip of upper jaw with a pair of papillae (rarely indistinct)..... *S. aliae*

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ヨロイザメ科の *Squaliolus aliae* Teng ツラナガコビトザメは有効

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ヨロイザメ科のツラナガコビトザメ属 *Squaliolus* は Seigel et al. (1977) が *S. sarmenti* Noronha, 1926 と *S. aliae* Teng, 1959 を *S. laticaudus* Smith et Radcliffe, 1912 のシノニムとして以来1種のみを含むと考えられてきた．模式標本を含む 47 標本を比較した結果，*S. aliae* の眼は *S. laticaudus* より明らかに小さく，有効種であることが判明した．眼窩上縁の形状，上顎口唇部の肉質突起の有無によっても両種は区別可能であるが，これらの形質には種内変異あるいは種間の重複がある．和名ツラナガコビトザメは *S. aliae* に，オオメコビトザメは *S. laticaudus* にそれぞれ対応する．

ツラナガコビトザメ属の種の検索：

1a. 眼径は両眼間隔幅の 73–86%，また吻長の 61–82%．眼窩上縁はほとんど直線状（稀に中央が上方へ折れ曲がる）．上顎の唇に肉質突起がない．
……*S. laticaudus* オオメコビトザメ

1b. 眼径は両眼間隔幅の 46–70%（ほとんど 60% 以下），また吻長の 43–66%（普通約 50% で稀に全長 120 mm 以下の幼魚で 60% をこえるものがある）．眼窩の上縁は常に上方へ折れ曲がっている．上顎の唇には一対の肉質突起がある（ごく稀に不明瞭なものもある）……*S. aliae* ツラナガコビトザメ

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