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Review of the Deep Sea Squaloid Shark Genus *Scymnodon* of Japan, with a Description of a New Species

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Abstract *Scymnodon* in Japan is represented by two species, *S. squamulosus* and *S. ichiharai* sp. nov. The new species differs from other species of the genus by the shape of 1st dorsal fin, dermal denticles and lower teeth, the head length, and the interspace between the pelvic and caudal fins. *S. squamulosus* is redescribed from 12 specimens. *S. obscurus* is regarded as a junior synonym of *S. squamulosus*. A key to the species of *Scymnodon* is given. *Scymnodon* is closely related to *Centroscymnus*.

The deep sea shark genus *Scymnodon*, belonging to the family Squalidae, can be distinguished from related genera by: its upper teeth being much longer midway along each side of jaw than either toward the center of the mouth or toward its outer corner; broadly rounded inner corners of the pectoral fins; and no concave crown-like dermal denticles.

Bocage and Capello (1864) established *Scymnodon* as a new genus, and described *S. ringens* from Portugal. From the seas around Japan, Günther (1877) described a species, *S. squamulosus*, which he originally placed in the genus *Centrophorus*. Jordan and Fowler (1903) proposed a new genus *Zameus* for *C. squamulosus* but Regan (1906) referred *squamulosus* to *Scymnodon*. Garman (1913) included in *Scymnodon* the species *S. ringens, S. squamulosus, S. macracanthus* (Regan, 1906), from Magellan, *S. plunketi* (Waite, 1910), from New Zealand, and treated *Centroscymnus obscurus* Vaillant, 1888, off the coast of northwestern Africa, as a synonym of *S. ringens*. Archey (1921) described a new species, *S. sherwoodi* which Garrick (1956) later placed in a new genus *Scymnodalatias* within the Dalatiidae. Fowler (1933) proposed for *S. plunketi* a new subgenus *Proscymnodon* which Whitley (1934) regarded as a genus. Fowler (1940), also, referred *S. squamulosus* and *S. sherwoodi* to a subgenus *Zameus*, *S. ringens* to a subgenus *Scymnodon*, and *S. plunketi* to a subgenus *Proscymnodon*. Bigelow and Schroeder (1954) reported that *S. melas* Bigelow, Schroeder et Springer, 1953 was a juvenile stage in the growth of *Centroscymnus coelolepis*. Bigelow and Schroeder (1957) referred *S. ringens, S. squamulosus* and *S. obscurus* to *Scymnodon* but placed *S. plunketi* and *S. macracanthus* in *Centroscymnus*. Garrick (1959b) identified *C. plunketi* as a species of *Scymnodon*. *S. plunketi* and *C. macracanthus* have been variously placed in *Centrophorus, Centroscymnus* and *Scymnodon* by several authors. Recently, the genus *Scymnodon* was stated as including four species: *S. ringens, S. squamulosus, S. obscurus* and *S. plunketi* (Cadenat and Blache, 1981).

The new species *S. ichiharai* is described here on the basis of 14 specimens caught in Suruga Bay and adjacent waters. It is clearly discriminated from the closely related *S. plunketi* and *S. ringens*.

The denticles of the trunk of *S. squamulosus* as pictured by Günther (1887) show no trace of transverse ridges. Bigelow and Schroeder (1957), and Cadenat and Blache (1981) used the absence (*squamulosus*) or the presence (*obscurus*) of transverse ridges on the denticles as the main difference between these species. But our reexamination of the dermal denticles of the holotype of *S. squamulosus* from the British Museum revealed that transverse ridges are present in that species just as they are in *S. obscurus*.

Materials and methods

The Japanese specimens used for this study were caught with bottom longlines and bottom drop lines, which were set at depths between 400 m and 1,500 m. These localities are shown

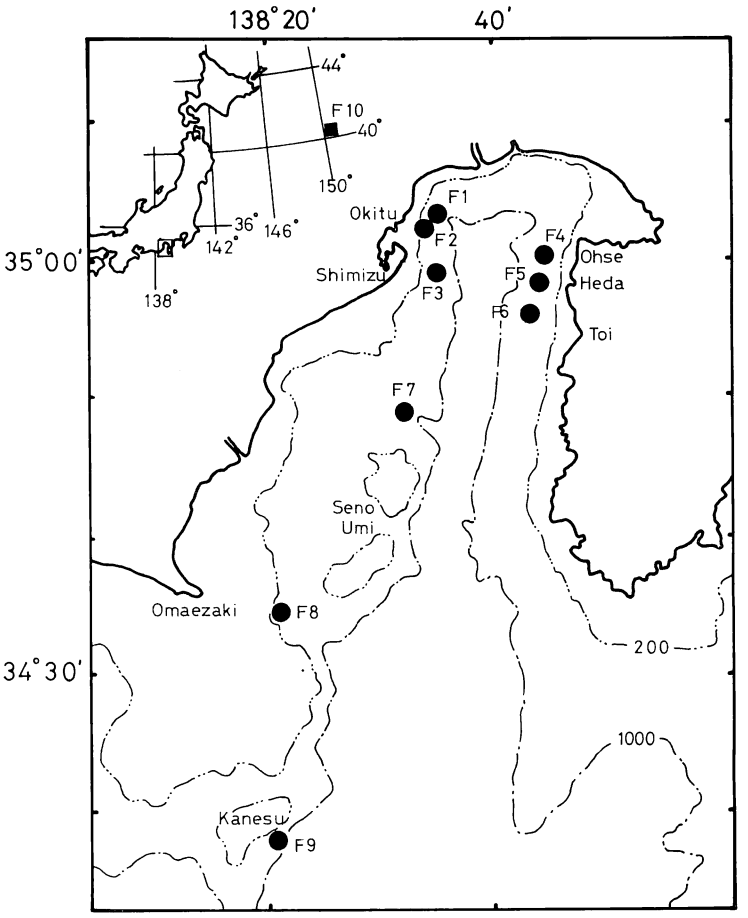

Fig. 1. Fishing grounds of *Scymnodon ichiharai* sp. nov. and *S. squamulosus*. F1～F8, fishing area of *S. ichiharai*; F8～F10, fishing area of *S. squamulosus*; ●, caught with bottom longline and bottom drop line; ■, caught with floating longline.

in Fig. 1. The specimens of *S. plunketi*, NSMT-P 42001 (bottom trawl, off New Zealand, 48°51′S, 167°22′E, Apr. 13, 1983, 585～632 m in depth), FSFL-EH 858 (Kaiyo Maru, off New Zealand, 42°39.5′S, 176°01.6′E, Dec. 12, 1977, 1,025～1,027 m in depth) and FSFL-L 461 (Kaiyo Maru, off New Zealand, 48°15.0′S, 179°52.0′E, Dec. 15, 1974, 520 m in depth), were used for comparison with our specimens. Denticles of the type specimens of *S. squamulosus, S. ringens, S. obscurus* and *S. plunketi* from the British Museum (Natural History), Muséum National d'Histoire Naturelle and Canterbury Museum (New Zealand) were used for comparison with those of our specimens.

Specimens are deposited in the following institutions: Department of Zoology, British Museum (Natural History) (BMNH); Far Seas Fisheries Research Laboratory, Shimizu (FSFL); Department of Fisheries, University Museum, University of Tokyo (FUMT); National Science Museum, Tokyo (NSMT); Elasmobranchii Collection of the Department of Fisheries, Faculty of Marine Science and Technology, Tokai University (TMFE); and Marine Science Museum, Tokai University (MSM).

Measurements were carried out in the same way as in Yano and Tanaka (1983), with the addition of the following items: snout tip to anterior margin of spiracle; interspace between 1st dorsal and 2nd dorsal fin spines; interspace between 2nd dorsal and caudal fins; interspace

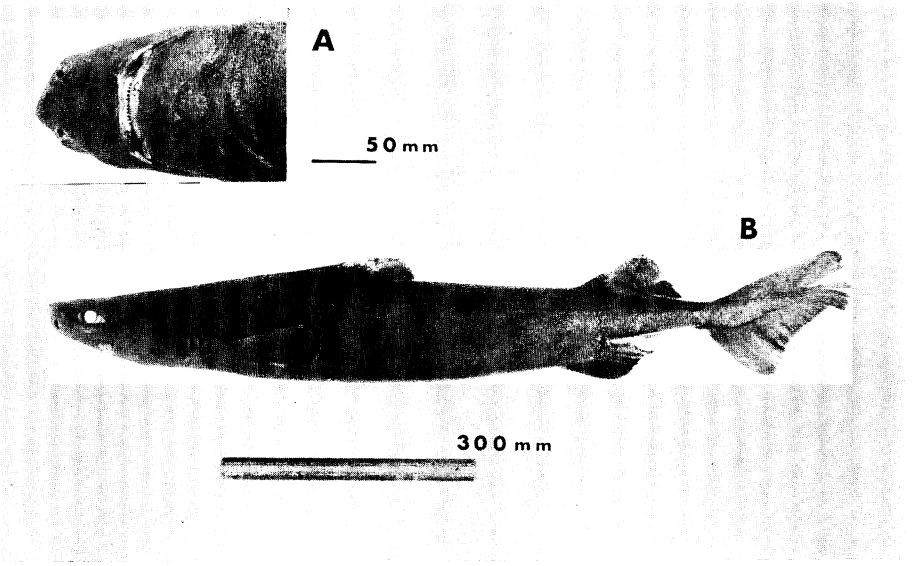

Fig. 2. Holotype of *Scymnodon ichiharai* sp. nov., male, 1,011 mm TL, NSMT-P 21723. A, ventral view of head region; B, lateral view.

between pelvic and caudal fins; distance between origins of pectoral and pelvic fins; length of the posterior margin of 1st dorsal and 2nd dorsal fins; depth of pelvic fin; and depth of subterminal notch.

Dermal denticles were studied under a binocular microscope and photographed with a scanning electron microscope.

The vertebral counts were made according to the method of Springer and Garrick (1964). Soft X-ray was used for counting the number of vertebrae of small sharks.

All turns in the spiral valves were counted in the left lateral view of the ileum.

Scymnodon ichiharai sp. nov.
(New Japanese name:
Ichihara-biroudozame)
(Fig. 2)

Holotype. NSMT-P 21723, male, 1,011 mm in total length (TL), 829 mm in body length from snout tip to upper caudal origin (BL), off Okitsu in Suruga Bay (35°02.9′N, 138°34.6′E), 580 m in depth, bottom drop line, Mar. 16, 1982.

Paratypes. Fishing areas are shown in Fig. 1. BMNH 1983.11.8: 1, male, 955 mm TL, 799 mm BL, off Okitsu (fishing area F2), 690～790 m in depth, bottom longline, June 5, 1980. FUMT-P 3849, male, 927 mm TL, 775 mm BL, off Toi (F6), 665～720 m in depth, bottom longline, July 17, 1980. MSM-80-273, male, 892 mm TL, 733 mm BL, off Heda (F5), bottom longline, July 30, 1980. TMFE 169, male, 993 mm TL, 820 mm BL, off Yui (F1), 800 m in depth, bottom longline, Aug. 25, 1980. TMFE 1138, male, 924 mm TL, 745 mm BL, off Okitsu (35°02.8′N, 138°34.5′E, F2), 500 m in depth, bottom drop line, June 30, 1982. TMFE 1275, male, 492 mm TL, 387 mm BL, off Omaezaki (34°29.8′N, 138°24.9′E, F8), 450～830 m in depth, bottom longline, Nov. 9, 1982. TMFE 1875, male, 951 mm TL, 780 mm BL, off Yui (35°02.0′N, 138°37.0′E, F1), 700 m in depth, bottom drop line, May 14, 1983. NSMT-P 21724, female, 1,340 mm TL, 1,125 mm BL, off Heda (F5), 675～750 m in depth, bottom longline, Nov. 20, 1980. FUMT-P 3850, female, 1,455 mm TL, 1,221 mm BL, Seno Umi (F7) 630～645 m in depth, bottom longline, July 29, 1981. TMFE 76, female, 1,367 mm TL, 1,127 mm BL, off Ohse (F4), 620～720 m in depth, bottom longline, July 16, 1980. MSM-80-274, female, 1,260 mm TL, 1,021 mm BL, off Ohse (F4), 620～720 m in depth, bottom longline, July 16, 1980. TMFE 78, female, 1,266 mm TL, 1,066 mm BL, off Ohse (F4), 620～720 m in depth, bottom longline, July 16, 1980. TMFE 288, female, 1,230 mm TL, 1,040 mm BL, off Miho (F3), bottom longline, Oct. 31, 1980.

Diagnosis. Length from snout tip to 1st dorsal fin spine 42.4～46.9% of body length. Interspace between pelvic and caudal fins 10.2～14.0% of body length. Pectoral fin not reaching a vertical from the 1st dorsal fin spine. Lower

Table 1. Proportional dimensions in percentage of total length of *Scymnodon ichiharai* sp. nov. B, broken; H, dorsal spine hidden by the skin.

Catalogue number	Holotype NSMT-P 21723	Paratypes TMFE 1275	MSM-80- 273	TMFE 1138	FUMT-P 3849	TMFE 1875	BMNH 1983. 11.8: 1	TMFE 169	TMFE 288	MSM-80- 274	TMFE 78	NSMT-P 21724	TMFE 76	FUMT-P 3850
Sex	male	male	male	male	male	male	male	male	female	female	female	female	female	female
Total length (mm)	1,011	492	892	924	927	951	955	993	1,230	1,260	1,266	1,340	1,367	1,455
Snout tip to:														
outer nostrils	1.9	2.1	1.9	1.6	1.9	2 2	1.4	1.8	1.6	1.6	1.7	2.8	1.9	2.7
eye	4.6	5 3	5.6	3.6	5.0	5.3	4.6	4.5	3.7	3 6	4 1	4.6	5.3	5.2
spiracle	11.7	12.2	12.7	10 7	11.0	10.9	11.5	10 6	11.4	9.9	9 8	12.2	11.6	10 3
mouth	7.2	6.7	7.7	6 6	7.2	7.5	6.3	6 2	6 5	5.4	7 1	5.6	6 9	5.6
1st gill opening	17.0	17.1	18.8	17.1	16.1	17.9	17.5	15.6	17.9	13.9	15 8	15.7	15.9	14.5
5th gill opening	22.0	21.5	22.5	22 0	20 3	22.1	21.2	19.3	24 0	18.7	20.7	19 4	20.3	18.6
pectoral origin	22.3	22.0	22.7	22.1	21.1	22 2	21.4	19.1	23.6	19.0	21.5	19.4	20.5	19.3
pelvic origin	60.8	60.8	61.7	60.9	61.9	62.7	63.1	62 5	64.6	60.4	65 2	65 7	61.8	63.8
cloaca	66.8	67.5	67.7	67.1	67.4	68 5	67.7	68.7	68.7	67.2	69 2	69.8	67.4	70.2
1st dorsal spine origin	34.8	36.6	36.2	36.3	36.5	36 2	37.0	33.2	38.9	36 8	38.2	38.4	35.5	36.1
2nd dorsal spine origin	68.2	68.5	69.8	68.7	68.5	70.9	70.8	67.6	70.7	69.4	72.1	72.0	69.2	72.2
upper caudal origin	82.0	78.7	82.2	80.6	83.6	82.0	83.7	82.6	84.6	81.0	84.2	84.0	82.4	83.9
lower caudal origin	78.5	77.0	79.0	77.9	79.8	79.0	82.6	80 9	83.2	78 8	81.5	82.4	79.7	80 8
Interspace between:														
1st dorsal and 2nd dorsal spine origins	28.6	27.6	30.5	27.3	28.5	29.4	30.3	28.2	28.5	27.7	29.6	29.1	29.4	32.0
2nd dorsal and caudal	6.9	7.7	8.1	6.0	8.1	7.2	7.3	7.0	6.1	8.1	6.6	7.1	7.3	6.2
pelvic and caudal	11.4	11.0	10.3	9.8	11.0	9.5	11.1	11.1	11.4	10.9	9.9	10.4	10.2	8.6
Distance between origins of pectoral and pelvic	41.0	38.0	37.6	38.6	42.2	41.5	42.1	—	38.6	43.0	44.1	39.0	41.3	44.8
Nostrils: distance between inner corners	4.4	B	3.9	4.1	4.5	4.2	4.5	4.5	5.3	4.7	4.2	4 5	4.2	4.5
Mouth width	9.1	10.6	9.3	10.2	8.8	8.7	9.4	8.7	10.2	9.9	8.5	9.7	9.5	8.6
Preoral clefts: distance between inner corners	6.6	6.3	6.6	7.3	6.6	6.5	7.0	—	6.7	6.7	6.0	5.9	6.2	6.1

Gill opening lengths:														
1st	2.3	1.6	2.1	1.6	2.2	2.1	2.1	1.5	2.4	2.5	2.1	2.2	2.6	2.7
5th	2.5	1.6	2.1	1.8	1.9	2.1	2.1	2.2	2.8	2.4	2.1	2.1	2.4	2.4
Horizontal diameter of eye	4.3	6.1	5.6	5.4	4.9	5.3	5 2	4.8	4.9	4.1	4.3	4.1	4.2	3.8
Interorbital width	9.1	10.2	8.4	8.7	9.0	9.4	9.0	—	9.6	9.1	8.5	9.1	9.3	9.1
First dorsal fin:														
length of base from spine	4.0	4.1	3.4	4.3	4.5	3.7	4.0	—	3.7	4 0	4.1	3.6	4.4	3.6
length of posterior margin	4.0	4.1	3.9	3.8	4.3	3.2	4.7	5.0	4.1	4.4	3.9	4.1	4.0	4.1
height	3.5	2.6	3.4	3.5	4.4	3.2	3.7	3.5	4.1	3.3	3.4	3.1	3.3	3.4
spine length	2.0	1.2	2.0	1.6	1.4	1.8	0.9	1.1	0.7	1.4	B	B	0.7	0.7
Second dorsal fin:														
length of base from spine	6.1	5.7	5.8	6.0	5.7	5.5	5.8	—	6.0	6.3	6.1	5.9	5.9	5.5
length of posterior margin	8.4	6.7	7.2	8.7	7.6	6.7	8.4	8.1	8.1	8.7	7.5	7.5	6.6	6.9
height	6.4	4.5	5.6	6.0	5.4	5.7	5.8	5.5	6.1	6.4	5.9	5.6	5.5	5.7
spine length	1.7	0.6	1.4	1.2	0.6	1.5	0.7	0.3	H	B	B	H	0.7	H
Pectoral fin:														
length of anterior margin	10.9	12.2	13.5	13.3	10.8	13.0	12.0	11.9	15.0	14.3	12.2	12.7	12.7	13.4
length of distal margin	6.6	5.1	7.3	4.9	7.4	7.9	5.2	5.5	7.3	7.9	6.7	4.5	5.6	4 9
Pelvic fin:														
length of anterior margin	7.9	7.1	6.7	7.6	7.0	7.4	7.9	8.1	8.1	7.9	8.3	7.5	8.4	6.9
depth	4.9	4.5	4.8	5.8	5.9	—	5.5	—	6.9	5.6	6.3	5.5	5.9	6.3
Caudal fin:														
length of upper lobe	18.3	22.4	18.2	19.7	19.4	19.2	17.8	17.6	19.1	19.8	17.4	17.2	17.9	17.2
length of lower lobe	12.2	12.8	11.2	13.4	12.4	11.6	11.5	11.9	13.8	11.5	11.5	11.2	12.4	11.8
depth of notch	2.3	4.1	2.2	2.7	2.2	2.6	3.1	2.3	2.4	2.4	1.3	1.9	1.8	1.7
Trunk at pectoral origin:														
width	14.8	14.6	14.0	15.2	14.6	14.2	15.4	16.6	17.5	16.3	15.6	15.7	16.5	15.1
height	10.9	13.2	10.7	13.2	10.2	11.8	11.7	11.1	13.4	9.7	13.4	11.2	11.7	12.3

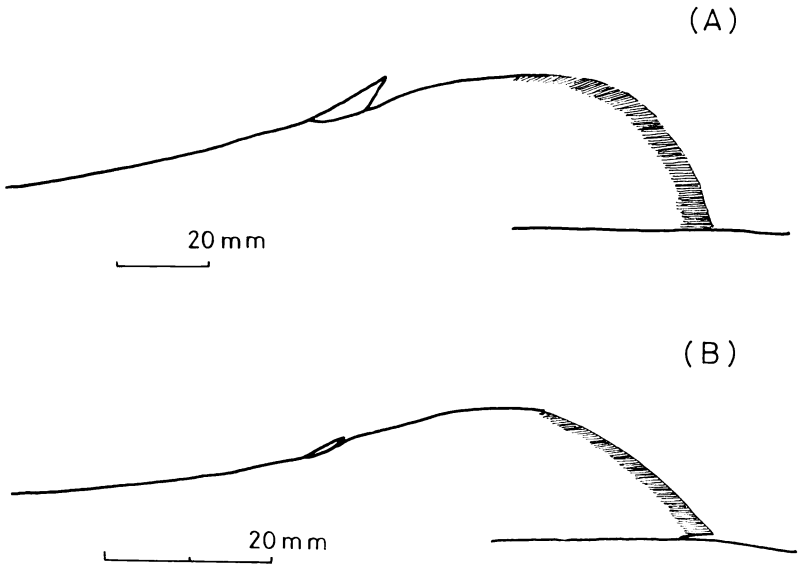

Fig. 3. Shape of 1st dorsal fin of *Scymnodon ichiharai* sp. nov. and *S. squamulosus*. A, holotype, male, 1,011 mm TL, NSMT-P 21723; B, *S. squamulosus*, male, 547 mm TL, NSMT-P 21725.

teeth triangular, oblique, with rectangular bases, their cutting edges inclined toward the outer corners of the jaw. Median lower tooth not symmetrical. Dermal denticles of adults leaf-like, their posterior margins not tridentate but with serrations or smooth. External surface of the denticles lacking transverse ridges, but with three distinct longitudinal ridges.

S. ichiharai is distinguishable from other species by the following characters: from *S. ringens* in having the first dorsal fin spine located anterior to the mid point of body length (length from snout tip to 1st dorsal fin spine 53.6% of body length in *S. ringens*), the oblique shape of the lower teeth and the median tooth not symmetrical, the dermal denticles without tridentate posterior margins in adults, and the lower margin of caudal fin with well-marked subterminal notch; from *S. squamulosus* in having the oblique shape of the lower teeth and the median tooth not symmetrical, and the dermal denticles without transverse ridges; from *S. plunketi* in having the dermal denticles without tridentate posterior margins in adults, the shorter interspace between pelvic and caudal fins, the longer head length, the dorsal fin spine relatively large, and the posterior margin of 1st dorsal fin steep.

Description. Proportional dimensions in percentage of TL are shown in Table 1. In the following, the value for the holotype is followed by ranges of paratypes in parentheses.

Trunk subcylindrical; head depressed, flat above, and broad; abdominal ridges weak. Height of trunk at origin of pectoral 13.3% (11.9～16.8%) of body length. Caudal peduncle without lateral keels or precaudal pits. Snout short, its length anterior to eye 0.92 (0.73～1.52) in horizontal diameter of eye and 1.96 (1.50～2.67) in interorbital width. Length from snout tip to mouth 1.26 (1.07～1.67) in posterior end of eye to 1st gill opening. Eye large, vertical diameter of eye 2.15 (1.92～3.00) in horizontal diameter. Spiracle semicircular, its length 2.39 (2.25～4.17) in horizontal diameter of eye. Gill opening small, almost vertical. Length of 1st gill opening 1.87 (1.38～3.75), 3rd 1.87 (1.38～3.75), 5th 1.72 (1.71～3.75) in horizontal diameter of eye. Nostrils oblique, each nasal aperture subdivided into a circular, anterolateral aperture and an elongate, subovoidal, posteromedial aperture by posterior nasal flap, which extends anteriorly as a fleshy triangular process from posterior nasal margin. Mouth broad and little arched, its width greater than preoral length. Preoral length 1.26 (1.16～1.83) in mouth width. Upper lip fimbriated, lower lip smooth. Preoral clefts deep. Distance between inner corners of nostrils 1.52 (1.29～

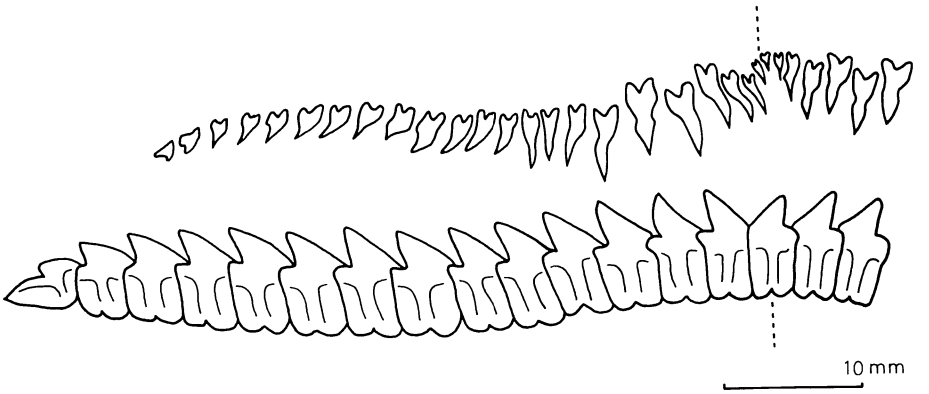

Fig. 4. Teeth of *Scymnodon ichiharai* sp. nov., paratype, male, 993 mm TL., TMFE 169.

1.76) in distance between inner ends of preoral clefts. Pectoral fin, when laid back, in advance of 1st dorsal spine. Posterior margin of 1st dorsal fin shorter than anterior margin, posterior margin steeply sloped (Fig. 3 A). First dorsal fin dissimilar in shape to 2nd dorsal fin. Length of 1st dorsal fin base 1.55 (1.26~1.73) in length of 2nd dorsal fin base. Height of 1st dorsal fin 1.14 (0.92~1.54) in length of 1st dorsal fin base. First dorsal spine relatively large, but its relative size decreases with growth of body length, length of spine 58.1% (16.0~60.0%) of 1st dorsal fin height. Length of 1st dorsal fin base 5.55 (4.48~6.70) in head length. Length of anterior margin of 2nd dorsal fin as long as its posterior margin, 2nd dorsal fin triangular-shaped. Height of 2nd dorsal fin as long as length of 2nd dorsal fin base. Spine of 2nd dorsal fin slightly shorter than that of 1st dorsal. Length of 2nd dorsal spine 20.6% (12.0~25.9%) of 2nd dorsal fin height, but 2nd dorsal spine of three large female specimens (1,230 mm, 1,340 mm and 1,455 mm TL) is hidden by skin. Pectoral fin rounded, posterior margin curved, its origin just posterior to 5th gill opening. Pelvic axilla just below 2nd dorsal spine. Length of anterior margin of pelvic as long as that of posterior margin. Clasper subcylindrical, with spur present.

Teeth $\frac{21-1-20}{14-1-14}$ ($\frac{23-1-24}{14-1-15}$ in 993 mm TL, male and $\frac{22-1-22}{15-0-13}$ in 937 mm TL, male), dissimilar in both jaws. Upper teeth single cusped, smooth-edged, lanceolate. Counting from the symphysis, the teeth in the 1st and 2nd series are smaller than those in the 4th to 7th series, which include the largest teeth in the upper jaw (Fig. 4). Lower teeth triangular, oblique, with rectangular bases, their cutting edges inclined toward the outer corner of the jaw. Median lower tooth not symmetrical (Fig. 4). Two or three rows of teeth regularly functional in upper jaw, and one in lower jaw.

Dermal denticles of adults small, leaf-like. Posterior margins of the dermal denticles on the trunk below 1st dorsal fin have three to seven serrations in holotype (Fig. 5) and ten in paratypes, but are smooth and not serrated in a larger female (Fig. 6). Dermal denticles on the interorbital region are not serrated on their posterior margins, and lack pointed processes (Figs. 5, 6). External surface of each denticles with three distinct longitudinal ridges, the median ridge longer and higher than the lateral ridges; no transverse ridges. Dermal denticles of a juvenile (492 mm TL, male) tridentate, with three longitudinal ridges and no transverse ridges; lateral ridges higher than median ridge (Fig. 6); external surface of each denticle slightly concave.

Outer margins of all fins lacking denticles. Outer margins of nostrils, borders of mouth and gill opening, axilla of pectoral fin, posterior region of bases of 1st and 2nd dorsal fins and inner margin of clasper covered with mucus, but denticles are present underneath the mucus.

Color uniformly black.

Number of turns in the spiral valves are 12~15 in seven paratypes.

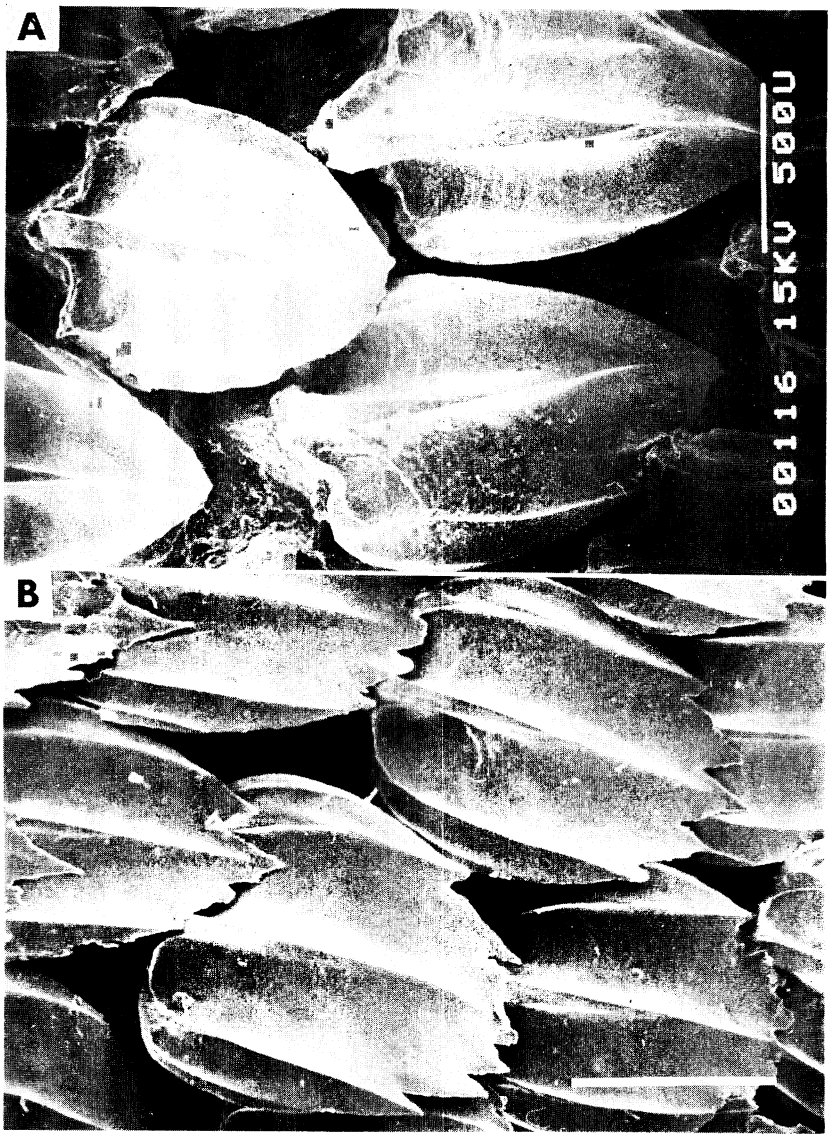

Fig. 5. Dermal denticles of holotype of *Scymnodon ichiharai* sp. nov., adult male, 1,011 mm TL, NSMT-P 21723. A, interobital region; B, side of trunk below 1st dorsal fin. Each scale indicates 500 μm.

Total vertebral number 102, monospondylous 57, and precaudal 76 in a juvenile specimen (TMFE 1275).

Distribution. The adults and immatures of *S. ichiharai* were caught in Suruga Bay, with bottom longline and bottom drop line, which were set at depths between 500 m and 800 m. The juvenile, however, was caught at the entrance of Suruga Bay, with bottom longline which was set at depths between 450 m and 830 m. This species is rare in Suruga Bay. Thirteen specimens of *S. ichiharai* were caught on 14,800 hooks (19 operations) with bottom longline, which were set at depths between 400 m and 830 m, and three specimens were caught on the 2,240 hooks (112 operations) with bottom drop line, which were set between 400 m and 1,500 m.

Reproduction. The males, from 892 mm to 1,011 mm TL, were considered to be mature, since they had large and hard claspers with spurs.

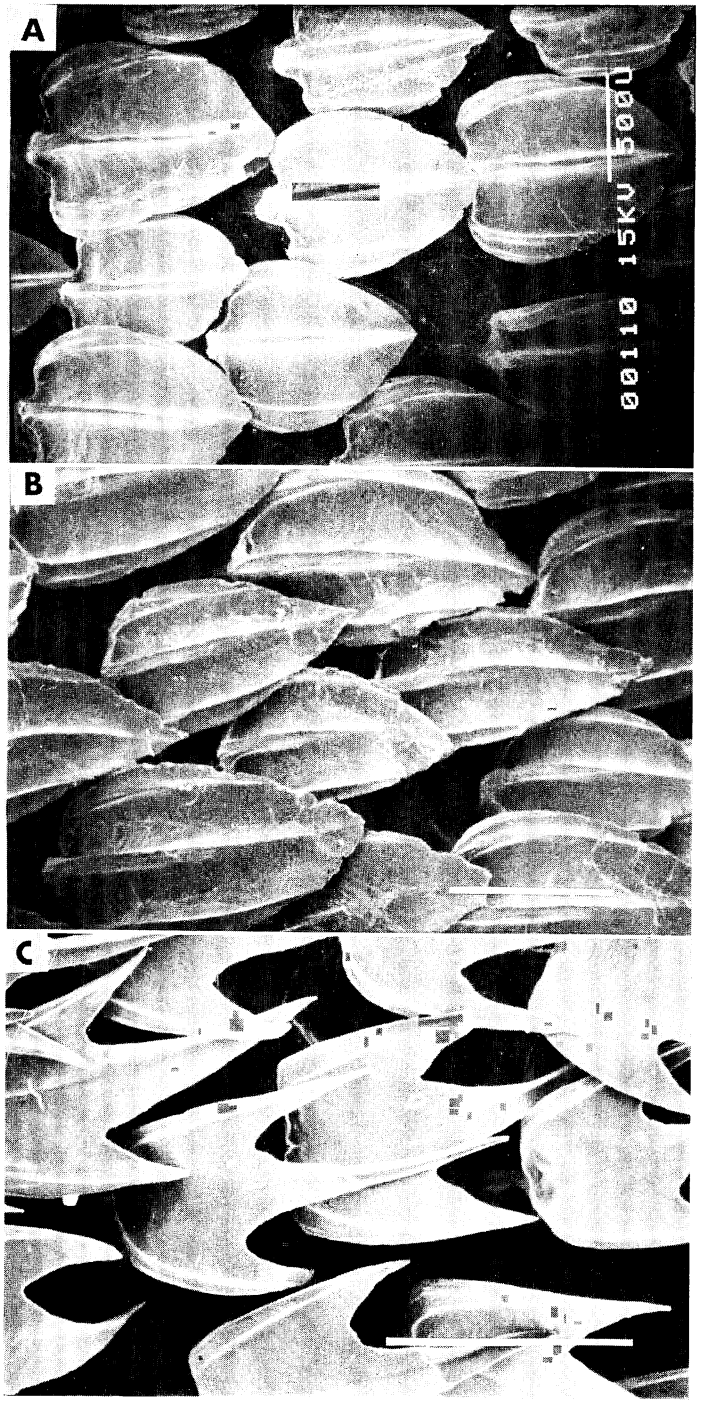

Fig. 6. Dermal denticles of paratypes of *Scymnodon ichiharai* sp. nov. A, interobital region, adult female, 1,455 mm TL, FUMT-P 3850; B, side of trunk below 1st dorsal fin, specimen same as A above; C, side of trunk below 1st dorsal fin, juvenile male, 492 mm TL, TMFE 1275. Each scale indicates 500 μm

Table 2. Proportional dimensions in percentage of total length of *S. ringens* and *S. plunketi*.

Catalogue number	*S. ringens* MNHN 1969–90	NSMT-P 42001	*S. plunketi* FSFL-L 461	FSFL-EH 858
Sex	female	male	male	female
Total length (mm)	295	1,155	1,185	968
Snout tip to:				
outer nostrils	—	0.9	1.1	0.9
eye	4.8	3.0	3.5	3.3
spiracle	—	9.1	9.7	9.8
mouth	8.6	5.4	5.5	6.6
1st gill opening	—	13.4	14.4	15.0
5th gill opening	—	17.3	17.8	18.8
pectoral origin	25.0	17.5	18.1	19.0
pelvic origin	62.0	59.3	60.3	58.1
cloaca	64.7	64.1	65.4	62.5
1st dorsal spine origin	42.8	35.1	36.5	35.1
2nd dorsal spine origin	66.8	67.1	67.2	65.0
upper caudal origin	79.8	81.0	79.6	78.2
lower caudal origin	—	77.0	78.5	77.3
Interspace between:				
1st dorsal and 2nd dorsal spine origins	—	28.1	27.3	25.3
2nd dorsal and caudal	—	9.1	7.6	8.5
pelvic and caudal	—	13.0	12.2	13.7
Distance between origins of pectoral and pelvic	—	44.2	41.1	40.6
Nostrils: distance between inner corners	4.1	3.5	3.5	3.6
Mouth width	—	8.4	8.4	8.8
Preoral clefts: distance between inner corners	7.5	5.2	4.7	4.4
Gill opening lengths:				
1st	—	1.3	1.7	2.1
5th	—	2.2	1.7	1.9
Horizontal diameter of eye	9.6	4.1	4.2	4.9
Interorbital width	—	8.0	7.0	8.1
First dorsal fin:				
length of base from spine	—	4.5	4.2	4.9
length of posterior margin	—	4.8	4.9	7.2
height	—	3.6	3.7	3.7
Second dorsal fin:				
length of base from spine	—	5.2	5.1	5.3
length of posterior margin	—	6.9	6.1	6.2
height	—	4.4	4.5	5.1
Pectoral fin:				
length of anterior margin	—	13.2	12.7	13.7
length of distal margin	—	5.4	4.4	6.2
Pelvic fin:				
length of anterior margin	—	6.1	6.0	6.9
depth	—	4.3	4.6	5.2
Caudal fin:				
length of upper lobe	26.0	20.6	21.0	21.7
length of lower lobe	—	12.3	10.1	12.0
depth of notch	—	2.6	2.3	2.7
Trunk at pectoral origin:				
width	—	13.9	14.7	15.2
height	—	11.7	13.5	11.4