

Galeus longirostris, a New Species of the Sawtail Catshark from Japan

Hiroyuki Tachikawa and Toru Taniuchi

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Abstract *Galeus longirostris* sp. nov. is described based on 46 specimens taken off the southern part of Japan. It is distinguished from all known species of *Galeus* in having a considerably longer snout. This species is morphologically close to *G. nipponensis*, which commonly occurs off the southern part of Japan, but differs in having longer preoral length than the mouth width, a bluntly rounded snout, larger pectoral fins, a shorter interspace between anal and lower caudal fins, and a greater number of monospondylous vertebrae.

A specimen of the scyliorhinid shark genus *Galeus* was captured off the Ogasawara Islands in 1981. At a symposium on elasmobranchs held at the Ocean Research Institute, University of Tokyo, in 1982, Taniuchi reported that this might be an undescribed species since it possesses a longer snout than any other known species of *Galeus*. Since then, additional specimens of this long-snouted *Galeus* have been taken in considerable numbers from off the Izu Islands and off Amami-oshima.

According to a recent revision of Scyliorhinidae (Springer, 1979), eight species and three subspecies were included in *Galeus*. Compagno (1984b) recognized ten species as valid. *Galeus eastmani* (Jordan et Snyder), *G. nipponensis* Nakaya, and *G. sauteri* (Jordan et Richardson) have been reported to occur around Japan (Nakaya, 1975). However, our specimens do not fall into any species that have ever been reported, although they are close to *G. nipponensis* in having a long snout. Here we describe this new species of *Galeus* and present a key to the species of *Galeus* from Japan and adjacent waters.

Methods

Measurements follow Compagno (1984a) except for total length (TL). In this study, total length was measured with the caudal fin laid in natural position. Dermal denticles were observed by taking photographs with a scanning electron microscope. Vertebral counts were made according to Springer and Garrick (1964), based on soft X-ray radiographs.

Institution names are abbreviated as follows:

FUMT, Department of Fisheries, University Museum, University of Tokyo; HUMZ, Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University; UF, Florida State Museum, University of Florida; ZUMT, Department of Zoology, University Museum, University of Tokyo.

Galeus longirostris sp. nov.

(New Japanese name:
hashinaga-yamorizame)

(Fig. 1)

Holotype. FUMT-P 10000, female, 683 mm TL, near Amami-oshima (28°40'N, 128°44'E), Japan, 440–520 m in depth, bottom longline, Nov. 1, 1983.

Paratypes. FUMT-P 10021, female, 620 mm TL, Ogasawara Islands (ca. 27°10'N, 142°10'E), Japan, 1981; FUMT-P 10023, female, 776 mm TL, FUMT-P 10024, female, 783 mm TL, Izu Islands (31°00'N, 138°56'E or 32°50'N, 139°10'E), Japan, 330–550 m in depth, bottom longline, Nov. 16 or Nov. 17, 1982; FUMT-P 10001, male, 660 mm TL, near Amami-oshima (28°36'N, 128°42'E), Japan, 400–480 m in depth, bottom longline, Oct. 30, 1983; FUMT-P 10011, male, 702 mm TL, UF 44276, male, 684 mm TL, UF 44276, female, 656 mm TL, taken with the holotype.

Other materials. Females: FUMT-P 10022 (750 mm TL), FUMT-P 10025 (772 mm TL), FUMT-P 10026 (803 mm TL), taken with the paratype FUMT-P 10023; FUMT-P 10002 (602 mm TL), FUMT-P 10003 (548 mm TL), FUMT-P 10004 (536 mm TL), FUMT-P 10005 (679 mm TL), FUMT-P 10006 (600 mm TL), FUMT-P 10007 (532 mm TL), FUMT-P 10009 (616 mm TL), FUMT-P 10010 (674 mm TL), FUMT-P 10227 (691 mm TL), FUMT-P 10228 (694 mm TL), FUMT-P 10229 (523 mm in precaudal length), taken with the paratype FUMT-P 10001; FUMT-P 10012

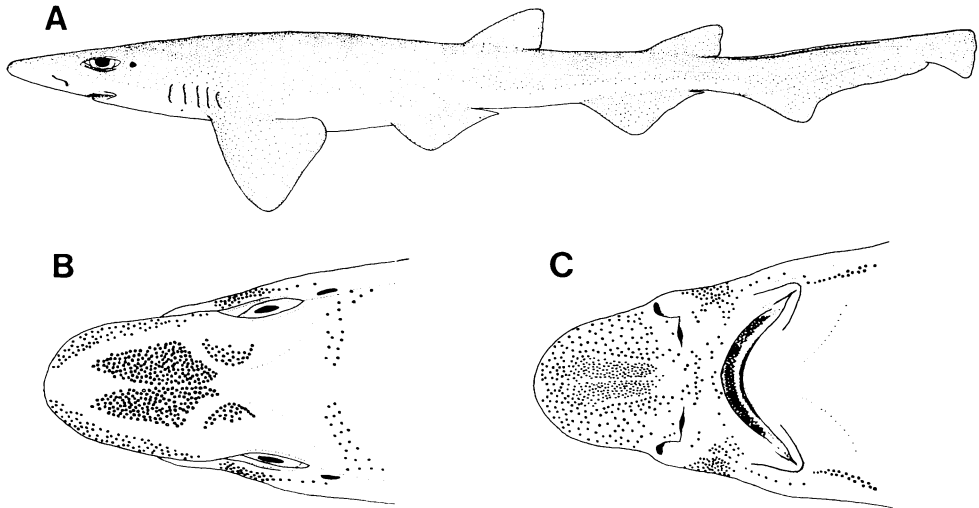


Fig. 1. Holotype of *Galeus longirostris* sp. nov., female, 683 mm TL, FUMT-P 10000. A, lateral view; B, dorsal view of head; C, ventral view of head.

(720 mm TL), FUMT-P 10013 (699 mm TL), FUMT-P 10015 (708 mm TL), FUMT-P 10016 (673 mm TL), FUMT-P 10018 (602 mm TL), FUMT-P 10019 (546 mm TL), FUMT-P 10020 (580 mm TL), FUMT-P 10021 (713 mm TL), FUMT-P 10230 (614 mm TL), FUMT-P 10231 (545 mm TL), FUMT-P 10232 (624 mm TL), FUMT-P 10233 (631 mm TL), FUMT-P 10234 (712 mm TL), FUMT-P 10235 (604 mm TL), FUMT-P 10236 (576 mm TL), FUMT-P 10237 (560 mm TL), FUMT-P 10238 (518 mm TL), FUMT-P 10239 (536 mm TL), FUMT-P 10240 (604 mm TL), FUMT-P 10241 (475 mm TL), FUMT-P 10242 (535 mm TL), taken with the holotype. Males: FUMT-P 10008 (611 mm TL), FUMT-P 10017 (705 mm TL, stained neurocranium and claspers), taken with the holotype; FUMT-P 10226 (681 mm TL), taken with the paratype FUMT-P 10001.

Diagnosis. A large *Galeus* (maximum length known is 803 mm TL) with long snout, broad pectoral fins, long interspace between pelvic and anal fins, and in adult males extremely long claspers. Dorsolateral body and caudal fin in adults uniformly dark gray, but in smaller specimens dark gray with obscure dark saddle blotches at 1st and 2nd dorsal bases and some obscure dark blotches on caudal fin. Ventral side whitish and inside of mouth grayish white. Snout long and bluntly rounded. Prenarial length longer than horizontal diameter of eye. Preoral length longer than mouth width. Pectoral fins large and broad, anterior margins 11.0–12.6% of total length.

Description. Proportional dimensions in percentage of total length are shown in Table 1. The following values are taken from the holotype. Numbers in parentheses show ranges of the paratypes.

Body moderately stout. Head depressed, width of trunk at pectoral origin greater than height. Caudal axis slightly elevated. Head 20.9 (19.5–21.3) % of TL. Snout long and flattened dorsoventrally, its tip blunt and rounded in dorsal view. Many mucous pores present above and below in head region. Preorbital length 2.6 (2.5–2.7), prenarial length 3.9 (3.9–4.2), preoral length 2.5 (2.5–2.6) in head. Nostrils large, anterior nasal flaps triangular, its anterior end nearer to front of mouth than to snout tip. Mouth wide and moderately arched, its width 1.1 (1.1–1.2) in preoral length. Labial furrows present around corner of upper and lower jaws, upper and lower furrows nearly equal in length, upper furrows not reaching level of symphysis. Eyes large and ovate, horizontal diameter of eye 2.1 (2.0–2.3) in preorbital length. Narrow subocular ridges present below eyes. Spiracles subcircular and moderately large, located behind orbit and slightly below level of horizontal axis of eye. Gill-openings short, the longest about 1/2 of horizontal diameter of eye, 5th behind insertion of pectoral fin.

Origin of first dorsal fin above posterior half of pelvic base. Origin of second dorsal fin above middle of anal base. First and 2nd dorsal fins large



Fig. 2. Dermal denticles of the trunk below 1st dorsal fin of the paratype of *Galeus longirostris* sp. nov., male, 702 mm TL, FUMT-P 10011. Scale indicates 0.5 mm.

and nearly the same in shape, but 2nd dorsal a little smaller than 1st. Overall length and base length of 2nd dorsal nearly equal to those of 1st dorsal, but its height 3/4 of the latter. Anterior margins of dorsal fins slightly convex, distal margins straight and at right angles to body axis. Pectoral fins large and broad, length of anterior margin 12.0 (11.0–12.9) % of TL, greatest width measured parallel to distal fin margin 11.4 (10.5–12.0), their apex moderately rounded, inner corners broadly rounded. Pelvic fins moderate, rear end of bases below anterior half of 1st dorsal base. Interspace between pectoral and pelvic fins 1/2 of length of dorsal lobe of caudal fin. In five mature males, length of claspers 15.7–17.2% of TL. Claspers extend beyond tip of pelvic fins by a distance two times of horizontal diameter of eye, their tip beyond origin of anal fin. Interspace between pelvic and anal fins a little longer than or subequal to anal base. Anal fin origin below halfway between 1st and 2nd dorsal fins. Anal fin base long and more than two times length of 2nd dorsal base, its height about 1/3 of overall length, its posterior tip beyond rear end of 2nd dorsal base. Interspace between anal and lower caudal fins shorter than preanial length. Caudal peduncle moderately compressed. Dorsal lobe length of caudal fin 26.2 (25.5–27.7) % of TL. About anterior three-fifths of dorsal margin of caudal fin with crest of modified denticles. No enlarged denticles on ventral margin of caudal fin and lower side of caudal peduncle.

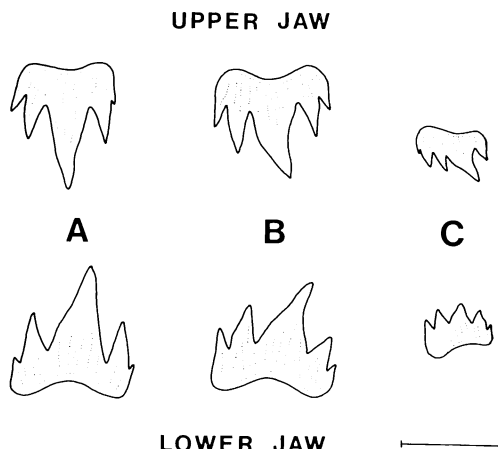


Fig. 3. Teeth from left jaw of the holotype of *Galeus longirostris* sp. nov., female, 683 mm TL, FUMT-P 10000. A, teeth near symphysis; B, teeth from midjaw; C, teeth near mouth corner. Scale indicates 1 mm.

Dermal denticles of trunk below 1st dorsal fin small and imbricated in adults. Each denticle three cusped with primary cusp the longest. Honeycomb microsculptures present on the surface of denticles (Fig. 2) as those of several other species of Scyliorhinidae and Squalidae (Hardy, 1985; Taniuchi and Garrick, 1986). Denticles absent on ventral side of the caudal fin crest, around cloaca, behind bases of 1st and 2nd dorsal fins, and axillae of pectoral fins. Claspers naked except distal 2/3 of the ventral side.

Teeth small, crowded, with 60–70 rows in each jaw and several series functional. Each tooth with three to six cusps and about the same in shape in both jaws (Fig. 3).

Colour of dorsolateral side dark gray and no prominent colour pattern in adult. In smaller specimens, obscure dark saddle blotches at 1st and 2nd dorsal bases, and some obscure dark blotches on caudal fin. Dorsal fins and dorsal side of pectoral fins dark gray with very narrow white margins, but these white margins sometimes absent. Anal fin and dorsal side of pelvic fins grayish. Claspers grayish with darker dorsal side. Ventral surface of body and paired fins whitish, sometimes stained with diffused dark spots on pectoral fins. Inside of mouth grayish white.

Number of monospondylous vertebrae 42 (40–45), precaudal 94 (91–97).

Table 1. Proportional dimensions in percentage of total length of *Galeus longirostris* sp. nov.

Catalogue number	Holotype			Paratypes			UF 44276	UF 44276
	FUMT- P 10000	FUMT- P 10001	FUMT- P 10011	FUMT- P 10021	FUMT- P 10023	FUMT- P 10024		
Sex	♀	♂	♂	♀	♀	♀	♂	♀
Total length (mm)	683	660	702	620	776	783	684	656
Snout tip to:								
outer nostrils	5.4	5.0	5.1	5.2	5.0	5.0	5.0	5.5
eye	7.9	8.0	7.8	8.1	7.7	7.5	7.6	8.5
spiracle	12.3	12.3	12.3	12.6	11.6	11.5	11.5	12.8
mouth	8.3	8.3	8.3	8.1	8.2	7.9	7.9	8.4
1st gill-opening	16.8	16.5	17.2	16.6	16.1	16.1	15.7	17.2
5th gill-opening	20.9	20.8	20.5	21.1	20.7	19.5	20.8	21.3
pectoral origin	20.4	20.0	19.9	20.3	20.1	18.9	20.3	20.1
pelvic origin	39.5	41.2	38.6	41.0	41.0	41.1	40.2	38.7
1st dorsal origin	46.3	45.2	45.6	45.2	46.1	46.5	46.5	45.4
2nd dorsal origin	65.2	64.1	64.7	65.5	64.4	65.8	66.1	64.3
anal fin origin	58.9	57.3	57.5	60.6	57.3	59.9	59.4	57.6
upper caudal origin	74.7	72.6	74.4	74.4	72.4	73.7	73.8	73.3
Distance between bases:								
1st and 2nd dorsal	12.6	13.9	13.7	14.2	13.1	13.7	14.2	12.5
2nd dorsal and caudal	3.4	3.9	4.1	3.7	2.8	2.8	2.9	3.7
pectoral and pelvic	13.0	15.2	14.5	16.1	16.5	16.2	14.6	12.7
pelvic and anal	10.4	8.8	9.5	11.3	9.4	10.7	10.5	11.1
anal and caudal	3.1	3.9	3.3	4.7	4.4	4.3	3.9	3.4
Interspace of nostrils	2.6	2.7	2.4	2.6	2.4	2.6	2.2	2.4
Mouth width	7.6	7.1	7.2	7.7	7.3	7.3	7.5	7.6
Labial furrow lengths:								
upper	2.5	2.3	2.3	2.3	2.3	2.3	2.2	2.1
lower	2.5	2.6	2.6	2.3	2.7	2.6	2.3	2.3
Gill-opening lengths:								
1st	1.6	2.0	1.6	2.1	1.5	1.5	1.8	1.7
5th	1.3	1.8	1.4	1.5	1.5	1.3	1.3	1.2
Horizontal diameter of eye	3.8	3.6	3.6	4.0	3.5	3.6	3.4	3.7
1st dorsal fin:								
overall length	8.9	8.0	8.1	8.5	8.8	9.1	8.0	8.8
base length	6.1	5.8	5.4	6.3	6.1	6.0	5.7	6.1
height	4.2	4.8	5.0	5.6	5.0	5.6	4.8	5.3
2nd dorsal fin:								
overall length	8.2	7.9	8.0	8.1	7.7	8.0	7.6	8.2
base length	6.0	4.8	5.0	5.5	5.3	5.6	5.6	5.6
height	3.5	3.3	3.7	4.0	3.6	4.6	3.8	4.0
Anal fin:								
overall length	13.6	12.0	14.0	11.6	12.5	13.4	12.7	14.3
base length	12.4	10.5	12.4	10.2	10.8	11.5	11.4	12.7
height	4.5	4.2	4.6	3.9	4.1	4.5	4.2	4.6
Pectoral fin:								
base length	7.2	7.7	6.7	7.1	7.0	6.6	6.4	6.7
anterior margin length	12.0	11.7	11.4	11.9	11.5	12.0	12.3	11.9
Pelvic fin:								
overall length	11.4	13.5	12.8	11.8	11.0	11.5	13.9	11.6
Caudal fin:								
dorsal lobe length	26.2	27.6	26.9	25.5	27.7	26.7	26.8	27.3
ventral lobe length	8.6	9.1	9.1	9.0	9.1	8.8	8.8	9.1

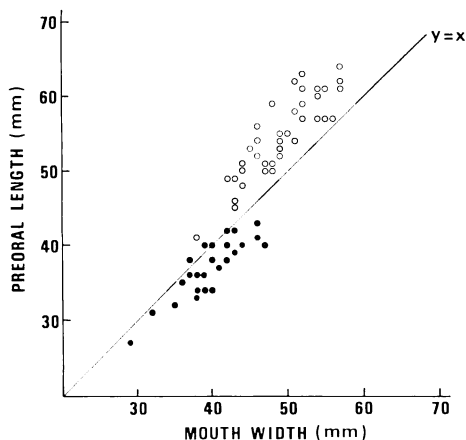


Fig. 4. Relationship between mouth width and preoral length for two species of *Galeus*. Open circle, *G. longirostris* sp. nov.; solid circle, *G. nipponensis*.

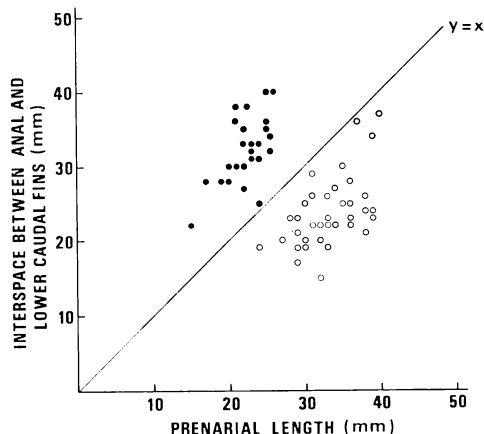


Fig. 6. Relationship between prenarial length and interspace between anal and lower caudal fins for two species of *Galeus*. Open circle, *G. longirostris* sp. nov.; solid circle, *G. nipponensis*.

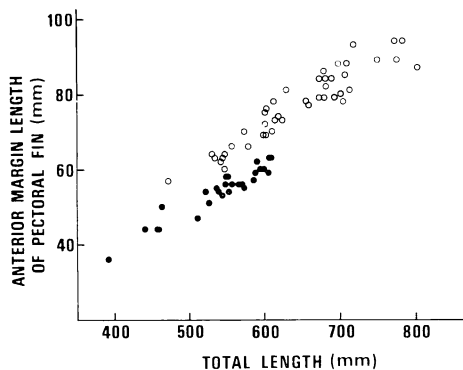


Fig. 5. Relationship between total length and anterior margin length of pectoral fin for two species of *Galeus*. Open circle, *G. longirostris* sp. nov.; solid circle, *G. nipponensis*.

Etymology. A combination of the Latin name “longus” long and “rostrum” beak or snout refers to the long snout.

Distribution. *G. longirostris* is distributed in Amami-oshima, the Ogasawara Islands, and the Izu Islands up to now. Forty and five specimens were collected with bottom long lines off Amami-oshima and the Izu Is. respectively. Only one specimen was taken off the Ogasawara Is.

Reproduction. Among the specimens examined internally (not type specimens), females larger than 673 mm TL had developed ovaries with ova 17–20 mm in diameter, large shell glands, and thickened oviducts, although no egg cases or embryos were found. Females smaller than 616 mm

TL had small undeveloped ovaries.

Five males, 660–705 mm TL, were considered to be mature because they had large and hard claspers. Claspers of a 611 mm TL male had not completely hardened, so this specimen is regarded as maturing.

Remarks. Specimens of *G. longirostris* collected from the three localities show some geographical variations in external features: a single specimen from off the Ogasawara Is. has the anal fin in a slightly posterior position (snout tip to anal fin origin 60.6% of TL; others 56.2–59.9%) and smaller caudal fin (length of dorsal lobe 25.5% of TL; others 26.2–28.6). However, the differences seem to come from the shrunken condition of the specimen. The specimens from Amami-oshima show a dark diffused stain on the ventral side of pectoral fins. Except for these slight differences, they share all other features so that we regard them as a single species.

G. longirostris is morphologically close to another Japanese species, *G. nipponensis*. The two species share the following characters: long snout with prenarial length longer than horizontal diameter of eye; long interspace between pelvic and anal fins (8.5–11.3% of TL in *G. longirostris* and 9.8–11.8% of TL in *G. nipponensis*); long claspers (in mature males, tip of claspers beyond origin of anal fin); and large body size (attain at least 60 cm). However, *G. longirostris* is clearly separable from *G. nipponensis* in having: bluntly rounded snout and longer preoral length than

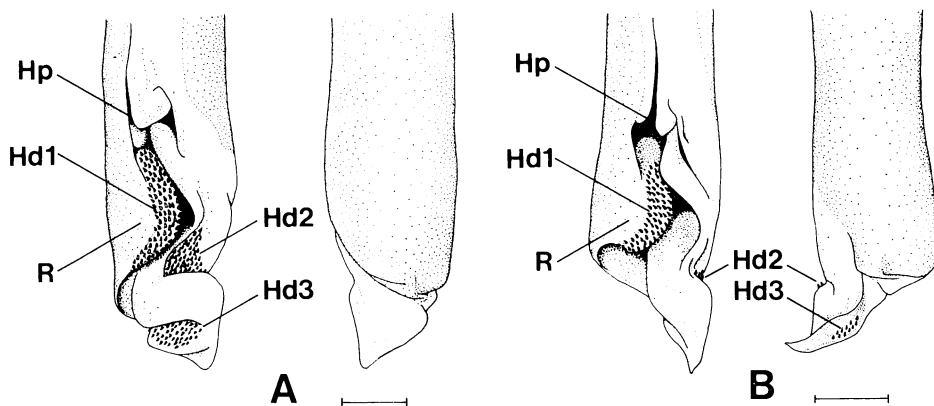


Fig. 7. Distal end of left clasper of: A, *Galeus longirostris* sp. nov., male, 705 mm TL, FUMT-P 10020; B, *G. nipponensis*, male, 571 mm TL, FUMT-P 10031. For each species, dorsal view is shown on left and ventral view on right. Hd 1–3, hooked denticles 1–3; Hp, hypopyle; R, rhipidion. Each scale indicates 5 mm.

mouth width (in *G. nipponensis*, snout rather pointed and preoral length equal to or slightly shorter than mouth width) (Fig. 4); anterior margin of pectorals 11.0–12.9% of TL (9.2–10.8% in *G. nipponensis*) (Fig. 5); interspace between anal and lower caudal fins shorter than preanal length (vs. longer than preanal length) (Fig. 6); number of monospondylous vertebrae 40–45 (vs. 38–40) (Table 2).

In addition, *G. longirostris* and *G. nipponensis* are different in the claspers (Fig. 7). Three groups of enlarged hooked denticles (Hd1–3) exist in both species but their distribution patterns differ greatly. In *G. nipponensis*, Hd2 and Hd3 are hidden in the fleshy folds and are difficult to observe unless the folds are opened while those of *G. longirostris* are partly exposed and can be observed without opening the folds. Hd3 of *G. longirostris* is composed of many (more than 60) hooked denticles whereas that of *G. nipponensis* consists of fewer (about 10) denticles. These hooked denticles may function as

attaching organs during copulation (Leigh-Sharpe, 1920, 1926; Schmidt, 1930). Accordingly, these differences are regarded to arise from reproductive segregation, which is one of the important factors of speciation.

Most species of *Galeus* are small in size but *G. longirostris* attains at least 80 cm TL. Although *G. melastomus* Rafinesque is said to attain 80–90 cm (Compagno, 1984b), it differs from *G. longirostris* in having a well defined dorsal coloration with dark saddle blotches and spots and much shorter interspace between pelvic and anal fins.

G. longirostris differs from other species of *Galeus* in the following characters: from *G. murinus* (Collett) and *G. boardmani* (Whitley) in having no crest of enlarged denticles on the pre-ventral caudal margin (Compagno, 1984b); from *G. arae* (Nichols), *G. eastmani*, *G. piperatus* Springer et Wagner, *G. polli* Cadenat, *G. sauteri*, and *G. schultzi* Springer in longer interspace between pelvic and anal fins which is subequal to or longer

Table 2. Numbers of monospondylous vertebrae in species of *Galeus* from Japan and adjacent waters.

Species	Number of monospondylous vertebrae														
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
<i>G. sauteri</i> *	2	3	4	2											
<i>G. eastmani</i> *				4	5	2									
<i>G. nipponensis</i>							1	6	10	2					
<i>G. longirostris</i>										3	5	12	1		1

* Data from Nakaya (1975).

than anal fin base while it is much shorter than anal base in these six species (Jordan and Richardson, 1909; Jordan and Snyder, 1904; Nichols, 1927; Springer, 1979; Springer and Wagner, 1966; Compagno, 1984b), high monospondylous vertebral count (33–39 in *G. arae*; 33–36 in *G. eastmani*; 29–33 in *G. piperatus*; 32–35 in *G. polli*; 31–34 in *G. sauteri*; 32–33 in *G. schultzi*, according to Compagno (1984b) and Nakaya (1975)), and larger body size.

**Key to the species of *Galeus*
from Japan and adjacent
waters**

- 1A. Anal fin base 12–15% of total length; height of 2nd dorsal fin 2.3–3.0% of total length; body plain-colored and without dark stain except tips of dorsal and caudal fins; number of monospondylous vertebrae 31–34. *G. sauteri* (Jordan et Richardson) (Japanese name: taiwan-yamorizame)
- 1B. Anal fin base 8–13.5% of total length; height of 2nd dorsal fin 3.2–5.2% of total length; body either plain-colored or with dark saddle blotches; number of monospondylous vertebrae 32–42. 2
- 2A. Snout short, prenarial length shorter than horizontal diameter of eye; claspers short, not reaching anal fin origin even in adults; number of monospondylous vertebrae 34–36; small in size, total length less than 50 cm *G. eastmani* (Jordan et Snyder) (Japanese name: yamorizame)
- 2B. Snout long, prenarial length longer than horizontal diameter of eye; claspers long and beyond anal fin origin in adults; number of monospondylous vertebrae 38–45; large in size, total length more than 60 cm 3
- 3A. Dorsal side of body with dark saddle blotches; snout long and rather pointed; preoral length shorter than or about equal to mouth width; interspace between anal and lower caudal fins longer than prenarial length; number of monospondylous vertebrae 38–40. *G. nipponensis* Nakaya (Japanese name: nihon-yamorizame)
- 3B. Dorsal side of body usually plain-colored, sometimes with obscure dark saddle blotches on 1st and 2nd dorsal base; snout very long

and broadly rounded; preoral length longer than mouth width; interspace between anal and lower caudal fins shorter than prenarial length; number of monospondylous vertebrae 40–45. *G. longirostris* sp. nov. (New Japanese name: hashinaga-yamorizame)

Comparative materials

G. nipponensis. Paratypes: HUMZ 40000 (female, 518 mm TL), HUMZ 40004 (female, 572 mm TL), Kii Suido Channel, Dec. 21, 1972; HUMZ 40002 (male, 752 mm TL), Mimase, Oct. 13, 1972. Other materials: FUMT-P 10027 (female, 607 mm TL), off Choshi, June 24, 1977; FUMT-P 10028 (female, 465 mm TL), FUMT-P 10029 (female, 550 mm TL), off Choshi, Feb. 28, 1982; FUMT-P 10030 (female, 550 mm TL), FUMT-P 10031 (male, 571 mm TL), stained neurocranium and claspers, FUMT-P 10032 (female, 392 mm TL), off Choshi, Apr. 23, 1982; FUMT-P 10033 (female, 411 mm TL), FUMT-P 10034 (female, 458 mm TL), off Choshi, Apr. 24, 1982; FUMT-P 10035 (female, 574 mm TL), FUMT-P 10036 (female, 595 mm TL), FUMT-P 10037 (female, 523 mm TL), FUMT-P 10038 (male, 546 mm TL), FUMT-P 10039 (female, 588 mm TL), FUMT-P 10040 (female, 606 mm TL), FUMT-P 10041 (male, 552 mm TL), FUMT-P 10042 (female, 527 mm TL), FUMT-P 10043 (female, 537 mm TL), FUMT-P 10044 (male, 512 mm TL), FUMT-P 10045 (male, 458 mm TL), off Choshi, June 16, 1982; FUMT-P 10052 (male, 544 mm TL), FUMT-P 10053 (male, 588 mm TL), FUMT-P 10054 (male, 565 mm TL), FUMT-P 10055 (male, 548 mm TL), FUMT-P 10056 (male, 592 mm TL), FUMT-P 10057 (male, 611 mm TL), off Shimoda, 1985.

G. sauteri. ZUMT 6395 (female, 443 mm TL), Nagasaki, 1915.

G. eastmani. ZUMT uncatalogued (male, 338 mm TL).

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- (Department of Fisheries, Faculty of Agriculture, University of Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113, Japan; Present address of HT: Ogasawara Marine Center, Byobudani, Chichijima, Ogasawara-mura, Tokyo 100-21, Japan)
- 日本近海産トラザメ科の新種ハシナガヤモリザメ *Galeus longirostris*
- 立川浩之・谷内 透
- 奄美大島・小笠原諸島・伊豆諸島近海から得られた標本をもとに、トラザメ科ヤモリザメ属の新種ハシナガヤモリザメ *Galeus longirostris* を記載した。本種はヤモリザメ属の既知種のうちニホンヤモリザメ *G. nipponensis* に最もよく似るが、口前吻長が口幅より長いこと、吻が円鈍なこと、胸鰭が大きいこと、臀鰭と尾鰭下葉の間隔が短いこと、単椎骨数が多いことなどにより後者と区別される。
- (113 東京都文京区弥生 1-1-1 東京大学農学部水産学科; 立川, 現住所; 100-21 東京都小笠原村父島宇屏風谷 小笠原海洋センター)