

## Records of *Apristurus herklotsi* (Lamniformes, Scyliorhinidae) and Discussion of its Taxonomic Relationships

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**Abstract** Additional specimens of the rare *Apristurus herklotsi* are reported, and the characteristic features of this species are discussed. *A. herklotsi* is concluded to be a distinct species, having a very long snout, a narrow distance between the nostrils, a long caudal fin, a short abdomen, numerous teeth on both jaws, and a low number of monospondyloous vertebrae. *A. herklotsi* appears to be mature at about 44 cm in total length.

The genus *Apristurus* Garman, 1913, contains at least 36 species, but the status and relationships of many of these species are still poorly known or confused. Since the revisional works by Nakaya (1975), Springer (1979) and Compagno (1984) on the genus, many new species have been described from Chinese and Japanese waters (Chu et al., 1981; Deng et al., 1983, 1985; Meng et al., 1985; Dolganov, 1985; Chu et al., 1986). Despite these recent studies, *Apristurus* species from these waters is still confusing, necessitating further revision.

One of these species is *Apristurus herklotsi* (Fowler, 1934), described from the waters of Cagayan Island in the Jolo Sea, Philippines, and based on a single immature female (USNM 93134); this type specimen had been the only known specimen of the species. Recently, I was able to

examine samples of *Apristurus* from various waters around Japan, and found specimens of this rare species, *A. herklotsi*, among them.

The purposes of the present paper are, therefore, to report additional specimens of *Apristurus herklotsi*, to give a fuller description of the species, and to discuss its taxonomic relation to other species, particularly *A. longicephalus*.

### *Apristurus herklotsi* (Fowler, 1934)

(New Japanese name: Yari-herazame)

*Pentanchus herklotsi* Fowler, 1934: 238, fig. 3 (original description); 1941: 55 (description).

*Apristurus herklotsi*: Springer, 1979: 18 (description); Compagno, 1984: 265 (description).

*Apristurus longicephalus* (in part): Nakaya, 1984: 42, 43, 296 (description).

**Materials.** *A. herklotsi*: 9 specimens (317.0–485.)

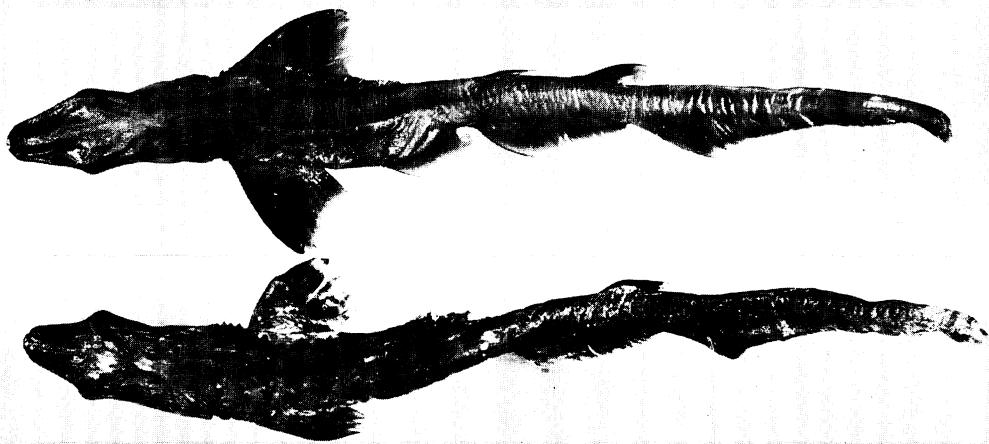


Fig. 1. *Apristurus herklotsi* (above, FUMT-P 10142) and *A. longicephalus* (below, BSKU 33518).

mm TL). USNM (U. S. National Museum of Natural History) 93134 (holotype, 326.0 mm TL, female), 9°37'05"N, 121°12'37"E, Cagayan Island, Jolo Sea, Philippines, Mar. 3, 1909; BSKU (Department of Biology, Faculty of Science, Kochi University) 23110 (317.0 mm TL, female), BSKU 23109 (318.0 mm TL, female), 33°09'N, 133°39.6'E, Tosa Bay, 615 m, Jan. 25, 1975; BSKU 26674 (320.0 mm TL, male), 30°01.8'N, 128°21.9'E, Okinawa Trough, East China Sea, 900 m, Feb. 3, 1978; BSKU 27598 (350.0 mm TL, male),

Table 1. Proportional measurements and counts for *Apristurus herklotsi* and *A. longicephalus*. Measurements are shown in percent of total length.

Total length (mm)	<i>A. herklotsi</i>		<i>A. longicephalus</i>
	Holotype 326.0	Other specimens 317.0-485.0 (8 specimens)	274.0-501.0 (21 specimens)
Snout tip to:			
anterior nostril	7.9	7.4-8.6	6.4-7.9
posterior nostril	10.3	9.6-11.0	8.3-10.0
mouth	12.3	12.3-14.3	10.7-12.2
eye	13.9	12.6-14.2	11.2-13.5
1st gill opening	21.7	20.0-21.5	19.0-22.4
5th gill opening	24.4	22.6-25.0	22.7-26.7
1st dorsal origin	46.6	43.1-49.1	42.0-47.1
2nd dorsal origin	57.4	54.1-58.8	54.0-59.1
anal origin	48.8	46.7-49.0	46.1-49.8
lower caudal origin	64.7	61.9-64.7	61.2-65.7
pelvic origin	37.7	36.6-39.0	35.4-41.2
pectoral origin	24.0	22.7-25.1	22.9-25.8
Head width (at mouth corner)	10.2	8.1-10.9	8.6-10.9
Horizontal diameter of eye	3.0	2.9-3.3	2.6-3.3
Mouth width	8.4	7.0-9.1	6.9-9.2
Internostril width	4.0	3.2-3.8	3.7-4.6
Interorbital width	6.8	5.6-6.4	5.3-6.5
Labial fold:			
upper	3.3	3.0-3.8	3.0-3.9
lower	2.9	2.7-3.6	2.3-3.6
Interspace between:			
1st and 2nd dorsal fins	7.1	4.3-6.1	6.1-8.8
pelvic and caudal fins	18.0	17.6-19.3	17.2-21.3
nostril to mouth	2.2	2.2-2.8	1.7-2.4
Distance between:			
origins of paired fins	14.4	14.4-16.1	13.6-16.5
First dorsal fin:			
vertical height	1.3	1.1-1.6	1.4-1.9
base length	4.7	4.6-6.4	3.7-5.5
Second dorsal fin:			
vertical height	2.4	2.0-2.7	2.2-2.8
base length	6.1	5.5-7.7	4.4-6.6
Anal fin:			
vertical height	3.7	2.7-4.0	2.7-3.6
base length	16.3	14.6-16.58	14.6-16.8
Caudal fin:			
lower caudal origin to tip	35.6	34.1-37.2	34.1-38.6
Teeth:			
upper	53	49-57	36-44
lower	56	49-58	31-41
Monospondylous vertebrae	28	31-33	30-33

28°44'N, 127°01'E, Okinawa Trough, East China Sea, 610–640 m, Mar. 11, 1978; BSKU 27882 (437.0 mm TL, female), 28°45'N, 127°17'E, Okinawa Trough, East China Sea, 520–542 m, Mar. 16, 1978; FUMT-P (Department of Fisheries, University Museum, University of Tokyo) 10143 (373.0 mm TL, male), FUMT-P 10142 (485.0 mm TL, female), FUMT-P 10144 (438.0 mm TL, female), Choshi Fish Market, Chiba Pref., Feb. 28, 1982.

**Comparative materials.** *A. longicephalus*: HUMZ (Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University) 42399 (holotype, 367.0 mm TL, male), and 20 other specimens (274.0–501.0 mm TL, males and females), taken from southern Japan.

*A. platyrhynchus*: 30 specimens (280–739 mm TL, males and females), taken from southern Japan.

**Description.** Measurements are taken according to the method of Bigelow and Schroeder (1948). Proportional measurements and counts are shown in Table 1.

Body thin and very slender (Fig. 1). Snout very long and greatly flattened (Figs. 2, 3); snout length before nostrils not less than 7.4% TL even in the largest specimen (485 mm TL, Fig. 4), and much greater than interorbital width. Snout length before mouth 12.3–14.3% TL (Fig. 5). Head slender and narrow; width at mouth corners not more than 10.9% TL even in the smallest

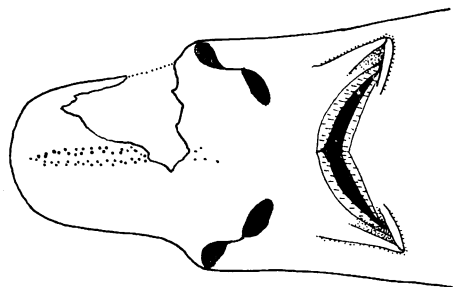


Fig. 2. Head of the holotype of *Apristurus herklotsi* (USNM 93134).

specimen (317 mm TL). Nostrils oblique and rather small; nostril diameter less than 4% TL even in the smallest specimen; interspace between nostrils narrow and less than 4% TL (Fig. 6), about equal to nostril diameter or smaller than depth of caudal peduncle. Nostril separated from mouth lip by a distance greater than half of interspace between nostrils. Pores of Lorenzini's ampullae small and rather inconspicuous; those on ventral midline of snout arranged in a few rows, and those on dorsal side in several rows posteriorly and fewer rows anteriorly. Mouth with well developed labial grooves; the upper groove longer than the lower, reaching beyond middle of in-

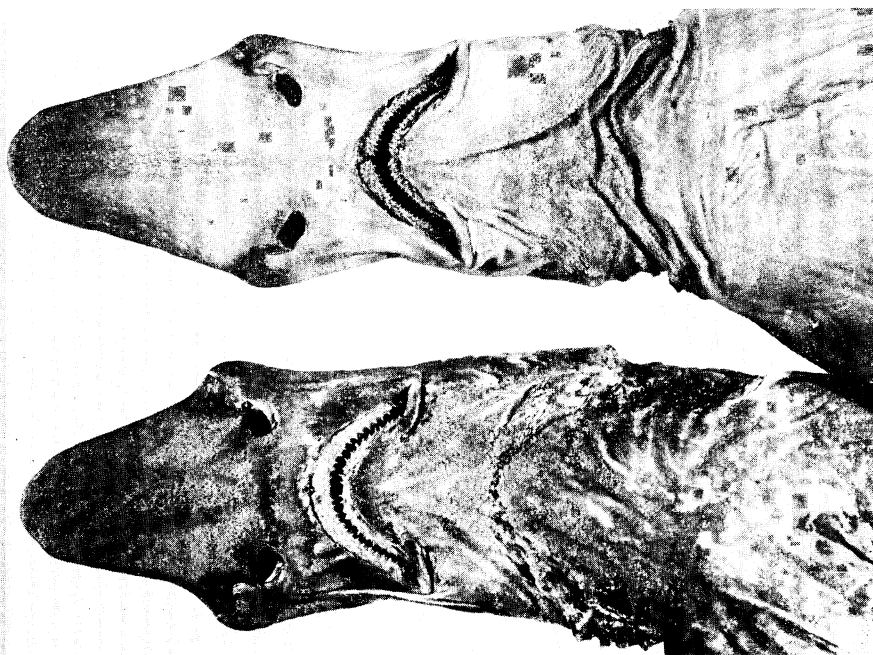


Fig. 3. Ventral views of the heads of *Apristurus herklotsi* (above, FUMT-P 10142) and *A. longicephalus* (below, BSKU 33518).

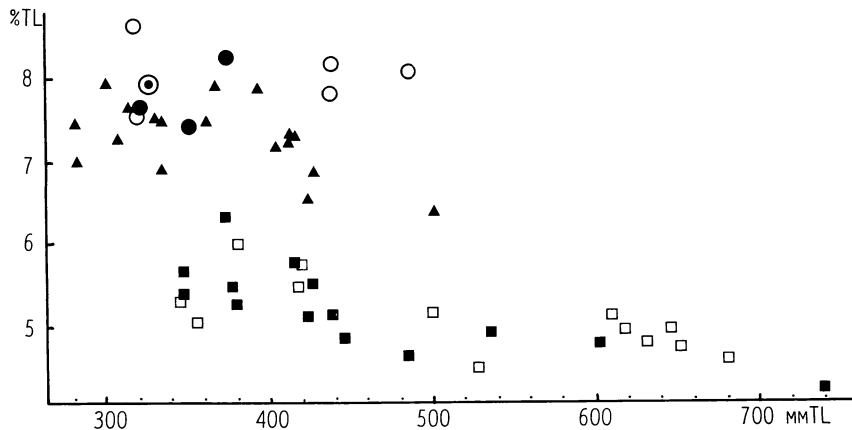


Fig. 4. Ontogenetic changes of proportional length from snout tip to anterior nostril in *Apristurus herklotsi* (circles), *A. longicephalus* (triangles) and *A. platyrhynchus* (squares). Double circle indicates holotype of *A. herklotsi*. Closed symbols are males and open symbols are females.

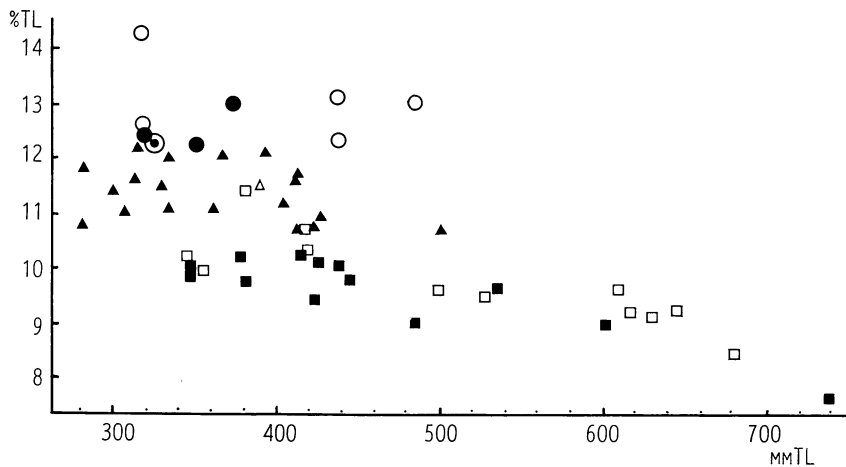


Fig. 5. Ontogenetic changes of proportional length from snout tip to mouth in *Apristurus herklotsi* (circles), *A. longicephalus* (triangles) and *A. platyrhynchus* (squares). Double circle indicates the holotype of *A. herklotsi*. Closed symbols are males and open symbols are females.

terspace between mouth corner and posterior margin of nostril. Eye small with a weak subocular fold. Spiracle moderate, behind orbit and slightly below level of horizontal axis of eye. Five small gill openings with 5th, or 4th and 5th openings above pectoral base. Pectoral fin relatively large, its inner tip reaching beyond middle point of interspace between bases of paired fins, or almost reaching to pelvic origin in some specimens. Distance between origins of pectoral and pelvic fins very short, less than 17% TL and a little longer than snout length. Interspace between pectoral and pelvic fins very short, about equal to

pectoral base or less. Pelvic fin anterior in position, located at anterior 2/5 of body or before. Interspace between pelvic and anal fins very short. Anal fin origin located a little before middle of body below base of 1st dorsal fin, but anal origin below posterior end of 1st dorsal base in some specimens. Anal fin base moderately long, but very low in height; posterior end of anal base always behind that of 2nd dorsal base; outer margin straight. First dorsal origin above pelvic base in most specimens, but a little behind pelvic base in some; first dorsal base usually ending above anal base, but above anal origin in some.

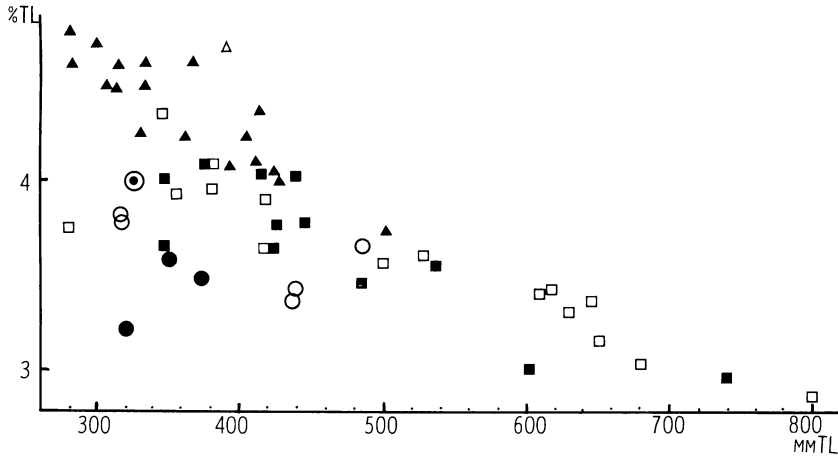


Fig. 6. Ontogenetic changes of internostril width in *Apristurus herklotsi* (circles), *A. longicephalus* (triangles) and *A. platyrhynchus* (squares). Double circle indicates the holotype of *A. herklotsi*. Closed symbols are males and open symbols are females.

Second dorsal base always entirely above anal base, and posterior end of 2nd dorsal base before that of anal base. First dorsal fin about two thirds of 2nd dorsal fin in size. Caudal fin very long; length from lower caudal origin to tip longer than 1/3 of total length even in adults; axis almost straight; its lower anterior corner not greatly expanded; distinct subterminal notch present. Anal fin and caudal fin separated only by a notch.

Dermal denticles on body small, weak and velvety to touch; denticles on dorsolateral surfaces of trunk with three cusps and a strong central ridge (Fig. 7). Denticles on dorsal margin of caudal fin normal and not enlarged.

Teeth (Fig. 8) very small and numerous on both jaws; teeth on upper jaw slender with a long central cusp and a few lateral cusps on both sides; teeth on lower jaw similar to upper teeth, but central cusp shortened in teeth toward sides of jaws, so that lateral teeth are fan-shaped. Teeth numerous; number of vertical rows along entire jaw 49-57 on upper jaw, 49-58 on lower jaw (Fig. 9); only two or three series functional.

Number of monospondylous vertebrae 28-33.

Three male specimens (320-373 mm TL) have short undeveloped claspers, which are less than 2% TL. The female of 438 mm TL, and the smaller females, have small undeveloped ovaries, except for one specimen of 437 mm TL in which large eggs are present in the ovary; developed shell glands are present in a 485 mm TL female. Egg cases unknown.

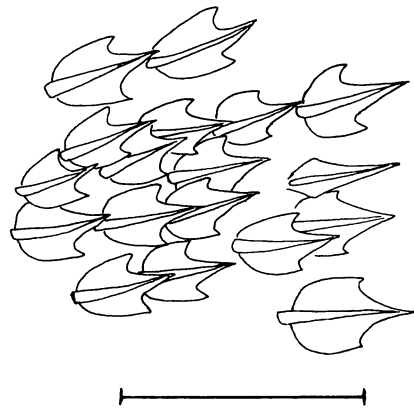


Fig. 7. Dermal denticles on dorsolateral side of trunk in *Apristurus herklotsi* (BSKU 27882). Scale is 1 mm.

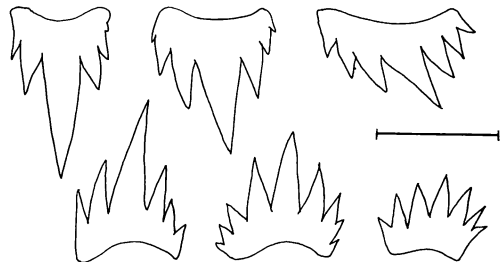


Fig. 8. Third, 10th and 20th left teeth (from left to right) on upper and lower jaws in *Apristurus herklotsi* (FUMT-P 10142). Scale is 1 mm.

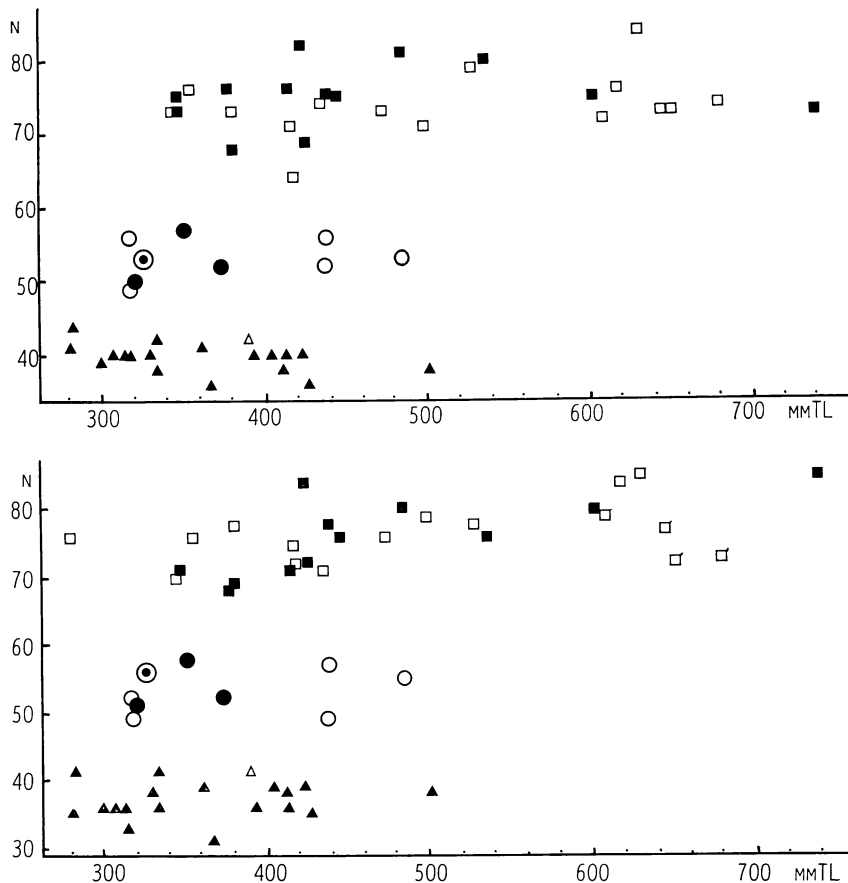


Fig. 9. Number of vertical rows of teeth on upper (above) and lower (below) jaws in *Apristurus herklotsi* (circles), *A. longicephalus* (triangles) and *A. platyrhynchus* (squares). Double circle indicates the holotype of *A. herklotsi*. Closed symbols are males and open symbols are females.

Color of body and fins generally brownish to blackish brown; sides of body paler below lateral line than above. Leading edges of fins blackish. Inside of mouth blackish.

**Distribution.** Choshi, Tosa Bay off Shikoku Island, East China Sea (Okinawa Trough) and the Philippines.

**Discussion**

Fowler (1934) figured *Apristurus herklotsi* in his original description, but the figure and text do not give much information on the species. Springer (1979) and Compagno (1984), when reviewing the genus *Apristurus*, only described the type specimen of *herklotsi*. Therefore, *A. herklotsi* has remained one of the very poorly known species in the genus.

Recently, at the U.S. National Museum, I examined the holotype of *herklotsi*, which is now in bad condition with the head region dissected and broken. Despite this, the species was found to be characterized by having a remarkably long snout, short abdomen and long caudal fin. These characters are also shared by *longicephalus*, *abbreviatus*, *xenolepis*, *longianalis*, *brevicaudatus* and *longicaudatus* from Chinese and Japanese waters, which further resemble *herklotsi* in general external morphology and tooth counts.

Using the extensive taxonomic information given for *longicephalus* (Nakaya, 1988), it is now possible to compare *herklotsi* with *longicephalus*; the results are summarized below. To show the general tendencies of ontogenetic changes and variation, I include the data of *A. platyrhynchus* in the figures. Ontogenetic changes and relative

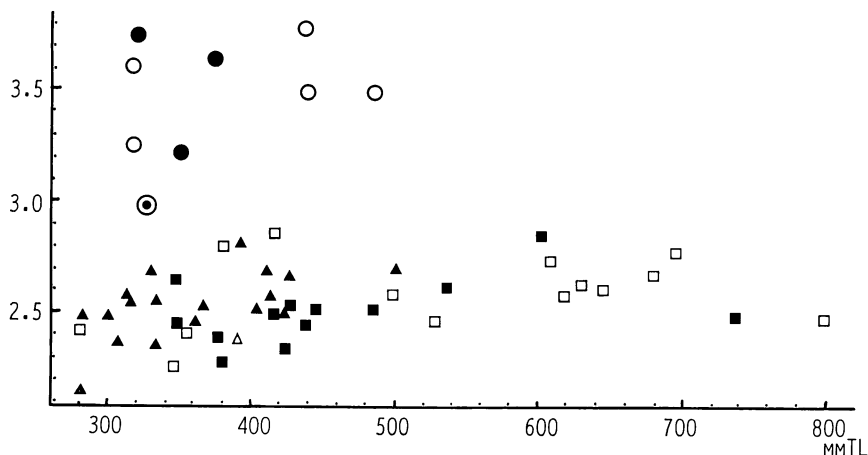


Fig. 10. Ontogenetic changes of ratio of internostril width in length from snout tip to upper lip in *Apristurus herklotsi* (circles), *A. longicephalus* (triangles) and *A. platyrhynchus* (squares). Double circle indicates the holotype of *A. herklotsi*. Closed symbols are males and open symbols are females.



Fig. 11. Enlargement of mouth part, showing differences in the tooth arrangement in males of *Apristurus herklotsi* (right, BSKU 27598, 350 mm TL) and *A. longicephalus* (left, BSKU 22338, 334 mm TL).

growth for *herklotsi* are generally the same as those for *longicephalus*. The numbers of vertical rows of jaw teeth do not change with growth (Fig. 9). Although a very long snout is one of the distinctive characters in these two species, *herklotsi* has a far longer snout than *longicephalus* (Figs. 4, 5). The head is more slender in *herklotsi* (Fig. 3). Internostril width is always narrower in *herklotsi* than in *longicephalus* (Figs. 3, 6), and the nostrils are more distant from the mouth in the former species (Fig. 3). Interorbital widths are almost the same in both species throughout life. Distance between origins of pectoral and pelvic fins is very short in both species (Fig. 1). Interspace between dorsal fins is shorter in *herklotsi* than in *longicephalus*, and the bases of the fins are longer

in *herklotsi*. Caudal fins are very long even in adults, being more than one third of total length in both species. *A. herklotsi* has more rows of teeth on the jaws than does *longicephalus* (Fig. 9). Both species have about the same numbers of monospondylous vertebrae (28–33 in *herklotsi* and 30–33 in *longicephalus*), and these are the lowest numbers in the species of the genus.

Although the specimens of *longicephalus* used in Nakaya (1988) were mostly males, and the present specimens of *herklotsi* are mostly females, two groups of specimens of each species, with specimens of different sexes, are apparently different in some characters, as shown above. The specimens of these two species overlap in terms of specimen size, i.e. total length. Therefore,

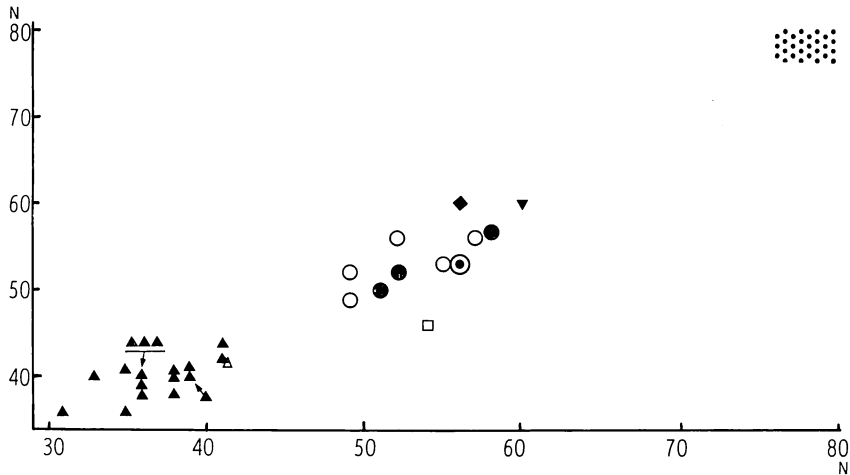


Fig. 12. Interrelation of number of vertical rows of upper (Y axis) and lower (X axis) teeth. *Apristurus herklotsi* (circles), *A. longicephalus* (triangles), *A. xenolepis* (square), *A. abbreviatus* (diamond), *A. brevicaudatus* and *A. longicaudatus* (inverted triangle), *A. longianalis* (dotted). Double circle indicates the holotype of *A. herklotsi*. Closed symbols are males and open symbols are females.

it is concluded that the differences between *herklotsi* and *longicephalus* mentioned above are specific ones.

*A. longicephalus* becomes mature at 42 cm TL (Nakaya, 1988), and the available data on the ovary and shell gland for *herklotsi* suggest that it matures at about 44 cm TL.

Though Compagno (1984) figured the head of the holotype of *herklotsi* (p. 265), the snout was drawn too short to be the holotype of the species. Fig. 2 is the head morphology of the holotype of *herklotsi*, showing its very long snout.

To summarize the diagnostic differences between *herklotsi* and *longicephalus*, the former species has 1) longer snout before mouth which is always more than 12.3% TL (less than 12.2% TL in *longicephalus*; Fig. 5), 2) narrower internostril width, which is always less than that of *longicephalus* in specimens of same size (always less than 4% TL in *herklotsi*, whereas in *longicephalus*, it is more than 4% TL in specimens smaller than 450 mm TL, and less than 4% TL in the larger *longicephalus*; see Fig. 6), and 3) more rows of teeth, 49–57 and 49–58 on upper and lower jaws, respectively (36–44 and 31–41 rows in *longicephalus*; Figs. 9, 12).

The above data mean that the length from snout tip to anterior point of upper lip is more than 3 times the internostril width in *herklotsi* (less than 2.8 times the internostril width in

*longicephalus*; Fig. 10). In addition, the teeth are closely packed in *herklotsi*, but very sparsely arranged in *longicephalus*, as shown in Fig. 11. This is a good character for first hand identification of the species.

Other species from Chinese waters, such as *abbreviatus*, *xenolepis*, *longianalis*, *brevicaudatus* and *longicaudatus*, are very similar to *herklotsi*, and those except *longianalis* also seem to have similar numbers of tooth rows on the jaws (Fig. 12). However, as I do not have adequate available data of them to compare with *herklotsi*, I refrain from further discussing their taxonomic relationships at present.

Lastly, Compagno (1984) thought *A. herklotsi* “to be closest to the single dorsal-finned *Pentanchus profundicolus*, and possibly identical to it.” Although their general external morphology is similar, tooth counts for *P. profundicolus* (69 rows on upper jaw and 34 rows on left half of lower jaw) are well out of range of those for *A. herklotsi*.

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- 稀種 *Apristurus herklotsi* (Fowler, 1934) (新和名: ヤリヘラザメ) の記録および分類学的考察
- 仲谷一宏
- ヤリヘラザメはフィリピン近海から報告されて以来記録がなく、その分類については不明な部分が多かった。近年、銚子、土佐湾および沖繩舟状海盆海域から本種の標本を入手できたので、形態学的に本種の特徴を明確にすると共に、近縁種との分類学的比較検討を行なった。その結果、本種は極めて長い吻と尾鰭をもち、腹部が短いという特徴を有することが判明した。以上の特徴では本種はテングヘラザメに似るが、本種の歯はより数が多く、両鼻孔間隔がより狭く、さらに口前吻長がより長いことなどで識別可能である。また、シナ海より記載、報告された数種のヘラザメについては、入手できた模式標本の形質が不十分のため、これらと本種との分類学的検討が不可能であったが、これらは本種に酷似する。背鰭が1基の *Pentanchus profundicolus* は一部に本種と同種であるとの考えもあるが、本種とは歯数が一致しなかった。
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