

## Larval Ishikawa Icefish, *Salangichthys ishikawae* from Surf Zones of Central Honshu, Japan\*

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A total of 646 larval and 6 adult ishikawa icefish were collected in surf zones on the Pacific coast of central Honshu in late June 1984. Much more advanced origin of the anal fin and the existence of two distinct black spots at the caudal fin base differentiate the larval ishikawa icefish from the larval common icefish, *Salangichthys microdon*. The larvae, 17.4-34.8 mm, occurred more often in the eastern half of the coast line surveyed, while the largest number per haul of the larvae was obtained at the beach just outside Lake Hamana. Salinities at the beaches where any number of the larvae were collected ranged from 19.7 to 33.5 ‰. The six adult fish collected were all females with mature eggs, suggesting a prolonged spawning of the fish.

Ishikawa icefish, *Salangichthys ishikawae* Wakiya et Takahasi has a limited geographical distribution in the Pacific coast of northern Honshu, Japan, from Wakayama Prefecture (Wakiya and Takahasi, 1937) to Aomori Prefecture (Shiogaki, 1982). Contrasting with common icefish, *S. microdon* Bleeker which invades brackish and fresh waters, they live in coastal waters of the open sea. In shallow waters off sandy beaches of Chiba to Aomori Prefectures, they make one of important commercial fishes in winter and early spring (Fujimoto, 1954\*\*\*; Hori, 1971a, b; Takeuchi, 1972; Hiramoto, 1973; Shiogaki, 1982; Kitagawa, 1985) (Fig. 1A). The papers cited above suggest that the peak spawning season of the fish occurs in March and April.

Occurrence of larval common icefish in surf zones is known in Karatsu Bay, north coast of Kyushu (Senta and Kinoshita, 1985). In June 1984, we made larval fish collections in surf zones of the waters covering the southern half of the geographical range of ishikawa icefish. Larval

ishikawa icefish were yielded at one-third of the beaches surveyed. We report here their occurrence in surf zones, and give an illustration and description of the larvae.

### Materials and methods

We made collections of larval fishes within a wading depth of surf zones with a small seine (an unweighted, 1- by 4-m piece of polyester netting, 1.0 mm in mesh width; see Senta and Kinoshita, 1985 and Kinoshita, 1986) at 24 beaches ranging from Shirahama, Wakayama Prefecture to Taitoh, Chiba Prefecture (Fig. 1B) in late June 1984. The stretched net was pulled by two persons along 50 m of beach, with the upper part of the net kept in the air and the lower margin well above the sea bed. Three or four 50-m hauls were made at each beach. Specimens were preserved in 5 to 10% formalin and sorted and measured in the laboratory.

Of 36,620 larval and juvenile fishes collected,

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\*\*\* Although Fujimoto identified the fish he studied as *S. microdon*, it has turned out that the fish was *S. ishikawae* (personal communication from Mr. A. Nihira of the Fisheries Experimental Station, Ibaraki Prefecture).

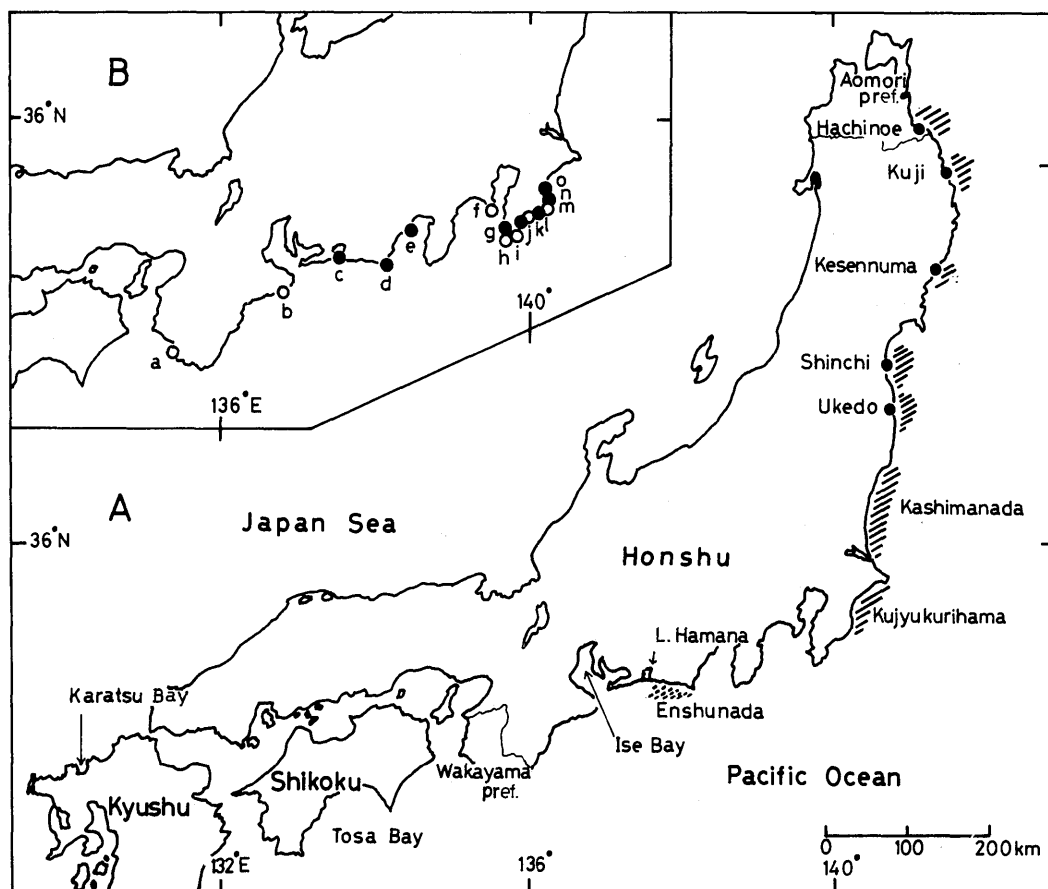


Fig. 1. A. Distribution of fishing grounds (shaded) and a probable fishing ground (shaded with dotted lines) of ishikawa icefish, *Salangichthys ishikawae*. Wakayama Prefecture and Hachinoe of Aomori Prefecture are the southern and northern extremities of the geographical distribution of the fish so far as known, respectively. Larvae of common icefish, *S. microdon* collected in Karatsu Bay were used for a comparative morphology.

B. Locations of 20 beaches where collections in surf zones were made in late June 1984. The alphabets agree with those before the name of places in Table 2. Solid and open dots represent the occurrence and non-occurrence of larval ishikawa icefish, respectively, at the beach.

ishikawa icefish accounted for 652, consisting of 646 larvae (17.4–34.8 mm TL) and six adults (63.3–68.0 mm TL).

Larval *S. microdon* used for the morphological comparison were a part of the specimens collected from surf zones of Karatsu Bay, north coast of Kyushu on June 5, 1984.

#### Description of larvae

In the smallest specimen (17.4 mm TL), the dorsal, anal, and pelvic fins already had the same

ray counts (14, 24, and 7, respectively) as those in adult, D. 13–16, A. 22–27, and  $P_2$ . 7 (Wakiya and Takahasi, 1937; Miyadi, et al., 1976), while the pectoral fin rays remained undifferentiated yet in the largest specimens (34.8 mm TL) of larvae collected. Myomeres  $44+15=59$ .

Most morphological characteristics showed little changes throughout the range of total length of the larval specimens; the body elongate, the head depressed, the gut straight yet, the adipose fin being formed, the adipose eyelid developed, about 20 small teeth on the maxillary (Fig. 2). Poste-

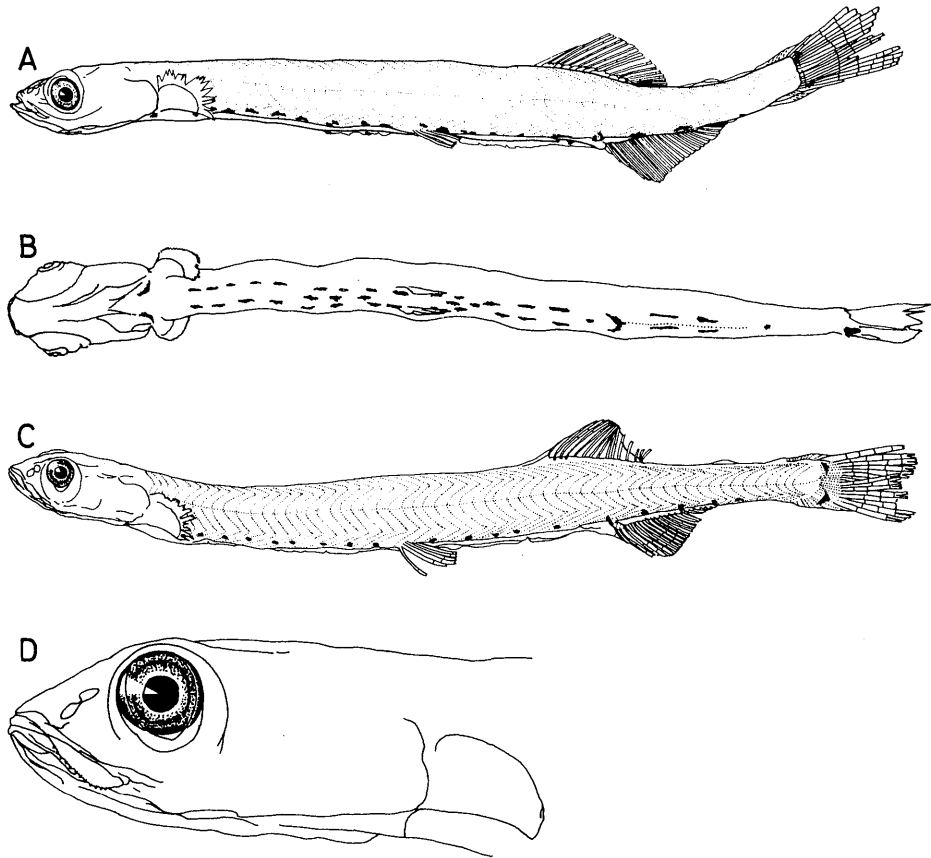


Fig. 2. Larval ishikawa icefish, *Salangichthys microdon*.

A. A larva, 20.3 mm TL from Araibenten. B. Schematic illustration of the ventral view of the same. C. A larva, 23.9 mm TL from Kagamigaura. D. Head of the same.

Table 1. Frequency distribution of numbers of the posterior dorsal fin rays situated above the anal fin in ishikawa icefish, *Salangichthys ishikawae* and common icefish, *S. microdon*.

Number of DF rays above AF	Number of larvae	
	Ishikawa icefish 21.7-31.9 mm TL	Common icefish 13.7-27.8 mm TL
none		10
1		18
2-4		
5	1	
6	15	
7	13	
8	1	
Total	30	28

rior five to eight dorsal fin rays are situated above the anal fin. (Fig. 2, Table 1).

A distinct triangular black spot is each on the upper and lower part of the caudal fin base. Otherwise, the distribution of melanophores is limited close to the ventral margin of the body; a pair on the throat, 16 pairs along the length of the gut to the anal fin base, a big one on the dorsal side of the anus, and a small one on the ventral margin of the caudal peduncle. Several melanophores are sparsely scattered in a row on the ventral finfold, from just before the anus anteriorly to the middle between the pectoral and pelvic fin bases (Fig. 2B). The ventral finfold, and the melanophores on it, disappeared at 27.5 mm TL.

*Differentiation of larval S. ishikawae from S. microdon* Fin ray counts in both the fishes

Table 2. Collection records of larval ishikawa icefish, *Salangichthys ishikawae* in surfzones of central Honshu in late June 1984. Three or four hauls with a 1- by 4-m seine were made at each beach. The location of each beach is shown in Fig. 1 by the same alphabet given before the name of the beach.

Name of beach	Date	Larvae collected		Water temp. (°C)	Salinity (‰)
		Total no.	No./haul		
a. Shirahama*	23/6	0	0	23.8-24.2	29.1-33.1
b. Shima**	25/6	0	0	22.5-24.0	32.5-32.8
c. Araibenten	26/6	560	140.0	24.9	25.7
d. Omaezaki	26/6	1	0.5	22.4	32.6
e. Shimizu*	27/6	2	0.5	21.3-21.7	19.4-19.7
f. Nagasawa	27/6	0	0	21.9	31.2
g. Kagamigaura	28/6	22	5.5	24.5	33.5
h. Nemoto	28/6	0	0	23.5	34.5
i. Shioura	28/6	0	0	24.9	24.7
j. Kamogawa	30/6	3	1.0	25.0	32.4
k. Kominato	30/6	0	0	24.0	32.5
l. Okitsu	30/6	1	0.3	24.0	32.9
m. Katsuura	29/6	0	0	21.2	33.0
n. Iwawada	29/6	57	19.0	20.0	27.4
o. Taitoh	29/6	6***	2.0	17.0	29.0

\* Consisting of two neighboring beaches.

\*\* Consisting of four neighboring beaches.

\*\*\* Adult.

widely overlap each other and the vertebral number is practically the same. However, there is no difficulty in differentiating larvae of the both.

The origin of the anal fin relative to the dorsal fin in *S. ishikawae* is much more advanced than in *S. microdon* (Table 1). The development of the pelvic fin is much more delayed in the latter, being still rudimentary at 23.1 mm TL and with the fin rays differentiated at 27.8 mm TL.

No distinct black spot is seen at the caudal fin base in *S. microdon*; instead, melanophores are scattered on the caudal fin membrane. The number of melanophores on the ventral finfold tends to be more in *S. microdon* (about 20).

The comparative osteology of larvae will appear elsewhere.

*Complementary note* Earlier in Table 1 we showed that posterior six or seven dorsal fin rays are located above the anal fin in most of the larval *S. ishikawae*. If we change the expression, the anal fin origin of the larvae is situated below the 8th or 9th dorsal fin ray in most cases. According to Wakiya and Takahasi (1937), the anal fin origin of adult is below the 3rd to 5th ray in male and below the 9th or 10th ray in female. We consider that the sexual dimorphism has not taken place yet in our specimens, rather than that all the specimens are females.

The two black spots at the caudal fin base are conspicuous also in adult, making the identification easy. Nevertheless, except for Miyadi, et al. (1976), nobody has clearly pointed this out\*. This must be due to that the melanophores fade in

\* Nakamura (1963) wrote "There are black spots on the caudal peduncle." Pictures in Uyeno and Aizawa (1984) and in Kitagawa (1985) clearly show the black spots.

several years in formalin.

#### Larval occurrence in surf zones

The larvae were collected at seven beaches out of 13 in the eastern half of the coast line surveyed (Fig. 1B, Table 2). As the fishing grounds of the fish are distributed to the further north of the surveyed beaches, it is sure that the larvae also inhabit surf zones on the Pacific coast of northern Honshu.

The largest number per haul of larval *S. ishikawae* was obtained at Araibenten on the channel connecting the open sea of Enshunada and Lake Hamana. While only *S. microdon* has been reported from the lake so far (Anon., 1966), icefish caught by minnow net fishing boat operating in the shallow waters (2-5 m deep) of Enshunada included *S. ishikawae* (personal communication from Mr. K. Baba of the Shizuoka Prefectural Fisheries Experiment Station). Although no special study has been made on the icefish in Enshunada and it is not known if the icefish caught by fishing boats in this sea consists solely of *S. ishikawae*, the result of our collection strongly suggest this possibility.

The larvae occurred at almost any salinities observed, with the lowest salinity being 19.7‰ (Table 2). Still, we consider that *S. ishikawae* is basically a shallow water species of the open sea, because the species has not been recorded in Ise Bay, one of the most productive fishing grounds of *S. microdon* in Japan.

Although the size frequency differed by beaches, the majority of the larvae were 22 to 32 mm TL (Fig. 3). While the main spawning season of the fish has been considered to be in March and April, the incubation period is not known, because no spawning grounds have been proven through the recovery of naturally spawned eggs and thus the environmental water temperature during the incubation is not known\*. Assuming that the

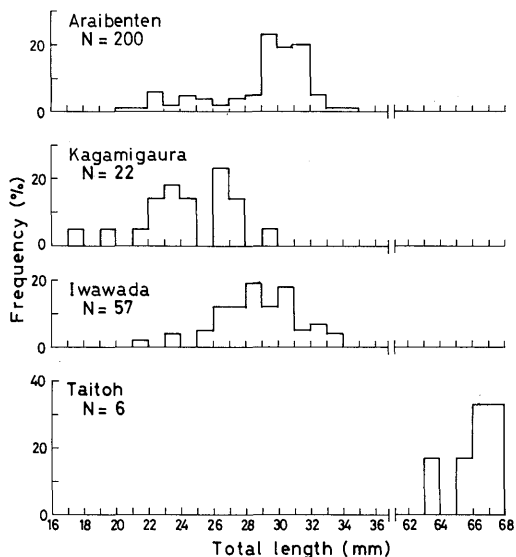


Fig. 3. Length frequency histograms of ishikawa icefish, *Salangichthys ishikawae* from four beaches.

incubation period is two weeks, the larvae we collected may be two or three months old. The accurate age determination of the larvae through observations of otolith, together with the age determination of other larval fishes occurring in surf zones, is still in process.

The adult fish collected at Taitoh were all females with mature eggs. This suggests a prolonged spawning in the fish.

#### Acknowledgments

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\* Miyadi, et al. (1976) suggested that they may spawn in the coastal waters of the sea.

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## 本州中部の砕波帯におけるイシカワシラウオ仔魚の出現

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1984年6月下旬に、本州中部の太平洋岸20箇所の砂浜海岸の波打際近くで、小型引網による採集をおこなひ、7箇所の海岸から合計646個体のイシカワシラウオ仔魚(17.4~34.8 mm TL)を得た。本種の仔魚は尾鰭基部の上下に各1個の顕著な黒点を有し、背鰭軟条のうち後方の5~8条が臀鰭上方に位置することにより、シラウオ仔魚(尾鰭基部に黒点なく、臀鰭起部は最後の背鰭条下またはより後方にある)と識別できる。仔魚は調査域の東半分——浜名湖入り口~房総半島——でより頻繁に採集された。本種の漁場の分布から考えて、本州北部の太平洋岸の砕波帯でも本種仔魚が出現することは確実である。1箇所の海岸からは熟卵をもった雌成魚6個体が採集され、産卵期が長いことを示唆した。

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## ERRATUM

Bull. Fac. Fish. Nagasaki Univ. No. 59

p. 31, the legend for Fig. 2.

"Salangichthys microdon" should read

"Salangichthys ishikawae".