The percophidid *Matsubaraea setouchiensis* from the Fukiagehama beach, south-western Kyushu

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Nineteen specimens of *Matsubaraea setouchiensis*, Percophididae, were collected from sandy beaches of Fukiagehama, south-western Kyushu. The illustration of the holotype of the species by Taki (1953), which has been cited in many books, was found to be erroneous in the shape of the second dorsal fin in which the median rays are shorter than others. They inhabit the waters of wading depth mostly burrowing in sandy bottoms, where they can merge into the bottom sand because of their color pattern. In an aquarium, they exhibit a life style of an infaunal benthos rather than that of a nekton.

Key words: a percophidid, *Matsubaraea setouchiensis*; new locality; Fukiagehama; fauna of sandy beach

Matsubaraea setouchiensis Taki of the family Percophididae is a small fish growing to about 70 mm SL. The fish have been known from the Seto Inland Sea and Tosa Bay in Japan (Taki, 1953; Kamohara, 1955; Inaba, 1963; Okamura, 1984), and from a beach of Prachuab Khiri Khan Bay facing the Gulf of Thailand (Iwamoto, 1980).

We collected 19 specimens of the fish with a small push-net at sandy beaches of Fukiagehama on the south-western coast of Kyushu on several occasions in 1988. Some of the specimens are being reared in an aquarium now (December 1988) to observe their behavior and hoping that they may spawn in captivity.

This paper is to report a new locality of the fish as well as to correct errors in the original illustration by Taki (1953) which is cited uncorrected by Matsubara (1955), Ochiai (1965) and Okamura (1984). Notes on habitat and their behavior in an aquarium are also given.

From the specimens we collected, two each are deposited at the National Museum of Science (Natural History), Tokyo (NMST), Department of Fisheries, University Museum, the University of Tokyo (FUMT), Fisheries Research Station, Kyoto University (FAKU), and Department of Biology, Kochi University (BSKU), with the remainings either under culture or not catalogued.

Matsubaraea setouchiensis Taki, 1953
Family Percophididae
(Japanese name: Matsubara-toragisu)

Matsubaraea setouchiensis Taki, 1953: 201-205, pl. 1 (type-locality: Takamatsu; holotype: final disporsal unknown; three of paratypes: in California Academy of Sciences, CAS 35531).

Matsubaraea setouchiensis: Kamohara, 1955: 3 (new locality: Kochi); Matsubara, 1955: 694, pl. 74; Inaba, 1963: 29; Ochiai, 1965; Iwamoto, 1980: 112-114 (new locality: Gulf of Thailand); Okamura, 1984.

Roxasella setouchiensis: Kamohara, 1958: 68.

Material examined and methods of collection

Our collection records of the fish in Fukiagehama are summarized in Table 1. Eight specimens among 16 caught on September 16, 1988 were brought back alive to observe live color and behavior in an aquarium. The others were examined for morphometric and meristic characters. Those which were dissected for examining inter-

Table 1. Collection records of *Matsubaraea setouchiensis* in Fukiagehama, south western Kyushu in 1988. Collections were made by pushing a modified Riley push-net along the beach.

Date	April 30th	May 1st	July 17th	September 16th		
Place	Eguchihama	Shinkawa	Eguchihama	Eguchihama	Irikihama	
Depth (cm)	50	100	30	70	30–50	80
No. of fish caught	1	1	1	13	2	1
Size of fish (SL, mm)	53.7	57.3	51.3	30.3–38.1	42.0, 55.5	35.1
Catalogue no,	FUMT-P 21319	n. c.	NMST-P 29846	BSKU 45402 BSKU 45403 NMST-P 30070 FAKU 112752 FAKU 112753 8 fish, n. c.	n. c.	FUMT-P 21318

BSKU: Dept. Biol. Kochi Univ.
FAKU: Fish. Res. Sta. Kyoto Univ.
FUMT: Dept. Fish. Univ. Mus. Tokyo Univ.
NMST: Nat. Mus. Sci. (Natural Hist.)

n.c.: either under culture or dissected, and not catalogued.

nal structure and food habit were not catalogued.

For comparison, five specimens from Tosa Bay (BSKU 45106, M7-M11) and three specimens from Prachuap Khiri Khan Bay, the Gulf of Thailand (CAS 32846) were also examined.

The net used in the collection is a slight modification of the Riley push-net (Riley, 1971): A bag net of 2-mm mesh is attached to a 1.5-m beam which has a 30-cm upright on either end; the lower end of each of the uprights is fixed on a ski foot on which a 2.0-m handle stay is also fitted; the upper and lateral margins of the mouth of the net are laced to the beam and uprights, while its free, lower margin is weighted with a chain; two rows of tickler chains lie in front of the mouth of the net. We call the net R-H push-net (Amarullah and Senta, 1989).

The net is pushed by two persons along 100 m of beach in water within wading depths, 15 cm to 100 cm.

Description

The following description is mainly based on NMST-P 29846 (Fig. 1). The measurements and counts of the catalogued specimens are given in Table 2.

Body subcylindrical, head much depressed.

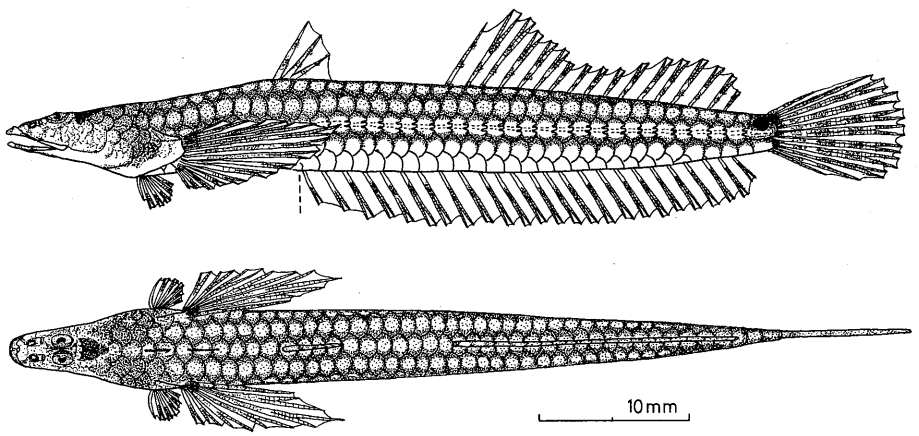

Fig. 1. *Matsubaraea setouchiensis*, 51.3 mm, from Fukiagehama (NMST-P 29846).

Eyes situated dorsally, close to each other. Snout bluntly pointed, lower jaw slightly shorter than upper. Premaxillary protractile. Posterior end of maxillary reaching below hind margin of orbit. Anterior nostril much larger than the posterior, entire margin of the former and anterior margin of the latter fringed with minute flaps (Fig. 2). Hind part of opercle covering the anterior base of pectoral. Margins of preopercle smooth. Gill membranes separate, free from isthmus; branchiostegals seven.

Teeth on upper and lower jaws villiform and in a narrow band. Vomer and palatine toothed. Four groups of gill rakers, each consisting of some 30 spinules, on lower limb; one on upper limb.

The first dorsal consisting of three spines; the second of 17 soft rays, all but anterior one or two branched. Both fins separated by six scales. Of second dorsal, rays in middle shorter than others

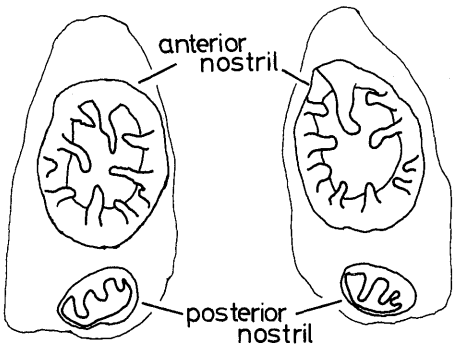

Fig. 2. A schematic illustration of nostrils viewed from above to show minute flaps surrounding nostrils.

Table 2. Measurement and counts of *Matsubaraea setouchiensis* collected in Fukiagehama in 1988

Catalogue no.	FAKU 112753	BSKU 45403	NMST-P 30070	FAKU 112752	FUMT-P 21318	BSKU 45402	NMST-P 29846	FUMT-P 21319
Standard length (mm)	30.3	31.3	34.8	34.8	35.1	37.1	51.3	53.7
% of standard length								
Total length	116.2	117.5	116.8	?	117.8	118.0	116.8	117.2
Predorsal length	38.5	38.2	38.0	38.5	39.6	37.6	36.2	39.0
Preanal length	40.5	40.2	39.1	39.7	41.0	39.9	38.9	40.4
Head length	28.8	26.6	26.6	27.6	28.0	26.8	24.9	25.7
Body depth	10.9	10.9	10.4	9.8	10.9	10.8	9,9	11.1
Body width	12.2	12.8	11.0	12.7	12.6	11.6	10.9	10.9
Length of pectoral fin	13.9	17.9	17.1	18.2	18.3	17.6	20.0	19.6
Length of pelvic fin	10.4	9.9	8.9	7.8	9.7	9.7	7.8	8.6
Head length (mm)	8.7	8.3	9.2	9.6	9.8	9.9	12.8	13.8
% of head length								
Horizontal dia. of eye	14.9	15.7	15.2	14.6	16.3	17.3	16.4	14.5
Snout length	21.8	21.7	20.6	22.9	25.5	20.3	23.5	26.1
Interorbital width	2.3	2.4	2.2	2.1	3.1	3.0	1.6	2.9
Counts								
Dorsal fin rays	III-17	III-17	III-17	III-17	III-17	III-17	III-17	III-17
Anal fin rays	25	25	25	25	25	25	25	25
Pectoral fin rays	16	16	16	16	16	16	16	16
Pelvic fin rays	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5
Caudal fin rays	7+2	7+2	7+2	7+2	7+2	7+2	7+2	7+2
Pored scales on LL	34	33	33	33	33	33	34	34
Scale raws above LL	2½	2½	2½	2½	2½	2½	2½	2½
Scale raws below LL	2½	2½	2½	2½	2½	2½	2½	2½
Predorsal scales	13	12	14	12	14	13	12	14

? : caudal fin distally broken.

(Table 3) (This was verified also with the specimens from the Gulf of Thailand, CAS 32846). Anal inserted below the first dorsal. Interradial membranes of the second dorsal and anal notched. Hind end of pectoral reaching above 3rd anal ray, pelvic much shorter. Hind margin of caudal rounded.

Color when alive. Ground color yellowish white. Minute pigments of pale grayish brown are distributed on head and dorsal side of body; much denser along dorsal and ventral margins of scales in upper three rows and along dorsal margin of those in the fourth row to form three longitudinal streaks above lateral line and one below. A darker spot in the dorsal side close to the posterior end of caudal peduncle. First dorsal with two grayish brown spots on each spine, second dorsal with two or three, anal with one, on each ray. Caudal with four transverse bands of the same color. Hind part of opercle silver with golden tinge.

Notes on habitat

Fukiagehama is a stretch of sandy beach along the western coast of Satsuma Peninsula, Kagoshima Prefecture, extending north and south for about 40 km (Fig. 3). Eight small rivers open the mouth on Fukiagehama. Even the Manosegawa, the biggest among them, is only some 30 km long with average discharge of 10 m^3 per second. The tidal range during the spring tide in this beach reaches about 280 cm. The bottoms of the places where we caught the fish consisted of

Table 3. Relative lengths of dorsal spines and soft rays in *Matsubaraea setouchiensis* collected in Fukiagehama and Tosa Bay.

Catalogue no.	FAKU	NMST-P	FUMT-P	BSKU	NMST-P	n. c.	BSKU 45106		
	112753	30070	21318	45402	29846		M9	M10	M11
Standard length (mm)	30.3	34.8	35.1	37.1	51.3	57.3	36.2	38.6	36.2
2nd ray of 2nd dorsal (mm)	3.9	4.1	4.0	4.1	6.2	8.2	4.7	4.8	4.7
% of the above									
1st dorsal									
1st spine	53.8	56.1	62.5	58.5	69.4	64.6	59.6	?	57.4
2nd spine	51.3	56.1	62.5	61.0	67.7	61.0	51.1	60.4	51.1
3rd spine	48.7	51.2	60.0	51.2	53.2	?	46.8	50.0	42.6
2nd dorsal									
1st ray	82.1	87.8	85.0	85.4	85.5	?	83.0	75.0	80.9
2nd ray	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
3rd ray	94.9	95.1	97.5	95.1	91.9	86.6	89.4	95.7	93.6
4th ray	71.8	87.8	85.0	90.2	74.2	70.7	80.9	85.4	80.9
5th ray	69.2	70.7	72.5	68.3	72 6	67.7	53.2	70.8	70.2
6th ray	53.8	53.7	57.5	58.5	53.2	45.1	38.3	47.9	61.7
7th ray	43.6	43.9	45.0	51.2	40.3	42.7	34.0	43.8	44.7
8th ray	41.0	46.3	40.0	36.6	40.3	31.7	29.8	39.6	36.2
9th ray	41.0	46.3	40.0	39.0	37.1	37.8	29.8	35.4	31.9
10th ray	48.7	51.2	42.5	39.0	41.9	39.0	34.0	?	40.4
11th ray	56.4	53.7	47.5	56.1	50.0	56.1	44.7	?	55.3
12th ray	61.5	61.0	60.0	58.5	58.1	51.2	53.2	58.3	57.4
13th ray	64.1	63.4	67.5	68.3	62.9	48.8	57.4	62.5	63.8
14th ray	61.5	65.9	70.0	70.7	64.5	50.0	51.1	58.3	59.6
15th ray	56.4	63.4	60.0	61.0	59.7	36.6	44.7	54.2	44.7
16th ray	46.2	56.1	45.0	43.9	45.2	37.8	34.0	35.4	34.0
17th ray	25.6	26.9	25.0	26.8	21.0	31.7	17.0	20.8	21.3

n.c.: not catalogued. ? : distally broken.

medium to fine sand (Md Φ 1.5～2.3).

Eguchihama, the locality of NMST-P 29846 and 14 other specimens, lies near the north end of Fukiagehama. Two small rivers, the Eguchigawa (15.7 km long) and Kaminokawa (27.2 km long) flow into the sea apart from our sampling site by 1.3 km north and 2.2 km south, respectively. The slope of the beach is rather steep, the distance between the high and low water lines in the spring tide being about 60 m.

Irikihama, the locality of FUMT-P 21318 and two others, is located at the center of Fukiagehama, and on the south of the mouth of the Izakugawa (6.8 km long). A sandy flat of 150 m wide is exposed at the low water of the spring tide. In lower portions of the tidal flat, tidal pools of 30 to 50 cm deep remain undrained.

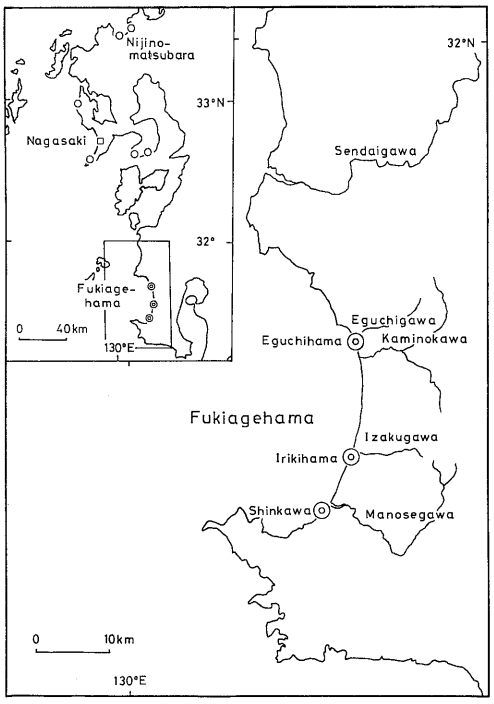

Fig. 3. A chart of Fukiagehama, a sandy beach extending for about 40 km. *M. setouchiensis* were collected at Eguchihama, Irikihama, and Shinkawa (double circles). In the insert, other beaches in Nijinomatsubara and around Nagasaki where samplings in the same methods were made but no specimen of the fish was obtained are also shown (open circles).

Shinkawa beach, where we caught one specimen (57.3 mm SL, uncatalogued), adjoins the south of the mouth of the Manosegawa, which is situated near the southern end of Fukiagehama. At the low tide, the water line recedes about 500 m from the high water line; between the two lines a sandy tidal flat with gentle ups and downs lies.

Since June 1987, we have also been doing sampling with the same net at several beaches in two other regions on the western coast of Kyushu, Nijinomatsubara and around Nagasaki (Fig. 3) (Senta et al. 1989). The beaches around Nagasaki have usually been visited twice a month, while samplings in Fukiagehama and Nijinomatsubara once every two or three months. *Matsubaraea setouchiensis* were collected only in Fukiagehama, suggesting that the fish are much more abundant in southern Kyushu than in northern Kyushu, even if they may be distributed further north.

Our specimens were collected in the waters of 30 to 100 cm deep at around the low tide. As the specimens reported by Taki (1953) and Kamohara (1955) were collected at fish markets, their actual habitats were not known. Iwamoto (1960), concerning the habitat of his Thai specimens, simply mentioned "W beach of Prachuab Khiri Khan Bay in front of Phukhao Chong Kajok". However, the collection record on the invoice attached to the specimens sent from the Department of Ichthyology, the California Academy of Sciences continues "In waves along beach. Sand bottom. . . . 0 -2 ft. Rotenone, dipnets, and by hand".

Dr. O. Okamura of Kochi University found no specimen of *M. setouchiensis* among the samples of monthly collections for three years with a baby trawl in the waters 15 m deep or more in Tosa Bay (personal communication). We can conclude that the fish is a dweller of sandy beaches.

Behavior in an aquarium

The live specimens are kept in a glass aquarium, 34×21×26 cm, of circulating system. The sand collected at Eguchihama was placed to cover

the bottom for 1-2 cm thick.

Almost always the fish remain burrowed in sand, usually burrowing several millimeters under the surface of the bottom or only showing their eyes. Although they sometimes, mostly at feeding time, show themselves, they just expose anterior one-third or so of their body, with the posterior part remained in the sand. Their color pattern is well adapted with the habitat. They merge imperceptibly into the sand grains mixed with small pieces of broken shells and pumices. When a fish is exposing its anterior part, the silver color with golden tinge of the opercle tells the whereabouts of the fish to scrutinizing eyes.

Frozen mysid are given them as feed. They take the feed drifting close to the bottom more actively than the feed settled on the bottom. In taking the feed, the fish come out of the sand only for a moment and return into the sand; they usually catch one piece of the feed at a time. There are two ways of burrowing after taking the feed: The fish return to the former position, lie on the bottom, and then burrow into the sand by shaking their body; or they continue advancing and dive into the sand, the head first.

We may say that the life style of *M. setouchiensis*, at least during the day time, is benthic rather than nektonic, and infaunal at that. The minute flaps surrounding the nostrils must be the adaptation to prevent sand grains from getting inside the nasal cavity.

Remarks

Dr. Taki himself had noticed at latest by 1964 that his original illustration of *Matsubaraea setouchiensis* (Taki, 1953, plate 1, fig. 2) was erroneous in the shape of the second dorsal fin. One of us (Senta) collected a juvenile of the fish, 12 mm TL, by horizontal tow with a fish larval net just above the sea bottom at the depth of 13-15 m off Shimotsui (lat. 34° 24'N, long. 134° 45-46'E) in the Seto Inland Sea on October 30, 1963 (unpublished). Every character suggested that the juvenile was the present species, except that fin rays of the second dorsal were much shorter in the middle part than in the anterior and posterior parts. I wrote a letter to Dr. Taki begging his opinion.

In his letter of reply dated May 5, 1964, Dr. Taki wrote: "My illustration became like that as I collected the specimens during my trip and the dorsal fin had lied down. It was erroneous. When I raised each ray successively, I found that the second dorsal was concave in the middle, separating into two parts."

Roxasella fusiforme reported from Aparri, Luzon by Fowler (1943) resembles with the present species in every aspect. The generic name was once replaced with *Cirrinasus* by Schultz (1960), as it was found to have been preoccupied by *Roxasella* Merino, 1936 in Vermes. After a careful comparison of the types of *C. fusiforme* and *M. setouchiensis* (the paratypes and the specimens from the Gulf of Thailand), Iwamoto (1980) placed *Cirrinasus* Schultz, 1960 in the position of a junior synonym of *Matsubaraea* Taki, 1953. Although he found no distinguishing features between the two species except for "a one-ray, one-vertebrae difference" (26 anal fin rays and 9 +26 vertebrae in *M. fusiforme*), he "followed a conservative course" to continue recognition of two species.

In the original illustration of the type of *R. fusiforme* (Fowler, 1943, fig. 23), the outer margin of the 2nd dorsal is almost straight, with the length of the rays continuously decreasing from the 3rd ray ($2^1/_8$ in head) to the last ($4^1/_4$). According to Schultz (1960), "outer edge of anterior nasal opening ringed with inward projecting cirri" in this species. On our request, Ms. Susan L. Jewett, the Co-collection Manager, Division of Fishes at the National Museum of Natural History, Smithsonian Institution kindly examined the holotype and paratype of *R. fusiforme* (USNM 99517 and 99518). Most dorsal fin rays were damaged in both the specimens, but it was found that in the holotype "the 10th ray is intact and is shorter than rays 11-13, ray 11 is shorther than 12 and 13. . . . the first few rays are longer than any of the remaining ones." In both specimens, the

nasal pore and cirri configuration are identical to those shown in Fig. 2.

For all these agreements in both the species, we also follow a conservative course, until we may get an ample number of specimens from the Philippines.

Acknowledgements

We are most grateful to the late Dr. I. Taki who was so kind to re-examine his type specimens for us. Our heart-felt thanks are to Dr. O. Okamura of Kochi University and Dr. T. Iwamoto of the California Academy of Sciences who gave us the chance to examine the specimens of the present species from Tosa Bay and the Gulf of Thailand. We express our gratitude to Ms. Susan L. Jewett of the Smithsonian Institution who kindly examined the types of *R. fusiforme* for us.

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九州南西岸，吹上浜で採集されたマツバラトラギス

千田哲資・乃一哲久・重光啓

従来瀬戸内海と土佐湾，およびシャム湾西岸のある砂浜海岸のみから知られていたホカケトラギス科の魚マツバラトラギスが鹿児島県の吹上浜に普通に生息することが発見された。瀧（1953）の原記載に付けられている本種の図では第2背鰭条はすべて殆ど等長に描かれており，この図はそのまま多くの著者により引用されているが，実際には中央部の鰭条はそれらの前後のものより短い。この魚はいつもは砂に潜っていて、餌をとるときに瞬間的に砂から泳ぎ出す。砂に潜るには，砂上に腹ばった姿勢から体を左右に揺すって潜るのと頭から突っ込むのと二通りの方法がある。地色は黄白色で，頭部背面と背部の各鱗列の上下の縁に淡灰茶色の色素が分布して小斑点を形成しており，時折この魚が体の前部のみを砂の上に出していても砂に紛れてよほど気をつけぬと所在を認め難い。鰓蓋部は黄金色の輝きを帯びた銀色で，馴れた目にはかなり目立つ。

Addendum: An additional specimen of *M. setouchiensis,* 44.7 mm SL, was collected at Maehama (15 cm deep; lat. 32° 37.5'N, long. 130° 10.0'E) on the south coast of Shimabara Peninsula, one of the beaches around Nagasaki shown in Fig. 3, on March 23, 1989.