

Studies on the Larvae and Juveniles of the Sinistral Flounders—I. *Taeniopsetta ocellata* (Günther)*

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Abstract Four giant postlarvae and one juvenile fish of a species of sinistral flounders were collected from Japanese waters. The postlarvae were all in metamorphosing stages and were characterized by having a large body size, standard lengths 59–81 mm, a serrated urohyal, a strongly serrated posterior process on the pelvic bone, three spines on the head and the first ray of the right ventral fin located opposite the second ray of the left ventral fin. The specimens are identified as *Taeniopsetta ocellata* (Günther) of which development and metamorphosis have not previously been described.

Introduction

The genus *Taeniopsetta*, including the subfamily Taeniopsettinae, of the family Bothidae, has a single species, *T. ocellata* (Günther), 1880, in the adjacent waters of Japan. This species occurs in fairly deep water from the Pacific coast of Japan to the Indian Ocean and is caught comparatively rarely by the trawl fishery in middle and southern Japan (Norman, 1934; Matsubara, 1955; Amaoka, 1969).

So far as the author is aware, no studies of the development or metamorphosis of larvae or juveniles of *T. ocellata* have been made, except for a report by Kuronuma (1942), who described a specimen of the early metamorphic stage and tentatively identified it as *Bothus bleekeri* Steindachner.

In the course of studying larvae and juveniles of the Japanese sinistral flounders, the author has lately had occasion to identify and study four postlarvae of metamorphic stages and one juvenile, collected from different localities in Japanese waters over a period of years.

These giant circular postlarvae and the juvenile, measuring 59–70 mm and 81 mm in standard length respectively, especially

the postlarvae, are characterized by having three spines on the head, a serrate urohyal and pelvic bone, and the first ray on the right ventral fin opposite the origin of the second ray on the left ventral fin. In the present paper, are given a detailed description at each stage and a discussion regarding the identification of specimens.

Materials and methods

The five specimens used for the examination fall naturally into four sharply divided stages: the early metamorphic stage—the right eye slightly migrating dorsally and the not perfectly symmetrical body; the middle metamorphic stage—the right eye migrating to the dorsal margin, and forming the rostral beak above its eye; the late metamorphic stage—the right eye completing its migration, and the rostral beak fused with the ethmoid region; the juvenile stage—the eyes, the pectoral fins, and the pigmentation on the body well developed. Data on the collection of the specimens are given in Table 1.

The specimens were examined by means of a binocular microscope and an X-ray plate (soft X-ray). The counts and measurements of body were made in accordance with the method used by Norman (1934).

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Table 1. The data of collection of the young specimens of *Taeniopsetta ocellata* in the waters of Japan.

Stage	Number of specimens	Date	Locality	Remarks
Early metamorphic stage	1	November 15, 1952	Misaki, Kanagawa Prefecture	Surface
Middle metamorphic stage	1	December 3, 1959	Owase, Mie Prefecture	Bottom trawl net in the depth 300-400
Late metamorphic stage	2	January 1, 1936 December 1938	Owase, Mie Prefecture Heta, Shizuoka Prefecture	Bottom trawl net
Juvenile stage	1	December 15, 1961	Mimase, Kochi Prefecture	Bottom trawl net in the depth 200-300 m

Description

1. Early metamorphic stage (Fig. 1; Pl. 3, 1)

Total length 66 mm; standard length 59 mm. Dorsal fin rays 94; anal fin rays 75; ventral fin rays 6 on each side; caudal fin rays 17; vertebrae including urostyle $10 + 32 = 42$.

Head 4.94 in standard length; depth 1.4. Snout 3.84 in head; left eye 3.4; right eye (not measurable); maxillary 3.84 on left side, 3.84 on right side; lower jaw 2.98 on left side, 2.59 on right side; depth of caudal peduncle 1.92; longest dorsal ray 1.19; longest anal ray 1.27; pectoral fin 4.25 on left side, 4.25 on right side; ventral fin 3.05 on left side, 2.83 on right side; base of ventral fin 4.25 on left side, 5.95 on right side.

Body deep ovate, highest at anterior 1/3 of body, its depth about 7/10 its length, and very thin, gradually becoming thinner toward dorsal and anal margins; the dorsal contour with a slight notch in front of upper margin of left eye, strongly rising to anterior 1/3 of body, and then slowly descending to caudal base; the ventral contour, apart from a rather large notch below the lower jaw, similar to dorsal in shape. Caudal peduncle very narrow, a little less than 1/6 depth of body.

Head blunt, very small, about 1/5 length of body. Snout short, about as long as diameter of left eye; the notched portion above snout loosely attached to ethmoid region of

the cranium. Eye situated on each side of body, the right eye slightly above the left. A round depression of cartilaginous tissue, of nearly same size as eye, located just above the left eye; the depression to receive the right eye, which migrates through a slit beneath the rostral beak in the following stage. Nostrils on the left side closely set between notched portion above snout and upper margin of the left eye, the anterior nostril with a short tube, the posterior not tubular, close to the anterior rim of the left eye; those on the right side nearly in a symmetrical position with those on the left and similar in shape and structure to those on the left. A series of three conspicuous spines on the left side arranged subvertically in the posterior margin of the head, the uppermost on the posterodorsal corner of the brain case, the middle on a horizontal from the upper margin of the left eye, the lowermost one much smaller than other two, on a horizontal from the middle of the eye; those on the right side almost symmetrical in position, but gradually becoming smaller downward.

Mouth oblique, subequal on both sides, the lower jaw slightly projecting beyond tip of upper jaw when the mouth is closed. Maxillary not extending to below orbital rim of the eye; the pedicel of the premaxillary large, triangular in shape, its tip extending to the notched region above snout. The

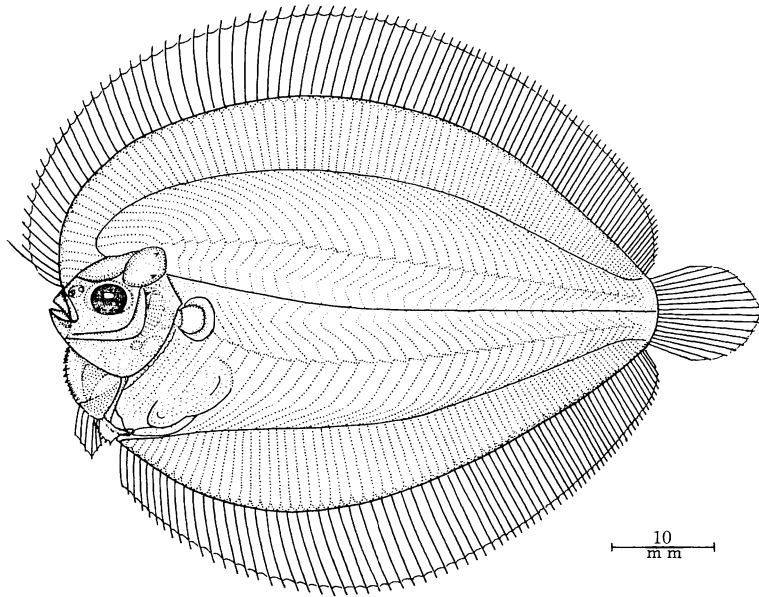


Fig. 1. Postlarva of *Taeniopsetta ocellata* (Günther) in early metamorphic stage, 59 mm in standard length; collected at Misaki on November 15, 1952.

small conical teeth varied in size, arranged in a row. Scales and lateral line not yet discernible.

Dorsal fin originating in the notched region above snout and before a horizontal line through upper margin of the left eye; the second ray slightly longer than the third, about two in diameter of eye; the remaining rays becoming higher toward middle part of body, and shortened evenly in height posteriorly. Anal fin starting on a vertical line through the posterior margin of the left eye, similar in shape and structure to dorsal. Pectoral fin symmetrical, fanlike, with a rather heavy peduncle at base surrounded by a thin transparent membrane, but the rays undeveloped. Ventral fins well developed on both sides, and asymmetrical, that on the left side originating below and slightly in front of the left eye, the second ray opposite the first on the right side. Caudal fin rounded on posterior margin. Urohyal above the anterior part of the pelvic bone, large and triangular in shape, with about 13 serrations along its ventral margin. Pelvic bones well

developed, but quite asymmetrical in shape: each bone bifurcate in lower region, the up-bent process of anterior part provided with a cartilaginous plate to support the six ventral rays; the left pelvic slightly in advance of the right; the posterior process extending backward and to above origin of anal fin, and surrounding the abdomen; the process with a thin bony plate on its ventral margin, the ventral edge of the plate strongly serrate. The exposed margin of cleithrum with rough serrations before the pectoral fin.

The liver and intestinal coil occupying greater portion of the abdominal cavity. The vent not opened. The brain and the digestive organ visible externally.

The color of this specimen when still alive was sketched by Prof. I. Tomiyama. Based on his water-color drawing, the following notes are made: the whole body and fins have a faint, rose-colored sheen; a pale orange, narrow and chevron-shaped *vertical* bar is present slightly posterior to the middle of the body, and on left side only, originating at the myoseptum immediately above midaxis

of body. inclined forward along segment, then inclined backward below midaxis; four reddish orange spots are present along base of the dorsal and of the anal fins in posterior half of body: an oblique yellow stripe is present extending from upper margin of eye through eye to near base of pectoral fin: the iris of eye is silver white. In formalin no pigmentation was observed, except for the eyes being blackish.

2. Middle metamorphic stage (Fig. 2; Pl. 3, 2)

Total length 69 mm; standard length 60 mm. Dorsal fin rays 87; anal fin rays 72; ventral fin rays 6 on each side; caudal fin rays 17; vertebrae including urostyle $10+31=41$.

Head 4.97 in standard length; depth 1.49. Snout 4.65 in head; upper eye 2.81; lower eye 2.69; maxillary 3.15 on ocular side, 3.15 on blind side; lower jaw 2.42 on ocular side, 2.33 on blind side; depth of caudal peduncle 2.02; longest dorsal ray 1.21; longest anal ray 1.21; pectoral fin 4.04 on ocular side,— on blind side; ventral fin 2.47 on ocular side, 2.47 on blind side; base of ventral fin 4.04

on ocular side, 4.85 on blind side.

Body deep ovate and thin, highest at middle part of body, a little lower than $7/10$ length of body; the dorsal and ventral contours strongly and evenly arched except for anterior profile of head. Caudal peduncle very narrow, a little shorter than $1/6$ depth of body.

Head blunt, very small, about $1/5$ length of body, the interorbital region and the snout bending to the left side, the front of the dorsal fin becoming detached from the ethmoid, thus forming a slit. Snout very short, a little shorter than eye diameter; a spine on the snout blunt and very short. Right eye penetrating through the slit beneath anterior part of dorsal fin extending to dorsal margin of head: the right eye located closely above and slightly in advance of the left and a little smaller than the left. The orbital ridge somewhat developed in front of the left eye. Nostrils on the left side in front of upper margin of lower eye, the anterior tubular with a flap posteriorly, extending to anterior margin of the posterior nostril when

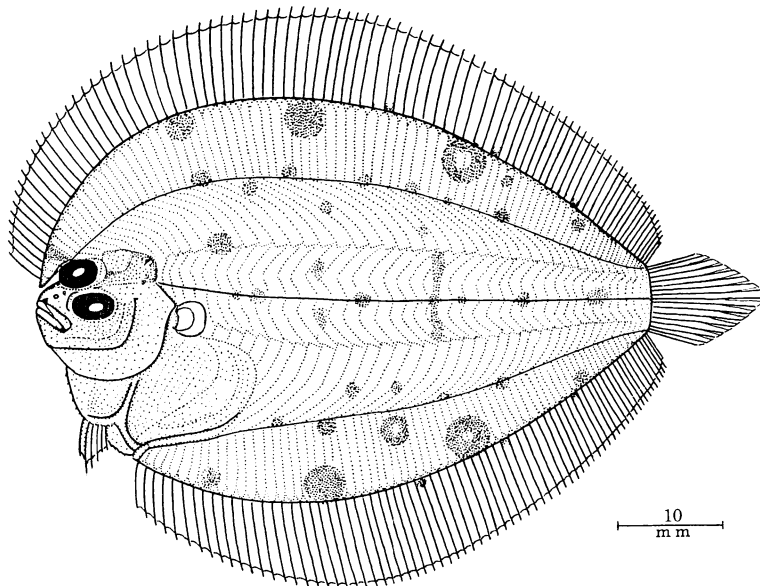


Fig. 2. Postlarva of *Taeniopsetta ocellata* (Günther) in middle metamorphic stage, 60 mm. in standard length; collected at Owase on December 3, 1959.

depressed backward; the posterior nostril not tubular and without flap; those on the right side almost symmetrical in position with those on left and similar in shape and structure to those on the left. Three spines arranged subvertically in posterior margin of head well developed, though the lowermost one is rudimentary.

Mouth oblique, rather small, subequal on both sides, the lower jaw slightly projecting beyond tip of the upper; the maxillary extending to below anterior margin of the left eye. Teeth all small, conical, and arranged in a row.

Scales and lateral line not yet developed. Dorsal fin originating at the tip of slit above snout; the second ray not longer than the third, the rays gradually growing higher toward posterior 1/3 of body, and evenly shortened in height posteriorly. Anal fin starting slightly at rear of vertical line through posterior margin of the left eye; similar in shape and structure to dorsal. Pectoral fin symmetrical, fanlike in shape, similar in structure to that in the former stage. Ventral fins well developed on both sides, asymmetrical, that on the left side starting below and slightly in front of the left eye, the second ray opposite the first on the right side. Caudal fin rounded posteriorly, the uppermost and lowermost two rays simple, the others branched. Urohyal, pelvic bone, and cleithrum resembling those of the former stage in size and structure, but the serrations becoming feeble or considerably lacking. Vent opening just behind the posterior end of the pelvic bone.

In formalin, general ground color pale brownish, speckled and spotted with darker, and with a number of rings and U-shaped markings, of which a row of large ones at dorsal and ventral edges of body being most prominent; marginal portion of the left eye brownish; some indistinct small spots at the bases of dorsal and anal fins. No pigmentation on the right side.

The brain and the digestive organ still visible externally.

3. Late metamorphic stage (Fig. 3; Pl. 3. 3)

Total lengths 93–96 mm; standard lengths 70–81 mm. Dorsal fin rays 88–90; anal fin rays 73–74; pectoral fin rays 13 on ocular side, 12 on blind side; ventral fin rays 6 on each side; caudal fin rays 17; scales in lateral line 105; vertebrae including urostyle $10+32=42$.

Head 4.41–4.84; depth 1.56–1.58. Snout 5.8–7.1 in head; upper eye 2.63–2.75; lower eye 2.61–2.73; maxillary 3.29–4.03 on ocular side, 3.22–3.63 on blind side; lower jaw 2.73–2.92 on ocular side, 2.42–2.53 on blind side; depth of caudal peduncle 2.04–2.15; longest dorsal ray 1.34–1.52; longest anal ray 1.31–1.47; pectoral fin 3.09–3.63 on ocular side, 5.13–5.18 on blind side; ventral fin 2.36–2.42 on ocular side, 2.38–2.48 on blind side; base of ventral fin 4.66–4.97 on ocular side, 4.66–5.32 on blind side.

Body deep ovate, but a little lower than in the former stage, highest at middle part of body measuring about 3/5 length of body; the dorsal and ventral contours evenly arched except for steep anterior profile of head. Caudal peduncle rather narrow, about 1/6 depth of body.

Head blunt, rather small, longer than 1/5 length of body; head with a slight notch in front of lower margin of upper eye; the front part of the dorsal fin touching the ethmoid region, and the slit in front of upper eye entirely lacking. Snout very short, about half diameter of lower eye; a rostral spine feeble and very short. Right eye, having finished the migration, located above the left eye, and separated by a narrow space; the anterior margins of both eyes on the same vertical line. The orbital ridge well developed, extending from anterior margin of the lower eye to the posterior margin of lower eye. Nostrils on the ocular side located in front of upper margin of lower eye, the anterior nostril tubular with a posterior flap, the *posterior* more or less tubular without flap; those on blind side below origin of dorsal fin, similar in shape and structure to those on ocular side.

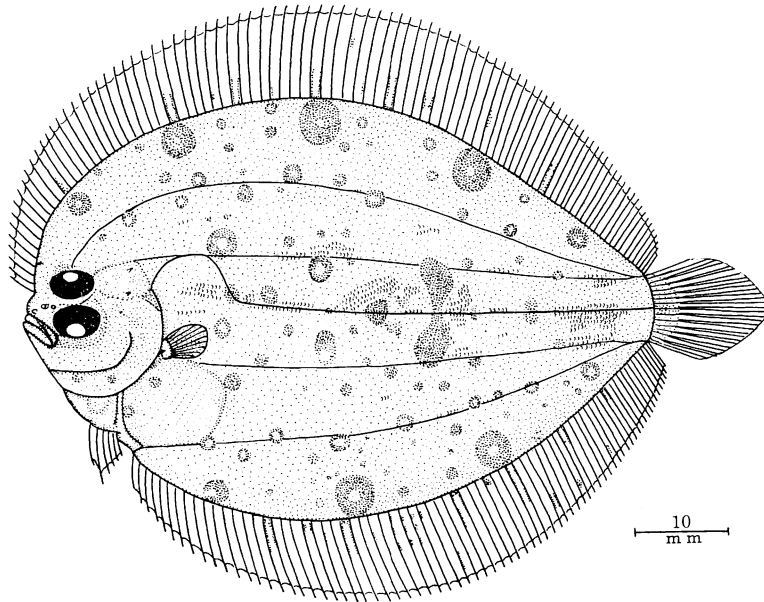


Fig. 3. Postlarva of *Taeniopsetta ocellata* (Günther) in late metamorphic stage, 70 mm in standard length; collected at Owase on January 1, 1956.

The three spines in posterior margin of head still visible on each side of body: the upper two spines projecting from the cranium, the lower, from the base of the opercle. Mouth oblique, rather small, subequal to eye diameter and almost symmetrical on both sides: the maxillary extending to below anterior margin of the lower eye. Teeth all small, and arranged in a row. Scales and the lateral line developed on the left side of body, but not on the right.

Dorsal fin originates on the blind side on a level with lower margin of upper eye, the rays gradually becoming higher toward posterior 1/3 of body, and growing shorter posteriorly. Anal fin starting below a vertical line through origin of lateral line, similar in shape and structure to dorsal. Pectoral fins asymmetrical, their fin rays visible, small *and slender*; fin on ocular side about equal to eye diameter. Ventral fin on the left side with broad base starting on a vertical line through posterior margin of lower eye, the second ray opposite the first on the blind side. Caudal fin rounded posteriorly, the

inner thirteen rays branched, the others simple. The marginal portions of the urohyal and cleithrum smooth, but the pelvic bone roughly serrate.

In formalin, general ground color pale brownish, four or five pairs of prominent darker rings or U-shaped markings along both upper and lower edges of body, and three pairs of rings of similar color above, below and on lateral line; a number of spots irregularly scattered on body; all fins paler than body, marked irregularly by small spots and streaks of dark brown. No pigmentation is observed on the blind side.

The brain and digestive organ scarcely visible externally.

4. Juvenile stage (Fig. 4; Pl. 3, 4)

Total length 96 mm; standard length 81 mm. Dorsal fin rays 88; anal fin rays 74; pectoral fin rays 13 on ocular side, 12 on blind side; ventral fin rays 6 on each side; caudal fin rays 17; scales in lateral line 106; gillrakers on first arch 0+5; vertebrae including urostyle 10+32=42.

Head 3.87 in standard length; depth 1.92.

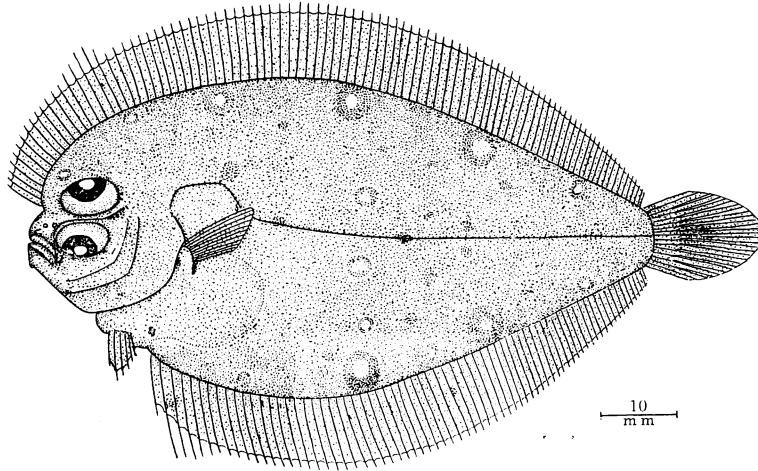


Fig. 4. Juvenile stage of *Taeniopsetta ocellata* (Günther), 81 mm in standard length; collected at Mimase on December 15, 1961.

Snout 5.36 in head: upper eye 2.79; lower eye 2.9; maxillary 3.07 on ocular side, 3.03 on blind side; lower jaw 2.13 on ocular side, 2.11 on blind side; depth of caudal peduncle 2.29; longest dorsal ray 2.2; longest anal ray 1.9; pectoral fin 1.81 on ocular side, 3.37 on blind side; ventral fin 2.71 on ocular side, 2.61 on blind side; base of ventral fin 5.36 on ocular side, 5.97 on blind side.

Body ovate, slenderer than in the preceding stage, and highest a little before the middle part of body, about half length of body; the dorsal and ventral contours evenly arched; caudal peduncle moderate in depth, about 1/5 depth of body.

Head blunt, rather large, a little longer than 1/4 length of body: the head with a slight notch in front of lower margin of upper eye. Snout short, a little shorter than half diameter of eye. A rostral spine blunt and very short. Eyes very large, about 1/3 length of head, separated by a narrow ridge, which extended from anterior margin of lower eye to posterior margin of upper eye; the other ridge developed along anterior margin of lower eye; upper eye slightly in advance of the lower. Nostrils on the ocular side closely set in front of middle part of lower eye, the anterior nostril tubular with a posterior flap, the posterior

nostril somewhat tubular, without flap; nostrils on blind side below origin of dorsal fin. The spines projecting from the posterior margin of head not visible on either side of body. Mouth oblique, arched, and small, a little shorter than eye diameter; maxillary extending to a little beyond anterior margin of lower eye. Teeth all small, uniserial. Gillrakers small and slenderer; none on upper limb. Scales and lateral line developed on ocular side of body, but lateral line absent on the blind side.

Dorsal fin originating on blind side on a level with upper margin of lower eye, the rays gradually becoming higher toward posterior 1/3 of body (except for slightly elongate 15th to 20th rays), and evenly shortened posteriorly. Anal fin starting below a vertical line through origin of lateral line, the first to sixth rays slightly longer. Pectoral fins unequal, that on ocular side about 1.5 of that on blind side: the third ray longest, and the lower rays becoming shorter downward; all the rays simple. Ventral fin on the ocular side originating on a vertical line through posterior margin of lower eye, the rays as well as base a little longer than those on the blind side: the second ray standing opposite the first on the blind side: the last

ray close to origin of anal fin. Caudal fin rounded, the uppermost and lowermost two rays simple, the others branched. Urohyal small, the anterior part covered by the subopercle. The posterior process of the pelvic bone short, triangular in shape, and not serrate.

In formalin, general ground color dark brownish with darker rings and U-shaped markings along edges of body, the rings above and below lateral line most prominent; a number of spots irregularly scattered on the body. All fins paler than body, marked irregularly by small spots and streaks of dark brown. No pigmentation on the blind side.

The brain and digestive organ not visible externally.

Discussion

The circular giant postlarvae and juvenile examined in this study are characterized by the following: the large body size, the second dorsal ray slightly elongate, the large urohyal serrate, the posterior process of the pelvic bone short, platelike in shape, and strongly serrate, three spines on the head, and the first ray on the right ventral fin opposite the second ray on the left.

The larvae are similar to those of species of the genus *Bothus*, described by many investigators (Kyle, 1913; Kuronuma, 1942; Ochiai and Amaoka, 1963). However, larvae of *Bothus* possess the following characters: rather small body size at the metamorphic stages, (30–40 mm in *Bothus podas* and 30–38 mm in *Bothus myriaster*), small urohyal not serrate, and pelvic bone with a long posterior process not serrate and tapering. Therefore the present specimens cannot be of genus *Bothus*. On the other hand, the larva at the early metamorphic stage is similar to a specimen identified tentatively by Kuronuma (1942) as *Bothus bleekeri* Steindachner, collected near the surface of the sea off Misaki, Kanagawa Prefecture. He identified it as a species of *Bothus* because of its extremely thin and translucent body, blunt anterior profile,

small mouth, and jet-black eye. Kuronuma's specimen, however, cannot be identified as a species of *Bothus* because of the significant generic characters pointed out above.

The genus *Arnoglossus* is another form to which attention should be paid. This genus is characterized by an elongate body and the smooth urohyal and pelvic bones (Kyle, 1913; Uchida, 1936; Ochiai and Amaoka, 1963). These differences indicate that the present larvae are not *Arnoglossus*.

A search of the literature on postlarvae of the Bothidae revealed three genera, *Crossorhombus*, *Engyprosopon*, and *Psettina*, with the serrate urohyal and posterior process of the pelvic bone (Ochiai and Amaoka, 1963; Pertseva-Ostroumova, 1965). No postlarvae of these genera have such a deep body as our specimens and the posterior process of their pelvic bone is rather elongate and tapering. By such characters, there is no difficulty in distinguishing the present larvae from the postlarvae of these three genera.

Finally, we find three other genera, *Laeops*, *Chascanopsetta*, and *Kamoharaia*, the larvae of which are most readily distinguished from ours by their elongate form, larger size (70.5 mm, 78 mm, and 91 mm in standard length), and smooth urohyal and pelvic bones (Hubbs and Chu, 1934; Bruun, 1937; Nielsen, 1961, 1963).

The present specimens cannot be identified with any previously described bothid larvae.

We therefore need to consider the remaining bothid genera that occur in our waters: *Parabothus*, *Tosarhombus*, *Asterorhombus*, *Japanolaeops*, *Neolaeops*, and *Taeniopsetta* (Amaoka, 1969). Our comparison with species of these genera, however, is based on the meristic characters of adult fishes, because we lack knowledge on the larval characteristics of fishes of these genera.

Two species of the genus *Parabothus*, *P. coarctatus* and *P. kiensis*, are similar to the present larvae in having vertebral counts of $10+32-33=42-43$ and $10+31-32=41-42$, but they have a higher number of

Table 2. Meristic characters of the larvae and juvenile of *Taeniopsetta ocellata* and of adult form; a larva described by Kuronuma (1942) as *Bothus bleekeri* is compared (see p. 9). EMS = early metamorphic stage; MMS = middle metamorphic stage; LMS = late metamorphic stage; JS = juvenile stage. Four stages are defined on p. 95.

Characters	Larvae and juveniles (original)				Sources of adult characters			<i>Bothus bleekeri</i>
	EMS	MMS	LMS	JS	Norman (1934)	Kuronuma (1940)	Amaoka (1969)	Kuronuma (1942)
Number of specimens	1	1	2	1	5	14	49	1
Standard length	59	60	61-70	81	135-155	121-169	104.9-172.0	61
Dorsal rays	94	89	87-90	88	88-93	83-96	85-97	93
Anal rays	75	72	73-75	74	74-78	67-80	71-81	78
Pectoral rays (left)	—	—	13	13	13-14	12-15	12-16	—
Pectoral rays (right)	—	—	12	12	—	7-12	10-14	—
Scales in lateral line	—	—	105	106	105	105-122	95-113	98
Vertebrae including urostyle	10+32 =42	10+31 =41	10+32 =42	10+32 =42	—	—	10+30-32 =40-42	10+32 =42

fin rays (dorsal 106-117, anal 87-95 in *P. coarctatus*; dorsal 104-113, anal 83-90 in *P. kiensis*) than the larvae (dorsal 87-94, anal 72-75). These counts will readily eliminate the genus *Parabothus* from consideration.

The monotypic genera *Tosarhombus*, *Asterorhombus*, *Japonolaeops*, and *Neolaeops* have been found in our waters. However, among these genera, *Tosarhombus* has a slightly higher number of fin rays (dorsal 96-104, anal 76-82) and a slightly lower number of vertebrae (10+28-30=38-40); *Asterorhombus* has too low a number of fin rays and vertebrae (dorsal 82-85, anal 63, vertebrae 10+26=36); and *Japonolaeops* and *Neolaeops* have too high a number (dorsal 109-125, anal 90-101, vertebrae 10+41-42=51-52; dorsal 108, anal 83-87, vertebrae 13+38=51, respectively). Thus there is no difficulty in distinguishing the larvae from those of these genera.

The characters of the only remaining genus, *Taeniopsetta*, are shown in Table 2. The meristic characters of the present larvae agree with those of the adult of *T. ocellata*. In the course of a systematic study of Japanese sinistral flounders, it has been found that location of the first ray of the right ventral fin opposite the second ray of the left fin is diagnostic to the genus *Taeniopsetta* (Amaoka,

1969). In the present larvae as described above, this character agrees well with that of the adult form. On the other hand, a giant larvae described and named *Bothus bleekeri* by Kuronuma (1942), with its meristic counts falling on the ranges of the present species *T. ocellata* and its resemblance in other external characters to the latter, are believed to be the present species, rather than to the former.

We therefore reach the conclusion that the larval and juvenile specimens should be identified as *Taeniopsetta ocellata*, of which neither the development nor the metamorphosis has previously been studied.

Acknowledgments

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ヒラメ類の稚仔魚の研究—I. イトヒキガンゾウ

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日本近海の各地から採集された5個体のヒラメ類の後期仔魚および稚魚を調査した。これらは1種類の一連の発達段階のものであり、非常に大きく(体長58~81mm)、ほとんど円形であること、尾舌骨の縁辺に多くの鋸歯をもつこと、腰骨の後方突起は板状でその下縁に多くの鋸歯をもつこと、頭部に3本の棘をもつことおよび右側の腹鰭第1軟条は左側の第2軟条部附近から始まることなどの特徴で、ダルマガレイ科(Bothidae)の他の種類の稚仔魚から明らかに区別される。

このような仔魚は黒沼(1942)によって、変態初期の1個体を *Bothus bleekeri* Steindachner として同定され、記載された以外に報告されていない。ここで調査した稚仔魚は背鰭条数、臀鰭条数および脊椎骨数などの形質から、イトヒキガンゾウ *Taenioipsetta ocellata* (Günther) と同定され、形態的な違いによって次の4段階に分けられる。

変態初期: 眼は体の両側にあり、ほとんど左右相称的な位置をしめる。鱗、側線および色斑は発達しない。変態中期: 眼は頭部の背辺に達し、その前上部に吻突起を形成する。体側に眼径大の眼状斑や斑紋が存在する。変態後期: 右眼は完全に移動を終る。吻突起は消失する。鱗、側線は発達する。稚魚期: 頭部、胸鰭および体色など良く発達する。

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Explanation of Plate 3

Photographs of the larvae and juvenile of *Taenioipsetta ocellata* (Günther) taken on the same specimens as illustrated (Figs. 1-4), showing true pictures of the young especially on delicate pattern of pigmentation. Numbers correspond to the same of the text-figures. 1, postlarva in early metamorphic stage, 59 mm; 2, in middle metamorphic stage, 60 mm; 3, in late metamorphic stage, 70 mm; 4, juvenile stage, 81 mm.

