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Postlarvae and Juveniles of Silver Sea Bream, *Sparus sarba* Occurring in the Surf Zones of Tosa Bay, Japan

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Abstract A total of 515 larval and juvenile *Sparus sarba* (8.2–17.8 mm TL) was collected at semimonthly intervals with a small seine in surf zones of Tosa Bay during the period of May 1981 to May 1982. They had morphological characteristics common to the larvae and juvenile of Sparinae, but were distinguished from the others by 24 dorsal and 14 anal fin rays, the first soft ray of pelvic fin not elongated and small melanophores along the dorsal margin occurring first on the caudal peduncle. They occurred in surf zones of Tosa Bay in two separate seasons, from late March to late May, and from late November to late January, being most abundant in April and May. In past studies using traditional larval nets or minnow-nets in coastal or shallow waters of Tosa Bay, larval and juvenile *S. sarba* were not reported. It seems that their distribution is limited in extremely shallow waters such as surf zones.

The silver sea bream, *Sparus sarba* (Temminck et Schlegel) (Sparinae, Sparidae) is important both to commercial and sport fishing in southern Japan. Tasting better than the black sea bream *Acanthopagrus schlegeli*, this is considered to be a promising fish for fish farming (Akazaki, 1962; Masuda *et al.*, 1980; Tsukashima and Kitajima, 1982). However, little is known about the ecology and early life history of this fish. Fragmental morphological reports were made on eggs by Kamiya (1925) and Mito (1963), on prelarvae by Kamiya (1925), Mito (1963) and Suzuki and Hioki (1979), on young by Kishinouye (1916), and on rearing from eggs to prejuvenile by Tsukashima and Kitajima (1982).

Recently it was found that larvae and juveniles of *S. sarba* as well as those of *Acanthopagurs schlegeli* and *A. latus*, occurred abundantly in surf zones of western Kyushu and Tosa Bay (Senta and Kinoshita, 1985). The morphological characteristics of postlarva to prejuvenile of *S. sarba* and their seasonal occurrence in the surf zones facing Tosa Bay were presented in this paper.

Study sites and materials

Semimonthly collections of larval and juvenile fishes with a small seine were made at three beaches, such as Usa, Tanesaki and Tei of Tosa Bay from May 1981 to May 1982 (Fig. 1). The seine was 1 by 4 m in size, having a mesh width of 1 mm, provided with a shallow conical bag at the center of the net, and with no weights attached (Fig. 2). Two persons kept the net stretched, and waded backwards in the sea, from ankle- to breast-depth along the beach for a distance of about 50 m. The upper one-fifth of the net was always kept in the air. A day's collection at each of the beaches usually consisted of four to six hauls. Specimens were preserved in 10% formalin until sorting and measurement in the laboratory.

Of 89,601 larval and juvenile fishes collected during the study period, 515 were sorted to *S. sarba*, 8.2–17.8 mm TL.

Result

1. Description of larvae and juveniles. The general morphological characteristics of postlarval and juvenile Sparidae are as follows; snout rounded, myomeres 24, head spines weak, and marked melanophores occurring on occiput, throat, ventral abdomen and in rows along the ventral. Among the Sparidae, postlarva and prejuvenile of Sparinae have more slender bodies, and melanophores are more heavily distributed than those of the Pagrinae.

All specimens smaller than 9.7 mm TL (three individuals) were too damaged and destorted to be illustrated. The smallest specimen collected (8.2 mm TL) already had numbers of dorsal (23) and anal fin rays (13) near to those of adult fish (D XI, 13; A III, 11).

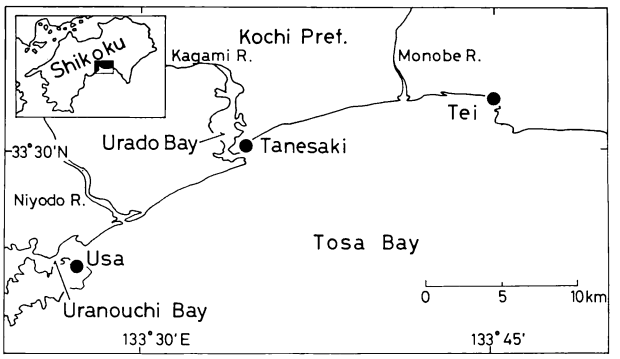

Fig. 1. A map showing three beaches, Usa, Tanesaki and Tei facing Tosa Bay where semimonthly collections in the surf zones with a small seine were made.

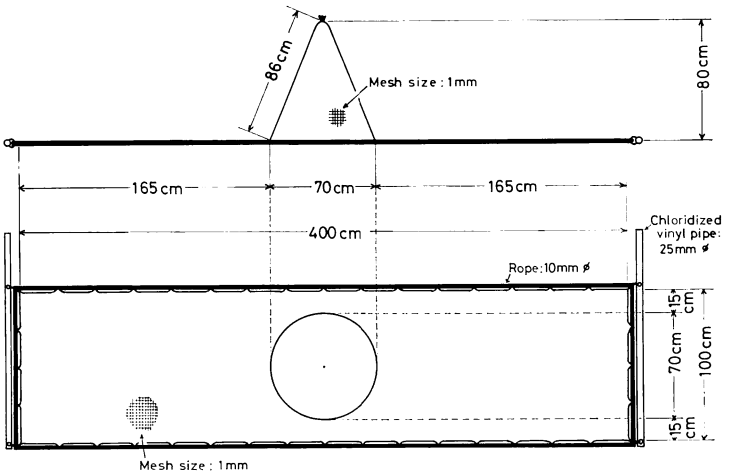

Fig. 2. The seine net used to collect eggs, larvae and juveniles of fish in surf zones.

9.7 mm TL postlarva (Fig. 3A): This specimen had the same dorsal and anal fin ray counts as the 8.2 mm TL larva. The body is compressed and moderately elongated, with a short and rounded snout. Two rows of preopercular spines are present; a lower row of four spines and an upper row of three. Pelvic buds are present. Branched melanophores are distributed on the top of the head, on the otocyst, on the ventral margin of body from throat to anus, and on the dorsal surface of the gut. Stellate or punctate melanophores are present along the anal fin base (double), along the ventral contour (single), on the dorsal side of the caudal peduncle (single) and at the caudal fin base.

11.2 mm TL postlarva (Fig. 3B): The dorsal and anal fin rays are completed in number. The spines on the lower row of the preopercular have increased to five.

12.2 mm TL postlarva (Fig. 3C): Punctate melanophores have appeared on the snout and tip of lower jaw. The spines on the lower row of the preopercular have increased to six.

13.2 mm TL postlarva (Fig. 3D): A series of distinctive melanophores has appeared along both sides of the posterior dorsal fin base. The rays of the pelvic fins are fairly developed, though their number is not yet the same as that of adults.

16.1 mm TL prejuvenile (Fig. 3E): The stellate melanophores along the dorsal fin base have increased in number (about 11), now reaching at 5th spiny ray base; those on the head also are more numerous. Seven small spines are present on the lower row of the preopercular; spines in

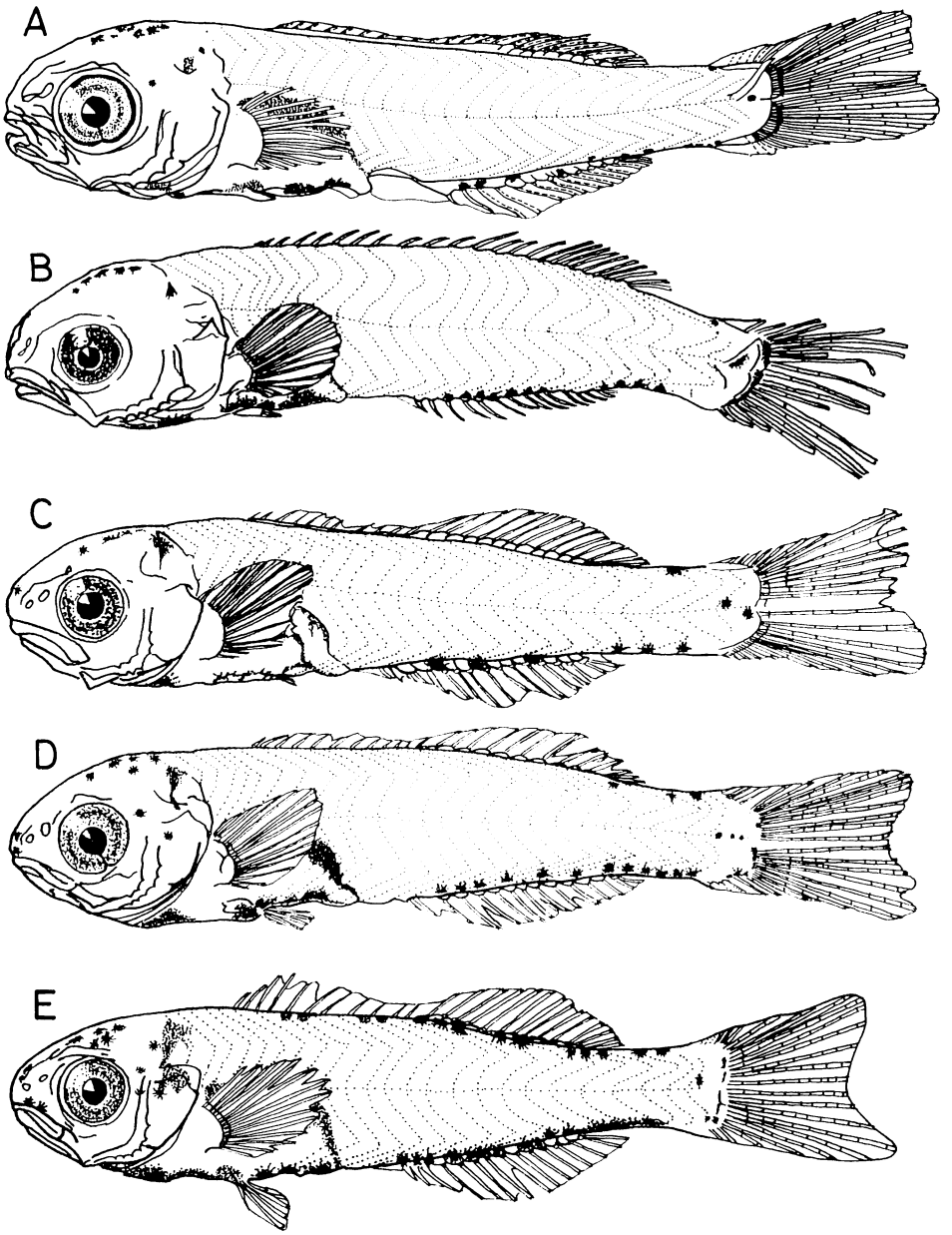

Fig. 3. Developmental stages of *Sparus sarba*. A, 9.7 mm TL postlarva; B, 11.2 mm TL postlarva; C, 12.2 mm TL postlarva; D, 13.2 mm TL postlarva; E, 16.1 mm TL prejuvenile.

the upper row have disappeared. The pelvic fin rays are complete.

2. Seasonal occurrence in Tosa Bay. Larval and juvenile *S. sarba* occurred in two separate seasons of the year; from late March to late May (spring group) and from late November to late January (autumn group), with a peak occurrence in April and May (Fig. 4). There was no morphological difference between the two seasonal groups. Body size ranged wider in the spring group (8.2–17.8 mm TL) than in the autumn group (11.6–16.5 mm TL), but the mode was larger in the latter (14.1–14.5 mm TL) than in the former (13.1–13.5 mm TL) (Fig. 5). Compared

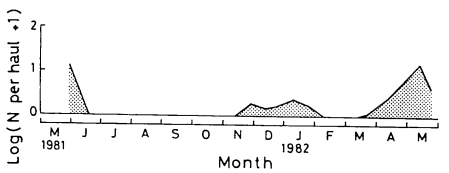

Fig. 4. Seasonal occurrence of larval and juvenile *Sparus sarba* in surf zones of Tosa Bay.

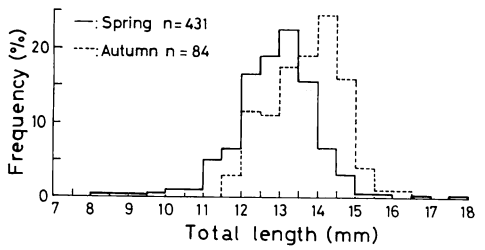

Fig. 5. Length frequencies of larval and juvenile *Sparus sarba* in spring and autumn.

with growth of reared fish (Tsukashima and Kitajima, 1982), the size of the specimens suggests that they could be about one month old. According to Kamohara (1958), *S. sarba* spawns in April and May in Tosa Bay. It is sure, however, that *S. sarba* in Tosa Bay spawns not only in spring, but also in autumn from October to December.

Discussion

Larvae and juveniles of *S. sarba* are very similar in general morphology to those of the closely related *Acanthopagrus schlegeli* and *A. latus*, but are easily differentiated from the latter two. Aggregate numbers of dorsal and anal rays in *S. sarba* are more than 23 and 13, against 22 and 11, respectively, in the *Acanthopagrus* species. The first soft ray of the pelvic fin is not elongated in *S. sarba* and *A. schlegeli* as in *A. latus* (see Shojima, 1958) during the juvenile stage. Stellate melanophores along the dorsal margin of the body first occur on the caudal peduncle in *S. sarba*, but at the base of the second or third dorsal spine in *A. schlegeli*, and at the base of the second or third dorsal soft ray in *A. latus*. The series of melanophores on caudal peduncle in *S. sarba* progresses forward to rim the entire dorsal and ventral margins of the body black with growth. A vertical band of melanophores had not formed on the largest specimens collected, 17.8 mm TL. On the other hand, in both the *Acanthopagrus* species the dorsal melanophores which appeared first extend their distribution ventrally to form a vertical band on the body.

In the preflexion or flexion stages when dorsal and anal fin rays are not yet differentiated, *S. sarba* can be identified when a melanophore has appeared on the dorsal margin of the caudal peduncle.

According to Tsukashima and Kitajima (1982), artificially reared *S. sarba* of 13.7–16.7 mm TL already have vertical bands on the body, suggesting that melanophores are generally less developed in wild juveniles which are also a little more slender in this fish. Similar differences between wild and reared juveniles are also observed in *Lateolabrax japonicus*, *Nibea mitsukurii*, *A. schlegeli* and *A. latus* (Kinoshita, unpublished).

The present study showed that larvae and juveniles of *S. sarba* as well as *A. schlegeli* and *A. latus* all of which belong to the Sparinae (black sparids) are usual components of the surf zone ichthyofauna, and that utterly or almost no larval and juvenile Pagrinae (red sparids) such as *Pagrus major* and *Evynnis japonica* occur in surf zones. Ruple (1984) reported frequent occurrences of larval sparids, *Archosargus probatocephalus* and *Lagodon rhomboides*, in surf zones of the Gulf of Mexico. It seems that utilization of surf zones in early stages of life history by certain black sparids is a worldwide phenomenon. In striking contrast to this, larval and juvenile black sparids never or seldom occur in samples from minnow-nets for whitebait which operate in waters just outside the present study sites, while larval and juvenile red sparids commonly occur in such collections (Hirata and Konishi, 1982; Ikemoto *et al.*, 1983). Similar phenomena are also known in Kyushu (Azeta *et al.*, 1980; Kinoshita, unpublished). Since adults of black sparids inhabit more coastal and shallower waters than those of red sparids, it is interesting that a similar habitat isolation is observed as early as in larval and juvenile stages.

Larval and juvenile *S. sarba* occurred twice a year in Tosa Bay, i.e., spring and autumn. On the other hand, larvae and juveniles of the other sparids occurred once a year, either in spring (*A. schlegeli* and *P. major*) or in autumn (*A. latus* and *E. japonica*) (Matsuda, 1969).

According to Senta (pers. comm.), larval and juvenile *S. sarba* in surf zones of west coasts of

Kyushu have been collected only in spring so far. As the west coasts of Kyushu are under the direct influence of the northwesterly monsoon during this period, the number of hauls made in surf zones there have been rather few. It may be too early to conclude that *S. sarba* spawns twice a year only in Tosa Bay.

S. sarba collected during the present study ranged from 8.2 to 17.8 mm TL, with the majority from 11 to 15 mm (Fig. 5). The mesh width of 1 mm is small enough to retain larval *Konosirus punctatus*, as small as 4 mm SL (Senta and Kinoshita, 1985). The upper limit of the range of total length of the *S. sarba* specimens in the present study is not attributable to the net avoidance by larger fish. It is not seldom that young as large as 40 mm TL or greater of many kinds of fishes (e.g. *Seriola quinqueradiata* and *Trachurus japonicus*) which can most probably swim faster than sparids of the same size were collected during the present survey (Kinoshita, 1984). We can conclude that *S. sarba* as well as *A. schlegeli* and *A. latus* are among the "migrants" (Modde, 1980) to the surf zones which utilize this habitat only for a limited period of their life history. The size frequency of the Sparinae indicates that a continual influx and departure of individuals from the surf zones occurred.

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土佐湾の砕波帯に出現するヘダイ仔稚魚

木下　泉

土佐湾の砕波帯において，1981 年 5 月から 1982 年 5 月の間に行われた小型曳網を用いた月 2 回の採集によって，ヘダイの仔稚魚，合計 515 尾 (8.2–17.8 mmTL) が得られた．ヘダイ仔稚魚は，ヘダイ亜科のものの一般的な形態的特徴を持ちつつも，以下の点で他と識別できる．背・臀鰭の総鰭条数は，それぞれ 24・14 である．腹鰭第 1 軟条は伸長しない．体側背縁の小黒色素胞は尾柄部に最初に出現する．ヘダイ仔稚魚は，土佐湾の砕波帯においては，3 月下旬–5 月下旬および 11 月下旬–1 月下旬の年 2 回に分けて出現し，最も量的に多かつたのは 4 月と 5 月であつた。過去，土佐湾の沿岸域や浅海域において，本種仔稚魚は全く報告されていない．それらの分布域は，砕波帯のような極く浅海域に限られているようである．

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