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GROWTH OF SOME MARINE FISH LARVAE HATCHED OUT FROM PELAGIC EGGS*

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ABSTRACTS

For the time being we do not have enough information concerning the early larval growth of marine fishes hatched out from pelagic eggs. Such information is useful in considering the periods required by the fish larvae to attain certain sizes from the time of hatching.

It should be noted that we have to be careful in comparing the results obtained from these experiments with those in the natural environment, because in the former case the larval growth depends largely on the rearing techniques. This paper is only a preliminary report on some examples of early larval growth observed in the rearing experiments.

INTRODUCTION

AT the present moment much effort is being expended in Japan to establish the production of fisheries resources artificially in the sea, and the establishment of advanced techniques on the culture of larval fishes is essential for the achievement of this objective. The authors carried out rearing experiments on some fish larvae on a large as well as small scale at the Hakatashima Station located at the central part of the Seto Inland Sea of Japan.

Through the experiments we have obtained some information on the early growth of fish larvae hatched out from the pelagic eggs. By using such information we can estimate the age of fish larvae collected from the sea. Moreover, we may know the locality where those fish larvae hatch out if we have enough information concerning the movement of the sea water, because these fish larvae have little locomotive ability and seem to be transported by the current.

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MATERIALS AND METHODS

The pelagic fish eggs used in the present experiments were mainly collected by a plankton net from near the Hakatashima Station. Some were obtained from the pond in the Station in which the matured adult fish were kept, whilst others were obtained by artificial fertilization.

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The eggs collected by the plankton net from the sea were sorted species-wise and put into glass or plastic tanks containing 12–30 litres of sea water, while those obtained from other sources were kept in plastic tanks containing 40 or 500 litres of sea water. The eggs were kept in stagnant sea water until they hatched out, after which aeration was started. Usually one week after hatching some of the water in the experimental tanks was replaced with fresh sea water at certain intervals. The amount and the interval of replacement of water in the experimental tanks depend on the culture conditions. A certain amount of sea water containing planktonic green algae was added to the water in the experimental tanks to keep the water quality stable.

The water in the experimental tanks was maintained at a temperature nearest to that of the natural sea water at that time, but in some cases the tanks were kept at room temperature. The hatched larvae were fed with the following items of food according to their developmental stages: Bivalve larvae (mostly oyster larvae), Rotifers (*Brachionus pricatilis*), Artemia nauplii, Zooplankton (micro and macro) and minced fish meat.

RESULTS

1. *Konosirus punctatus* (Temminck *et* Schlegel) Dorosomatidae (Fig. 1)

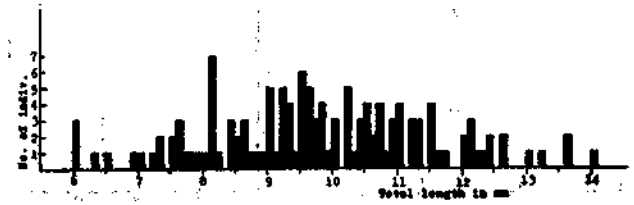

Fig. 1. Size frequency distribution of rearing larvae of *Konosirus punctatus* at 19 days after hatching.

2. *Engraulis japonica* (Houttuyn) Engraulidae (Fig. 2).

Fig. 2. Size frequency distribution of rearing larvae of *Engraulis japonica* at 18 days after hatching.

On 3rd and 4th June 1967, 150 eggs of *K. punctatus* and 600 eggs of *E. japonica* were collected by plankton net. The eggs of both species were kept in glass tanks both having 12 litre in capacity. The water temperature ranged from 20° to 23°C during the experiment. The duration of the experiment was 19 days in the case of *K. punctatus* and 18 days in the case of *E. japonica*. At the end of experiment 29 individuals of *K. punctatus* and 139 individuals of *E. japonica* survived. The frequency distribution of the total length of the larvae measured at the end of the experiment is shown in Figs. 1 and 2. The range and average of the total length of the larvae were 8.5 - 14.4 mm and 10.7 mm respectively in *K. punctatus*, and 5.0 - 14.0 mm and 9.7 mm respectively in *E. japonica*.

3. *Liza carinata* (Cuvier *et* Valenciennes)? Mugilidae (Fig. 3).

From 1st to 3rd June 1967, 115 eggs were collected by plankton net and they were put into a plastic tank containing 30 litre of sea water. The sea water was kept at a temperature of 22.6° – 28.0°C. The total lengths of the larvae at 12 – 14 and

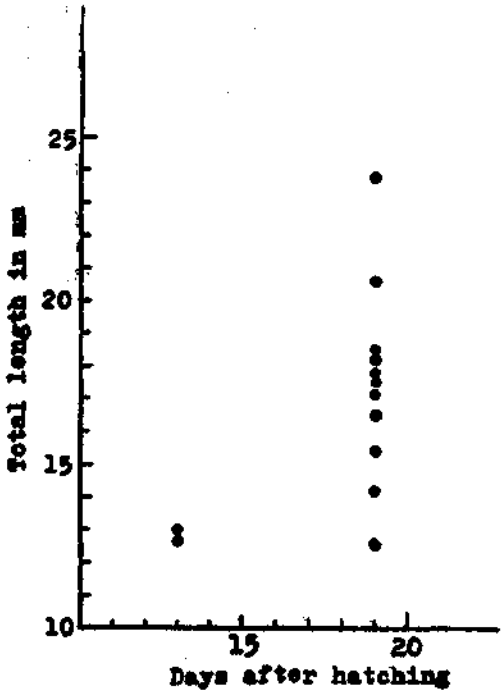

Fig. 3. Size frequency distribution of rearing larvae of *Liza carinata*?

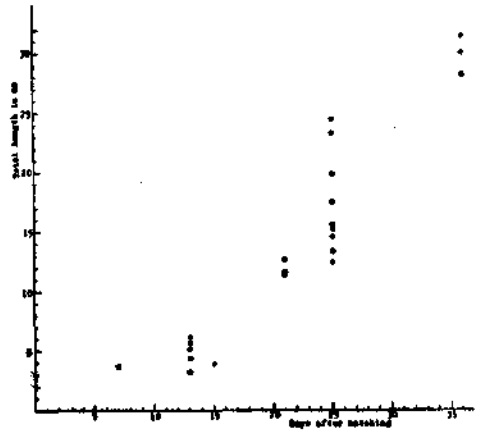

Fig. 4. Early larval growth of *Epinephelus akaara*.

18 – 20 days old are shown in Fig. 3. The survival rate at 18 – 20 days after hatching was about 30 %

4. *Epinephelus akaara* (Temminck *et* Schlegel) Serranidae (Fig. 4).

A series of rearing experiments were carried out from 24th July to 21st August 1966. The eggs spwaned by the captive adults in the pond were used in these experiments. In every case, about 20,000 eggs were kept in a plastic tank, 500 litre in capacity, and the water temperature was kept at 26°–31° C. The early growth of larvae is shown in Fig. 4. The survival rate at 35 days after hatching was about 0.5%.

5. *Pleuronichthys cornutus* (Temminck *et* Schlegel) Pleuronectidae (Fig. 5)·

The eggs were collected by the plankton net from 15th to 27th November 1966 by several hauls, and they were put into a plastic tank of 30 litre capacity. The water temperature was kept at 13.5°–15.2°C. The early larval growth is shown in Fig. 5. The survival rate in the early larval stage was not recorded.

6. *Kareius bicoloratus* (Basilewsky) Pleuronectidae (Fig. 6).

The eggs used in this experiment were obtained by artificial fertilization carried out on 17th December 1967, and 500 eggs were kept in a plastic tank having 40 litre capacity. The water temperature ranged from 10° to 15°C during the experiment. The size frequency distribution of the larvae at various ages is shown in Fig. 6. The survival rate at 40 days after hatching was about 20%.

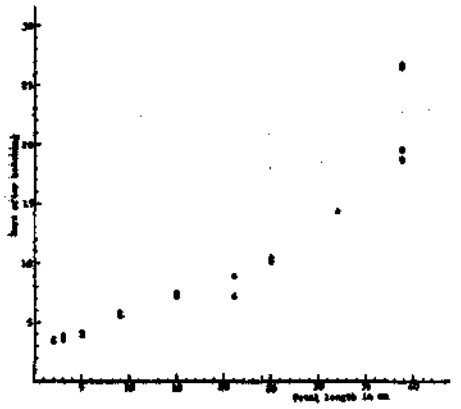

Fig. 5. Early larval growth of *Pleuronichthys cornutus.*

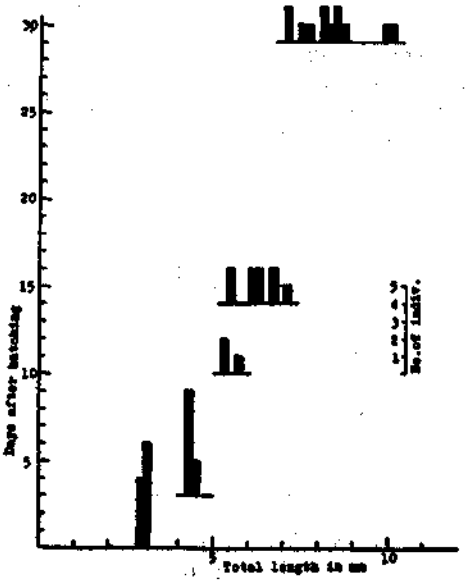

Fig. 6. Size frequency distribution of rearing larvae of *Kareius bicoloratus.*

7. *Pseudoaesopia japonica* (Bleeker) Soleidae (Fig. 7).

On 31st May 1967, 30 eggs were collected by a plankton net and put into a glass tank containing 15 litre of sea water. The water temperature was kept at 20.6° – 23.0°C. The total length frequency distribution of 22 day old larvae is shown in

Fig. 7. Size frequency distribution of rearing larvae of *Pseudoaesopia japonica* at 22 days after hatching.

Fig. 7. The total length range of the larvae at that age was 10.81 – 15.19 mm with an average of 13.32 mm. Several larvae were kept separately in the same sized tank at water temperatures of 22.6° – 28.0°C and they attained 15.10 – 17.46 mm in total length within 22 days after hatching. The survival rate at 22 days after hatching was 90%.

8. *Miscellaneous species*

Some *ad hoc* experiments were carried out on several species, but detailed data were not collected. The results are breifly summarised in Table 1.

TABLE 1. *Early larval growth of miscellaneous species*

Species	Period from hatching to end of experiment	Water temperature (°C)	Total length of larva (mm)
Leiognathus nuchails (T.*et*. S.)	VIII–10–VIII–25 '65	No record	9.65
Argyrosomus argentatus (H.)	VII–22–VIII– 7 '66	25 – 27	8.00
Sillago japonica T. *et* S.	VIII–10–VIII–25 '65	No record	8.45
Inimicus japonicus (C. *et* V.)	VII–17–VII–25 '65	,,	7.88
Hypodytes rubripinnis (T. *et* S.)	VII–20–VIII–25 '65	,,	9.30

CONCLUSION

From these experiments it is very difficult to say with certainty how many days are required by the fish larvae to attain certain sizes because the growth of the larvae depends largely on the rearing techniques and environmental conditions. Considerable size fluctuations are usually observed among larvae of the same age.

However, it is just as difficult to estimate the growth of the early larval stages of fish in the sea through the analysis of the collected samples, and the difference in larval growth under natural and artificial conditions is still unknown. Although there is no supporting evidence, the authors would like to propose that the growth of larval fish in the sea can be expected to be equivalent to the maximum growth rate observed in rearing experiments. In this connection the data obtained so far are summarised as Table 2.

TABLE 2. *Examples of early growth of larva hatched out from pelagic egg in Japan.*

Species of fish		Egg size (Yolk size)	Total length of larva just hatched	Maximum total length of larva observed in rearing experiment		
Scientific name	Family	(mm)	(mm)	Days after hatching	Total length (mm)	Water temp. (°C) (Estimate)
Konosirus punctatus	Dorosomatidae	1.3 – 1.6 (0.8–.1.1)	3.1 – 3.8	19	14.4	20 – 23
Engraulis japonica	Engraulidae	1.1 – 1.6 x 0.5 – 0.7	2.6 – 3.2	18	14.0	20 –23
Liza carinata?	Mugilidae	0.9 – 1.0	—	14 20	12.9 23.8	22.6 – 28.0
Leiognathus nuchalis	Leiognathidae	0.6 – 0.7	1.4	16	9.7	(28)
Epinephelus akaara[1]	Serranidae	0.7 – 0.8	1.5 – 1.6	13 26 36	6.2 24.5 31.4	26 – 31
Argyrosomus argentatus	Sciaenidae	0.7 – 0.8	1.5	17	8.0	25 – 27
Sillago japonica	Sillaginiadae	0.6 – 0.7	1.6 – 2.0	16	8.4	(28)

TABLE 2 (CONTD.)

Species of fish		Egg size (Yolk size)	Total length of larva just hatched	Maximum total length of larva observed in rearing experiment		
Scientific name	Family	(mm)	(mm)	Days after hatching	Total length (mm)	Water temp. (°C) (Estimate)
Mylio macrocephalus[2]	Sparidae	0.8 – 0.9	1.9 – 2.0	10	3.6	19 – 25
				20	7.0	
				30	14.3	
Chrysophrys major[3]	Sparidae	0.9 – 1.0	1.9 – 2.1	9	4.5	18.4 – 21.9
				20	7.8	
				28	12.4	
Hypodytes rubripinnis	Congiopodidae	0.8 – 1.0	2.3	37	9.3	(25 – 28)
Inimicus japonicus	Synanceiidae	1.3 – 3.4	3.2 – 3.4	9	7.9	(28)
Tanakius kitaharai[4]	Pleuronectidae	1.2 – 1.3	3.4	29	7.5	14.5 – 16.7
Pleuronichthys cornutus	Pleuronectidae	1.2 – 1.3	3.7 – 3.8	9	5.8	13.5 – 15.2
				21	8.9	
				39	26.6	
Kareius bicoloratus	Pleuronectidae	1.0 – 1.1	3.0 – 3.1	10	5.5	10 – 15
				19	8.0	
				29	10.2	
Pseudoaesopia japonica	Soleidae	1.6 – 1.8	4.1	10	10.7	20.6 – 23.0
				22	15.2	
				22	17.5	22.6 – 28.0
Zebrias zebra[5]	Soleidae	1.5 – 1.6	4.3	12	9.2	23 – 27

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* In Japanese, others in Japanese with English Summary