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LABORATORY REARING OF THE EGGS AND LARVAE OF MARINE FISHES

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Quality of Water Medium:

The quality of water in which fish eggs and larvae are reared includes both physical and chemical factors that make aquatic environment suitable. Various chemical and physical parameters interact to produce a variety of distinct environmental complexities. Certain aspects which directly have some bearing on the quality of water are outlined below:-

Temperature:

For laboratory rearing purposes the most important physical aspect to be considered is temperature. Temperature of water has a definite influence on the successful rearing of the larvae. Vijayaraghavan (1955) collected hatchling of Anchoviella tri from the sea when the temperature was 28.6°C and maintained them at temperatures of 15°C, 20°C, 25°C and 30°C. After 8 hours he noticed less survival rate at 15°C and 30°C and maximum survival rates at 20°C and 25°C. With more experiments he ascertained that the best survival rate is between 20° and 25°C. He was successful in rearing the larvae of Decapterus russelli, Engraulis gravi, Anchoviella tri, Scomberomorus guttatum, Saurida tumbil and Cynoglossus sp. in temperatures ranging from 20°C to 25°C. In tropics the seasonal fluctuation in temperature is slight, and this may lead to a narrow range of tolerance. Based on the experiments on a total of 10 species of fish larvae, Kuthalingam (1959)

had shown that the range from lower to upper lethal limit in temperature was only to the tune of 3 to 4°C. It is possible that the tolerance may vary with the advancement of stage. The present author could collect the eggs of S.commerson and rear them till 72 hours at a temperature varying from 25 to 28°C.

Salinity:

Slight variation in salinities can affect the development at the early stages. Osmotic properties of water play a vital role in the life-history of fishes, especially at the marine and estuarine habitat. An increase or decrease in salinity brings about changes in the specific gravity of water and this has considerable impact on the fish at its critical period of development. Seer fish larvae were observed at salinity ranges of 31.80‰ - 35.12‰. Sphyraena borealis larvae were reared at salinity ranges of 33.0 - 34.6‰, and the present author has reared Scemberomorus commerson at 34.39 - 34.9‰.

Other factors:

The viscosity of sea water is high enough to protect the eggs and youngones from mechanical disturbances and help them to float on the surface of water. Dissolved substances in the water have both direct and indirect effect on fishes especially at their critical stage of development. The nutrients available in water can produce microscopic plants which in turn, act as food for many young and adults of fishes. Excess of dissolved salts create osmotic burden on young fishes.

Attack by ciliates.

The larvae reared are easily attacked by ciliates, as they flourish on dead eggs and then spread to healthy ones. It may be noted that the prolarvae are the most

Vulnerable to ciliate attack. It is highly essential to keep the rearing system free from ciliates. Agitation of water has been widely considered useful by many workers. (Gross, 1939) By this the larvae are prevented from resting at the bottom where ciliates are abundant around decaying matter. Vijayaraghavan (1955) has made some studies on this aspect. It may be stated in this connection that the success with the rearing system depends to a large extent on absolute cleanliness while setting up the experiments.

Ambient Water:

Clean, unpolluted water with no suspended impurities is essential for successful rearing. Selection of the right quality of water from the right place and maintaining it in the right condition is an essential prerequisite. This can be achieved by ascertaining the natural spawning habits of fish, for utilising the water in which the fish spawns in the natural habitat. Water collected from any site where that particular fish breeds and undergo subsequent development is the most suitable one for rearing it through different stages. The ambient water thus collected, has to be filtered to remove all suspended particles and also the planktonic elements that are likely to develop, multiply or bloom subsequently, tampering with the experiments. Although considerable work has been done on the life history of fishes, little is known about the methods of laboratory rearing. Also, the approaches made in these study seem to differ from author to author, although the principles and objectives are one and same. Vijayaraghavan (1955) gave a brief account of the methods used by him to rear the eggs and larvae under tropical conditions. The methods adopted by the various workers are almost similar to these.

Methods of Rearing Eggs, Larval and Post Larvae

Methods used in rearing fish eggs and larvae vary from author to author. There is no standard procedure or equipment for the purpose. Bapat (1955) used troughs in the laboratory for hatching and for further studies as a routine measure. Seshappa and Bhimachar (1955) were able to keep alive Malabar sole larvae (Cynoglossus semifasciatus) in the laboratory through various stages of metamorphosis. Pelagic eggs of Sphyraena boreales were incubated and the larvae were reared in a 55 litre aquarium. Although, there are numerous instance of such rearing operations, the method adopted by Vijayaraghavan (1955) seem to carry more details. The water should be aerated and filtered frequently. According to needs, the size of the system may be changed. For few eggs or larvae even a finger bowel or breaker of one litre capacity may be enough. Glass troughs of 5 to 50 litre capacity may be used for larval rearing. The running water system can be better used for post larvae and Juvenile rearing. Use of light, constant aeration of water, proper maintenance of temperature and control of ciliates are the pertinent aspects which have to be taken care of during rearing.

Rearing Techniques used to rear eggs and larvae by the author

The present author succeeded in incubating the eggs and rearing the larvae of Scomberomorus commerson upto 72 hours hatching. The simple unpublished technique designed for rearing them in the laboratory and in situ is as follows:-

For the purpose of rearing the fertilised eggs, an improvised "Incubation unit" in which the eggs could pass through their critical stages, both before and just after hatching, and a 'Rearing Unit' in which one day old larvae could undergo further development, in situ,

were designed. The incubation unit (Fig. 9.1,a) consists essentially of a flat bottomed circular glass trough of 10 litre capacity and a glass beaker of 500 ml capacity. The beaker is filled to about 3/4th with fresh filtered seawater and the fertilised eggs were then transferred to the beaker. The mouth of the beaker is tightly closed with organdi cloth well soaked in filtered sea water. The beaker is then placed in the middle portion of the trough and the latter is filled gently with fresh, filtered sea water upto a level of about one centimeter below the mouth of the beaker. Besides providing ample circulation of water through the organdie cloth this also helps in preventing evaoperation of water in the beaker and keeps the temperature of the water more or less as that of the surrounding sea water. The same unit may also be utilised for rearing the larvae for about a day after hatching. The rearing unit (Fig. 9.1, b) is helpful in rearing the larvae in situ from the second day onwards. It consists of a plastic bucket with slits cut all along its sides and a beaker of 1000 ml capacity. One day old larvae can be transferred to the beaker and the mouth is closed with organdie cloth of sufficiently large mesh size and it is then placed in the plastic bucket. The beaker is fastened tightly to the bucket and the entire unit is kept suspended by means of four bridles and kept at a depth of about 40 cm from the surface. Sufficient weight may be kept in the bucket to keep it upright in water.

Live Food of Postlarvae and Fry:

Little is known at present on the nutritional requirement and diet preference of the larvae and postlarvae of various species. Recent studies have indicated that the early postlarvae of fishes like the Seabass (Lates calcarifer) feed upon the rotifer

Brachionus plicatilis, nauplii of Artemia and the freshwater cladoceran Moina macrura. The diet requirement of postlarvae may be different from that of the fry. As growth advances mouth and jaws become more functional. Early in larval life, tuna were found to feed on small organisms measuring less than 100 microns; in the midlarval life, the feeding habits change abruptly to organisms of 500 microns or more. At the end of the mid larval life the fish takes larger organisms including other fish larvae. In the natural habitat the postlarva and juvenile fish feed on a wide variety of materials present in the water column, such as diatoms, phytoplankton and zooplankton. The food of young fish may vary from fish to fish. The intake of food items may also differ according to the feeding nature of the fish. A mullet fry at 20 mm stage feeds mainly on organic matter present in the water column, where as a seer, at the same size, prefer to feed mainly on larval fishes. The chemical compositions of some of the important live food items widely used in culture practices are incorporated in Table 9.1.

Table 9.1 Chemical composition of some important live food Organisms.

Organism	Percentage dry weight				Reference
	Protein	Carbo hydrate	Fat	Ash	
Tetraselmis maculata	52	15.0	2.9	-	
Dunaliella salina	57	31.6	6.4	-	
Chaetoceros sp.	35	6.6	6.9	-	
Skeletonema costatum	37	20.8	4.7	-	Parsons et al. (1961)

Phaeodactylum tricornatum	33	24.0	6.6	-	Parsons et al. (1961)
Exuviella sp.	31	37.0	15.0	-	
Chaetoceros sp.(unialgal) Culture growing exponentially	48.6	9.2	9.5	-	Lewin and Guillard (1963)
S. costatum (unialgal culture growing exponentially)	60.6	34.71	7.7	-	
S. costatum (unialgal culture, grown 2-4 weeks)	43.52	34.55	21.93	-	
P. tricornatum (unialgal culture growing empo-nentially)	35.7	25.9	7.1	-	
P.tricornatum (fusiform cells from 16-d culture)	46.5	2.2	38.6	-	
P. tricornatum (oval cells from 16-3 culture	37.7	21.1	26.6	-	
Diatom (*Chaetoceros*)*	29.0	8.0	63.0	-	From Marshal and Orr(1960)
Diatom (Mixed)*	24.5	14.2	61.3	-	
Mixed Zooplankton*	46.0	6.0	23.0	25	
Artemia nauplii	55.60	-	15.20	15.25	Gallagher and Brown (1975)
Brachionus plicatilis	59.07	8.44	24.05	8.44	Charles John Bhaskar (1982)
Moina sp.	56.69	13.47	23.73	6.11	
Tubifex	65.0	15.0	14.0	6.0	Bardach et al (1972)

* Grams per 100 gram Organic matter.

Adaptations of Mouth and Jaws

The type of food ingested and the feeding mechanism have correlation. Different types of mouth parts of the postlarval and juvenile fishes are given below:-

1. Centriscus sp. (22.5 mm TL)

   Mouth, placed anteriorly at the tip of elongated tube like, snout. Jaws small and dorsally directed. At the younger stages it is pelagic and feeds on diatoms floating on the surface of water.

2. Mullet fry. (20 mm)

   Protuded mouth, bearing no teeth, adapted to take mainly suspended organic matters.

3. Leptocephalus (120 mm)

   Wide mouth, long and weak teeth, only to hold together the jaws when closed. Feeds on diatoms taken along with water. Mouth cavity is wide to suit it.

4. Caranx sp. (16.7 mm)

   Mouth small no teeth on jaws characteristic of phytoplankton feeders.

5. Euthynnus affinis (5.62 mm TL)

   Postlarvae, adapted to feed on plankton. Mouth wide, jaws prominent. Teeth pointed forward, to hold any live planktonic organism.

6. Saurida tumbil (33 mm TL)

   Pelagic, fast feeder, feeding on decapods and copepodes. Teeth on jaws,bristle like pointed forward, closely arranged to capture large amount of pray and retain them in the mouth cavity. The teeth on tongue, recurved, help to take live zooplankters.

7. Seer fish (20 mm)

   Mouth wide, jaws large, teeth strong mostly recurved. Few recurved teeth on palatine. Adopted for carnevorus type of feeding.

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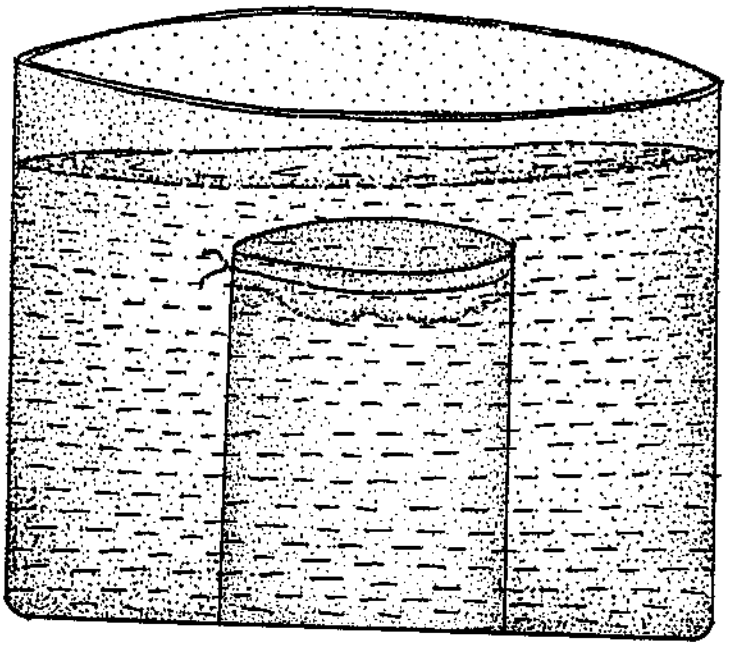
/ postlarvae and juveniles of Polynemus indicus, Sardinella longiceps,

a



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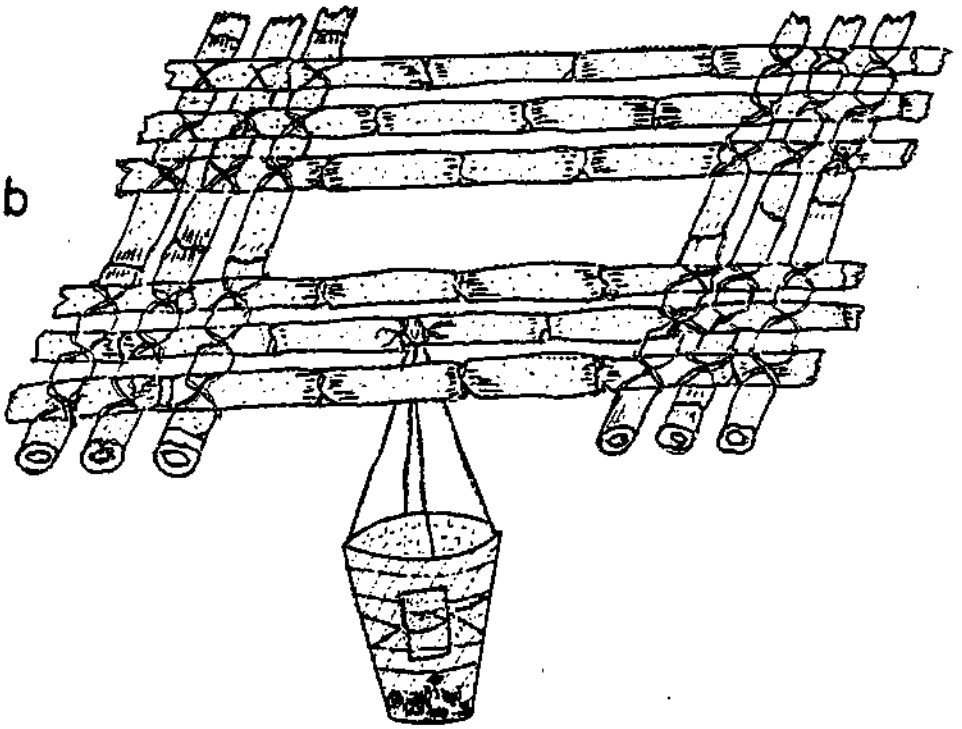

Fig. 9.1