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GUIDELINES FOR THE IDENTIFICATION OF LARVAE

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Introduction

The different stages or phases in the life history of fishes markedly vary from the adult and the degrees of difference vary in different groups. However, there is no sudden metamorphosis in fishes and the change of form is slow. The differences between the larvae and adults of some fishes have led erroneously to the descriptions of the early stages of eel as Leptocephalus, Molidae as Molacanthus and Centaurus, Chaetodontidae as Tholichthys, Schindleria as Hemirhamphus and Lampreys as Ammocoetus. Later, these generic names were given the status of stages in the early life history of the fish concerned. It has been frequently generalised that there is higher development in smaller sizes in the tropical areas than in temperate areas. Larval fish development would conform with this generalisation. In the tropics, the postlarval period is short especially in marine teleosts where the yolk is completely absorbed by the second day. In elasmobranchs which are ovoviviparous or viviparous true embryo directly gives rise to the juvenile since the uterine embryo gets nourishment from the parent. In the viviparous poecilids like Gambusia and Lebistes young ones are only postlarvae.

Changes that take place from the early prolarval to the late postlarval stages vary in different groups or families and no generalisation can be made. There is considerable overlap in the size ranges at which the

various transitions take place and the occurrence of salient characters such as, the time of appearance of chromatophores, change in shape of eye, changes in body profile etc. show differences. These factors sometimes makes separation of growth stages difficult in many species.

Size and shape of the body:

The size of the newly hatched larva may vary from about a millimeter to a few centimetres (eel) in length. The newly hatched prolarva of Leiognathus ranges from 1.2 to 1.4 mm, Engraulis from 2.2 to 3.0 mm, Epinephelus from 1.4 to 1.6 mm, Sillago from 1.6 to 2.0 mm and Pleuronichthys from 3.6 to 3.7 mm, The prolarvae of most of the Clupeidae, Belonidae, Hemirhamphidae, Syngnathidae, Synodontidae, and Blenniidae are elongate. Slender bodied prolarvae are those of Sillaginidae, Sphyraenidae, Bregmacerotidae, Cepolidae, Gobiidae, Gerridae, Coryphaenidae and Cynoglossidae. The prolarvae of Muraenidae and Ophichthyidae have an elongated ribbon-like body. The prolarvae of Mugilidae, Pomadasyidae, Thunnidae, Scombridae, Scomberomoridae, Stromateidae, Scorpaenidae etc. have short fusiform body. The prolarvae of Ostraciontidae and Tetraodontidae are globular in shape. The postlarvae of flatfishes have deeply compressed body and those of Platycephalidae, Pegasidae and Dactylopteridae are slightly depressed.

Nature of muscle fibres-Counting of number of myomeres:

Prolarvae of different groups could be distinguished by the number of myomeres which corresponds generally to the number of vertebrae in the adult and the general body proportions of the oldest metamorphosing stages available. The prolarvae of Balistidae, Aluteridae, Monacanthidae and Tetraodortidae have fewer than 24 myomeres. Mugilidae, Sphyraenidae, Carangidae, Mullidae,

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Istiophoridae, Theraponidae, Leiognathidae, Serranidae, Lutianidae etc. have 23-24 myomeres. The myomere number in Clupeidae, Engraulidae, Thunnidae, Scomberomoridae, Sillaginidae, Coryphaenidae, Belonidae etc. vary between 35-50. Dussumieriidae, Cepolidae, Bregmacerotidae, Belonidae, Cynoglossidae etc. have a little more than 50 myomeres. The muraenid leptocephali could be broadly divided into two groups, a majority group of comparatively short forms having 120-137 myomeres and the numerically insignificant group of longer ones with 180-216 myomeres. Leptocephalus of Muraenesox talabon has 136 myomeres of which 58 are preanal.

Delsman (1933) has compared the adult vertebral number of some Clupeoids with their larval myomeres counts and has pointed out the differences in the myomeres numbers, total as well as preanal. Since the total myomere count in the early clupeoid larvae is generally higher than the adult vertebral number and gets stabilised only later in the course of development, identification of clupeoids based on myomere number alone may not be reliable, especially when two species having difference in only one or two myomere number is involved. Identification of prolarvae is reliable when the total myomere number corresponds to adult vertebral number if other related species having overlapping vertebral numbers are not involved. Kowala coval has 40 vertebrae and no other related species has the same number. All the other clupeoids have more than 42 vertebrae and therefore their larvae should have 42 or more myomeres. In the prolarvae of Kowala coval there are 32 preanal and 8 postanal myotomes. The larvae of Kowala coval and Stolephorus insularis are similar in appearance. But the larvae of S. insularis has 28 preanal myomeres whereas the preanal myomeres of Kowala coval becomes 28 by the forward shifting of the vent only in advanced postlarval

stage. The caudal fin shows the beginning of heterocercal condition only when the larva reaches about 8 mm (Bensam, 1969).

In the prolarval stage of carangids measuring about 2 mm there are 29 myomeres of which 13 are preanal and 16 postanal. But, in slightly advanced stage of 2.1 mm, though the total number of myomeres remains 29, the preanal myomeres is 11.

In the prolarva of Xiphias gladius measuring 3.2 mm, the vertebral column is straight and tapers posteriorly without any upturn (flexin). The caudal fin though homocercal at about 7.6 mm, the hypural bones have partly developed and the vertebral column is partly visible. The myomere formula of some of the larval tunas is 18 + 21 which tallies with the adult vertebral number 39 and this enables to distinguish them. The urostyle generally makes its appearance in the early postlarval phase (3.2 mm) with the evidence of hypurals ventral to it in Psenes cyanophrys. In this species the myomeres at the posterior region of the body are clear, forming a zig-zag pattern (Legapsi, 1956). In Bregmaceros the vertebral column remains straight even after the larva attains 4 mm and the elements of the urostyle begins to develop only at about 4.8 mm (Clancey, 1956).

Alimentary canal and position of vent:

The alimentary canal is visible through vertical muscle strands in most of the prolarvae of Clupeidae, Engraulidae, and Dussumieriidae as a straight tract. Sometimes the midgut region is slightly swollen in the late postlarval stage. In Cynoglossidae and Soleidae the anterior part of the alimentary tract bulges out like a sac. Changes in the alimentary canal take place gradually as the yolk is absorbed.

The vent is generally situated behind the midpoint

of the body in the prolarvae of Clupeidae, Dussumieriidae, Engraulidae and Synodontidae. The vent is far forward in the prolarvae of Brogmacerotidae, Atherinidae, Trypauchenidae and Blenniidae. The vent is almost below the middle of the body in the prolarvae of the families Holocentridae, Apogonidae, Gobiidae, Sillaginidae, Carangidae, Lutianidae, Thunnidae, Scorpaenidae, Cepolidae, Opisthognathidae, Scomberomoridae, Coryphaenidae, Sparidae, Champsodontidae etc. Vent is situated far behind the middle of the body in the prolarvae of Apodes, Hemirhamphidae, Exocoetidae, Fistulariidae, Sphyraenidae, Platycephalidae and Cephalacanthidae.

In the newly hatched prolarvae of Caranx sp measuring 1.73 mm there are 13 preanal and 16 postanal myomeres. The gut is short and opens immediately below the 13th myotome. In a slightly advanced 2.04 mm stage although the gut remains tubular, the vent has shifted anteriorly and opens below the 11th myomere (Kuthalingam, 1959). In leptocephali of eels the vent situated about the middle of the body or in the posterior half progressively shifts towards the anterior region as growth advances. In an advanced stage of leptocephali which is about 60 mm, the vent which has shifted still further anteriorly is situated opposite to the 88-90th myotome.

Origin and location of paired and unpaired fins:

Continuous finfold is present in the prolarvae of Bregmacerotidae, Serranidae, Theraponidae, Carangidae, Coryphaenidae, Lutianidae, Gerridae., Opisthognathidae, Istiophoridae, Trypauchenidae, Cynoglossidae, Soleidae, Pleuronectidae, Leiognathidae, Platycephalidae, Cephalacanthidae etc. In the prolarvae of Bregmaceros, the continuous finfold is seen in the region of the first dorsal whereas the second dorsal and caudal fins give very slight indications of ray formation and the pelvic fin is composed of two short rays.

Two separate dorsal finfolds are found in Mugilidae, Apogonidae, Mullidae, and Gobiidae in the prolarval stage. In Carangid prolarvae the dorsal and anal finfolds are broad and rudiments of pectoral are visible. In fishes with 2 dorsal fins and 2 anal fins (eg. Bregmaceros), the fin membrane appears to be continuous in the embryonic stage itself, but these would be later divided into two groups, i.e. dorsal fins and anal fins with undeveloped short rays between them. It is difficult to distinguish a break between the two anterior groups, especially in the early stages. Sometimes a tuft or group of tufts are seen at the base of the pelvic fin of more developed prolarvae of Bregmaceros.

In Psenes cyanophrys 2.5 mm prolarva the dorsal and anal fins though rudimentary are confluent with the rounded caudal. The pectoral fins are set on a fleshy base and are rounded, with evidence of developing finrays in the prolarva. Below the bases of the pectoral fins, rudiments of the pelvic fins are present. In a slightly advanced 3.2 mm stage, the first dorsal fin is seen in the finfold stage, whereas the second dorsal and caudal shows indications of rays.

In leptocephali prolarvae, pectorals are absent but a minute bud-like protuberance on each side immediately behind the gill opening represents them. In Muraenesox talabon, the dorsal originates opposite the 42nd myomere approximately between the snout and vent and the anal just behind the vent between the 97th and 98th myomere. Both the fins are continuous with the caudal and the tail is nearly 5.5 in total length. Dorsal origin in leptocephali shifts forward as growth advances in the prolarval stage. In the postlarvae of clupeoids the predorsal length is about double the postanal length. The pelvic fin in clupeoids originates in the form of a bulge in the prolarval stage. The caudal region is rhomboidal with a few striations on the dorsal and posterior aspects

and the caudal fin shows the beginning of heterocercal condition.

Changing pattern of pigmentation:

Based on the intensity of pigmentation, prolarvae falls under four broad categories. The prolarvae of Holocentridae, Belonidae, Balistidae, Coryphaenidae, Blenniidate, Pegasidae, Istiophoridae and Cephalacanthidae are heavily pigmented. Only some parts of the body are pigmented in Exocoetidae, Atherinidae, Theraponidae, mullidae, Stromateidae, Lobotidae and Platycephalidae. Only very few pigments are found in the prolarvae of Engraulidae, Apogonidae, Serranidae, Leiognathidae, Scomberomoridae, Thunnidae, Pleuronectidae and Cynoglossidae. The prolarvae of Gobiidae, Trypauchenidae, Bothidae and Soleidae are almost without pigments.

In the leptocephali of eels, chromatophores are generally present in the heart region and a row of 5 to 6 chromatophores on the sides of the posterior half of the lower jaw. An irregular row of minute chromatophores is present along the base of the anal fin and along the ventral margin of the gut. A dendritic black chromatophore is found on either side below the gill slit. In the prolarva of Muraenesox talabon (65 mm) four stellate chromatophores are present, one along the margin of the sides of the upper lip, one anterior to the posterior nares, one below the orbit and another slightly behind it. Chromatophores are present in the posterior region of the head. A row of similar chromatophores is evident along the entire length of the alimentary canal, and another row immediately below the spinal cord on all the myomeres except the first ten. Slightly less distinct chromatophores are present at the base of the anal and caudal fins.

Pigmentation pattern is an excellent diagnostic character in identifying larval tuna where the fins are not fully developed (Matsumoto, 1958). Pigmentation begins to appear in the early prolarval stage. In scombroids, the first dorsal fin is heavily pigmented. A few faint chromatophores are visible at the anterior basal portion of the second dorsal fin, which is otherwise colourless. A darkly pigmented area colours the top of the head and extends forward to the brain region. Scattered chromatophores in the peritoneum are visible through the body wall, particularly in the abdominal region.

In carangid prolarvae, brown and yellow pigment spots are scattered all over the embryo, yolk mass and faintly developed finfolds. Black pigments are present on the inner surface of the oil globule and on the margins of the embryo. In a slightly advanced stage of 2.02 mm, yellow chromatophores are present on the finfolds, on the dorsal and ventral margins of the myomeres, on the yolk sac and pectoral rudiment. Black pigment cells are found on the oil globule (Kuthalingam, 1959).

In the prolarvae of Psenes cyanophrys measuring 2.5 mm the chromatophores are quite evenly distributed on the head and nape, scattering through the cheeks and opercle. A few are also scattered at the base of the pectoral fins, on the side of the body cavity and on the ventral side of the body to the tip of the vertebral column. In a slightly advanced 3.2 mm stage, the chromatophores remain as such, but present on the dorsal side of the head in the form of a crown (Legapsi, 1956).

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