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GUIDELINES FOR IDENTIFICATION OF POSTLARVAE

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Introduction

From the morphological resemblances and the progress of changes in morphology accompanying growth, it is possible to trace the development of fishes. However, the easiest means in identifying fish larvae is to identify the largest stage and work down to the smallest.

Structure and shape of the head, trunk and tail:

Bony structures are found on the head in the postlarvae of Syngnathidae, Pegasidae, Ostraciontidae and Dactylopteridae. Spiny scales begin to form in the postlarvae of Balistidae, Aluteridae, Cephalacanthidae, Diodontidae and Tetrodontidae. Postlarvae in some families like Lobotidae, Holocentridae, Cepolidae, Champsodontidae, Siganidae and Platycephalidae develop a bony crest of diverse types on the nape. Holocentridae, Istiophoridae, Cephalacanthidae and Dactylopteridae have a prominent spine on the supraoccipital part of the head. Preopercular spines are a common feature in the postlarvae of Holocentridae, Theraponidae, Carangidae, Coryphaenidae, Scomberomoridae, Istiophoridae, Thunnidae, Lutianidae, Cepolidae, Serranidae, Lobotidae, Pegasidae, Leiognathidae, Menidae, Sparidae, Platycephalidae, Champsodontidae and Scorpaenidae. Postlarval stages of Scombridae, Labridae, Gobiidae, Trypauchenidae, Clupeidae etc. have no preopercular spines. Scorpaenidae, Stromateidae, Cephalacanthidae, Cepolidae, Holocentridae, Istiophoridae and Champsodontidae have a bony ridge above the eye in the postlarval stages. Postlarvae of Holocentridae, Istiophoridae, Xiphiidae and Pegasidae have protruding snout. A barbel is generally present on the chin in postlarval Exocoetids. Champsodontidae have an elogated tentacle on the operculum. The mouth in the postlarvae may be oblique (Hemirhamphidae, Exocoetidae, Bregmacerotidae, Apogonidae, Leiognathidae, Carangidae, Lutianidae, Serranidae and Opisthognathidae), inferior (Holocentridae, Cephalacanthidae), subterminal (Engraulidae) or tube-like (Fistulariidae, Syngnathidae).

Large size of the head relative to the rest of the body, the sharply pointed snout with well developed teeth on the jaws and prominent preopercular spines distinguish scombroid larvae from others. The preopercular spines gradually get reduced from above to below and in the postlarvae extend to beyond the operculum in *Scomberomorus guttatus*, whereas in the corresponding stages in *S. commerson* the second spine situated at the angle of the preopercle is conspicuously larger than the next and it extends beyond the operculum. The preopercular spines which are present in the larvae and early juveniles of most scombroids are absent in *Rastrelliger kanagurta*. Thus, the absence of preopercular spines is a useful criterion in identifying and isolating the postlarvae of *Rastrelliger* from those of other scombroids. In *R. kanagurta* at about 8.6 mm the shape of the head and the body, particularly the dorsal and ventral profiles are markedly adult-like and the transformation from the larvae to the juvenile is at about 9.5 mm. Silas and George (1971) state that during the larval and metamorphosing stages of *Vinciguerria nimbaria* a progressive increase in the length of the head upto the postmetamorphic stage takes place. The head which has a more or less truncate snout in the larval stages, assumes the general shape as seen in the juveniles and adult in the postmetamorphic stages. There is a conspicuous increase in the depth of the body on transition from larvae through metamorphosing stages.

Disposition of fins and their rays and spines:

As growth advances, the larval fin characters become pronounced while the adult characters make their appearance. Progressive shifting in the position of the dorsal and anal fins is a general feature in the development in the postlarval stages of many fishes. In the postlarvae of Rastrelliger kanagurta measuring 5.4 mm there is a general change in the body form and fins during the flexion process, (Silas, 1974). Indications of differentiation of the median fins are seen in the anlages of the second dorsal and anal fins and incipient caudal rays are also seen. As growth progresses from the larval to the postmetamorphic stages, there is a relative decrease in the predorsal distance and a slight reduction in the preanal length.

In the elver of eels, the vent and the dorsal have shifted still further anteriorly opposite the 58th and 12th myotome respectively and the caudal fin becomes pointed. In the postlarvae of Xiphias gladius measuring 6.9 mm, the dorsal and ventral fins are separated from the caudal fin and the fin rays appear. The caudal fin is still homocercal and the pelvic fins appear as small buds between the bases of pectorals. In Rastrelliger kanagurta the paired fins in the larvae upto 8 mm do not show any ossification of rays, while the median fins are fairly well developed. Among paired and median fins it is the caudal fin that shows more rapid development and the earliest indication of ossification of the rays (Silas, 1974). This is evident in larvae above 5 mm and by the time the larvae are about 9 mm, most of the caudal rays are ossified.

Development of the fins in the postlarval stages is noticeably rapid in Psenes cyanophrys (Legapsi, 1956). The relatively small pelvic fins of P. cyanophrys helps to distinguish it from the postlarval stages of Carangidae to which it bears close resemblance. All the fins are present although rudimentary and not well differentiated. The pectoral fins in P. cyanophrys are set on a fleshy base and are rounded, with evidence of developing rays. Spines develop on the dorsal and anal fins which have started differentiating from the expanding caudal fin. The pelvic fins have grown but the ventral sheath is not yet visible. At about 4.7 mm the pectoral fins have several fully formed rays with indications of more in formation. In the pelvic fins a single spine develop and the fin ray elements are present. The dorsal and anal fins which have completely separated from the caudal have developing spines, but none of the fin rays is completely formed. The caudal is well defined, rather truncate preparatory to forking. Spines and rays are almost fully formed in the dorsal and anal when the postlarva reaches 6.9 mm. The pelvics are almost fully formed except for a complete adult fin ray count. Caudal fin with fully developed middle rays has a shallow cleft giving it a slightly emarginate posterior margin. When the larva reaches 9 mm, the pectorals assume a more definitely pointed shape and ray counts are those of the adult. Dorsal and anal have adult counts. The pelvic fins are fully developed and distinctly smaller than the pectorals.

In the postlarvae measuring 5.4 mm of Kowala coval, the pectoral fin is rounded with a few striations representing the future rays (Bensam, 1969). The predorsal length is almost double the postanal length. The pelvic fin has not yet appeared. The anal fin is represented by a strip of thick tissue. Caudal region is rhomboidal. When the postlarva attains 8.9 mm, the position of ventral is indicated by a protuberance below the midgut region. By about 11 mm the dorsal has about 15 rays and its origin has moved still more anteriorly, thus making the precaudal and post dorsal length almost equal. The pelvic fin has developed and is supported by 8-9 rays.

It is possible to fix the identity of postlarvae of Bregmaceros by the pronounced absence of dorsal and anal rays after the continuous finfold stage as the pelvic rays (Clancy, 1956) are rather long. Pectoral fin is dorsolateral in position. The second dorsal and caudal fins give very slight evidence of ray formation. At about 4.9 mm, rays are visible in the dorsal and anal and there are 9 rays in the caudal. Three pelvic rays are recognisable. At about 7 mm the first dorsal cannot be divided into two portions, but it has developed 23 rays and the second anal has 19 rays. The somewhat round caudal fin has 19 rays now and at this stage, the first evidence of two rather distinct caudal lobes appear. Evidence of pectoral ray development is seen. The most anterior pelvic ray has a small tuft at its base. In late postlarvae, it is difficult to determine the break in the anal. The caudal fin has lost its roundness and is arrowhead shaped, composed of 23 rays. Pectoral fin is narrower at its base and signs of 2 developing rays are seen.

Pigmentation pattern:

In some groups identification of the postlarvae is possible by the difference in the nature and distribution of chromatophores in combination with the differences in body proportions, shape of the head and fin characters. Pigmentation patterns are often useful in identifying small tuna larvae. In the larva of Rastrelliger kanagurta measuring 5.4 mm, a melanophore is present at the base of the urostyle and two at the distal margin of the hypural plate (Silas, 1974). On the ventral side of the abdomen there is a distinct melanophore and the primordium of the pelvic fin appears close to this. In a 6.6 mm stage, one or two chromatophores are present in addition at the base of the caudal fin just below the tip of the hypurals, besides the two at the lower caudal base. Only four melanophores are present at the posterior half of the base of the anal fin, while six are present at the anal finlets and the lower side of the caudal peduncle. In the late postlarva of mackerel, the basic pattern such as the post vent row of chromatophores, their numbers and disposition with size remain the same. The basic pattern of absence of branched chromatophores on the head until the Enlages of the hypural plates are formed is seen in the larva. The post-vent row of melanophores vary from 11 to 14 and their number decrease with growth. The number and disposition of melanophores at the base of the caudal fin in the postlarvae show slight variations. The chromatophores on the dorsum of the viscera and intestine are sometimes diffuse (Silas, 1974). In Scomberomorus, chromatophores are present in patches at the tip of the snout, above and between orbitals, above the region of the hind brain and in the posterior region of the opercle (Jones and Kumaran, 1962). On the body they are present close to the base of the dorsal fin and along the mid-lateral line and a few at the base of the caudal and anal fins. The anterior region of the first dorsal is slightly pigmented.

In Psenes cyanophrys postlarvae measuring 4.9 mm, chromatophores are seen on the head and abdominal regions (Legapsi, 1956). In an advanced postlarva of 7 mm the pigmentation of the gut has intensified and numerous chromatophores cover the body. A row of melanophores is seen along the anterior portion of the dorsal ridge and slight traces of the dorsal patches remain. In larger postlarvae, the body chromatophores seem to follow a definite pattern, those of the gut forming vertical stripes. Along the dorsal ridge two rows of chromatophores are seen separately widely anteriorly and fusing posteriorly. When the larva acquires adult characters at about 14 mm the intensity of pigmentation increases in these regions till the postlarvae attain a dark appearance.

A characteristic arrangement of pigmentation pattern is present in Bregmaceros spp. throughout the early postlarval stages (Clancey, 1956). In the early postlarval stage, chromatophores are seen in the head region, at the interorbital space behind the eye and below the mouth. On the body, chromatophores are found posterior to the head, along the gut region and posterior to the pectoral fin. Four distinct patches are found dorsal to anal finfold and two patches are ventral to the dorsal finfold. When the postlarva is 5.2 mm, pigmentation is more intense because chromatophores hinder to the eye have expanded forming a band extending across the head and showing patchiness behind the eye. Chromatophores appear along the upper and lower jaws. Pigmentation of the gut has become more intense and three definitive chromatophores are seen near the vent. Chromatophores are present behind the head and posterior to the pectoral fin. The four patches dorsal to the anal fin are larger and more intense. The patches below the dorsal fins now appear as four larger groups. In an advanced post-larva of 7 mm the pigmentation has intensified and numerous chromatophores cover the body. A row of chromatophores is seen along the anterior portion of the dorsal ridge and slight traces are still discernible. In larger postlarvae the number of chromatophores has increased and these are scattered throughout the body.

Myomeres and myosepta:

The number of myomeres in the postlarvae of Rastrelliger kanagurta are variable until the full complement of myomeres is formed by the time the larvae attain 4 mm (Silas, 1974). Myomeres grow obliquely with zigzagging in most of the segments by about 5.4 mm. The flexion of the notochord begins at about 5 mm and the simultaneous formation of the hypural plate also coincides with the zigzaging of the myomeres.

Migration of the eye in flat fishes:

According to Jones and Menon (1951), the duration of metamorphosis varies in different flat fishes. In Brachirus pan the pelagic life is short and transformation takes place early. The migration of eye is first indicated in the 3.4 mm stage and appears to be rather quick. At about 4.6 mm stage, the left eye reaches the dorsal edge and comes near to the right side when the fish becomes a postlarva. Among flat fishes Bothus pantherinus may be an example of late metamorphosis. The position of the eye in the postlarva of Cynoglossus lingua shows a condition different from that of Brachirus pan. They are so close that they appear to touch one another. During the first phase of migration the eyes become very close, but later these gradually move apart to give rise to the condition in the adult.

Development of scales:

In clupeoids, scales begin to appear when the larvae are about 15-16 mm in length. The scales are not formed uniformly all over the body. On the dorsal side anterior to the dorsal fin, these are formed subsequent to the other regions. The scales are very thin and fall off very easily. The scutes begin to develop in the juveniles of more than 20 mm and are formed in front of the pelvics and then gradually along the ventral edge of the abdomen. In mackerel, Rastrelliger kanagurta first signs of formation of scales are observed in specimens of more than 20 mm (Balakrishnan and Rao, 1971). In *Vinciguerria nimbaria* Silas and George (1971) observed in a stage of 15.3 mm that the scales are deciduous and scale pockets are discernible on account of the fine rows of pigment spots.

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