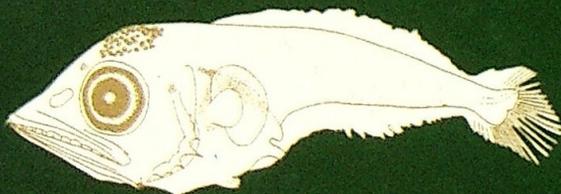
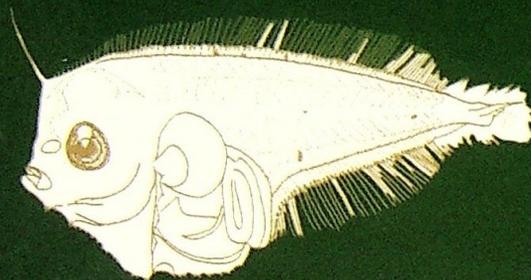
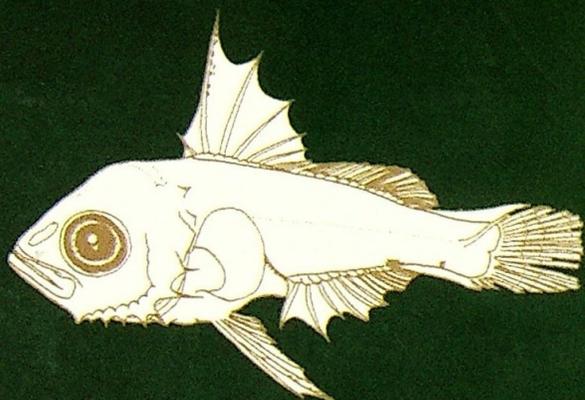


# LABORATORY GUIDE FOR SOME FAMILIES OF FISH LARVAE FROM THE SOUTH CHINA SEA



**Zulkifli Talib  
Rosdi Mohd Nor  
Nazmeer Nazri**

**Marine Fishery Resources Development and Management Department  
2006**



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## **FOREWORD**

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The South China Sea is very important to Malaysia and other countries in term of its fishery resources. It also has one of the most diverse fish faunas, especially at the area located around coastal area and the islands. A lot of studies have been done to determine its status. Contrary to that, very few efforts have been put into study of fish larvae. Information on fish larvae is one of the ways to determine the future fish resources. Unfortunately research on fish larvae is still scanty. Published works on studies of fish larvae in Malaysian waters in the South China Sea are still very limited. Countries like United States, Japan and Australia have been studying the fish larvae for a long time. Knowledge on the morphology, spawning season, spawning and nursery grounds are important for proper fisheries management.

Although over the years, considerable materials for the identification and determination of fish species for adult stages have been published. Information on identification of fish larvae is still hard to find. This is our first attempt to publish a guide on fish larvae identification based on selected families of fish larvae collected during the oceanographic surveys in the South China Sea. This guide is not the final work on the taxonomy of fish larvae of South China Sea, as there are many more species remain to be documented. Until now, the larvae stages of many marine fishes in South China Sea have been virtually undescribed. The larval fishes described in this book, are known as the common families of fish in South China Sea. Furthermore, the scientific work on fish larvae are still in the beginning. We hope that this guide book is a starting point to carry more work in the future.

## **ACKNOWLEDGEMENT**

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This book is the outcome of the study on fish larvae by the authors in especially in the east coast waters of Peninsula Malaysia and reference made from various sources. This is the authors' first attempt to come out with a guide book on fish larvae and may not contain as many families as the guide books by established authors. Nevertheless, this is a start and hopefully we will come out with a better publication in the future.

The authors would like to express their sincere gratitude to the Director-General of Fisheries Malaysia, Y. Bhg. Dato' Junaidi bin Che Ayub for his support in the preparation of this book. Special thanks also to the Chief of MFRDMD, Y.M. Raja Mohammad Noordin bin Raja Omar for his encouragement and confidence in the authors to carry out this project.

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# General Body Morphology

Adapted from Leis and Carson-Ewart 2000

## Abbreviations

These abbreviations are used throughout the text.

|                |                     |                  |                         |
|----------------|---------------------|------------------|-------------------------|
| A              | Anal fin            | P <sub>1</sub> L | pectoral-fin length     |
| BD             | body depth          | P <sub>2</sub>   | pelvic fin              |
| BL             | body length         | P <sub>2</sub> L | pelvic-fin length       |
| BW             | body width          | PAL              | preanal length          |
| C              | caudal fin          | PDL              | pre dorsal-fin length   |
| D              | dorsal fin          | SL               | standard length         |
| DSL            | dorsal spine length | SnL              | snout length            |
| ED             | eye diameter        | TL               | total length            |
| HL             | head length         | VAFL             | vent to anal-fin length |
| HW             | head width          |                  |                         |
| MW             | mouth width         |                  |                         |
| NL             | notochord length    |                  |                         |
| P <sub>1</sub> | pectoral fin        |                  |                         |

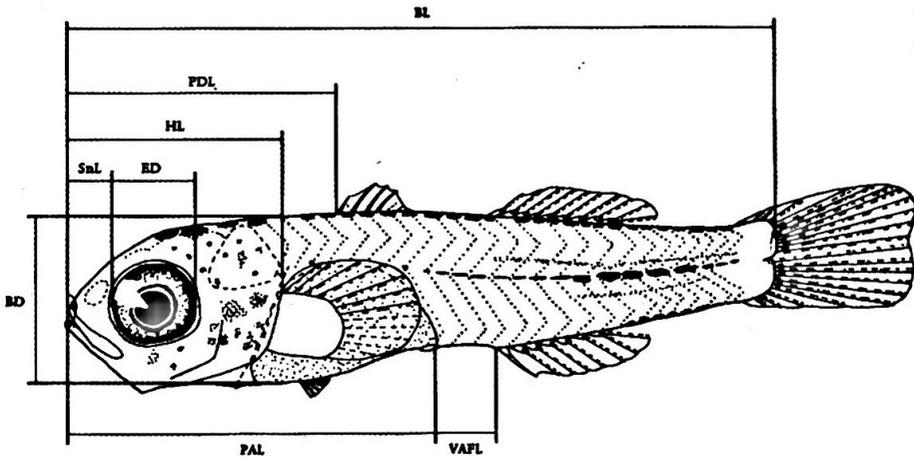


Figure 1. Postflexion larva showing the measurement taken routinely.

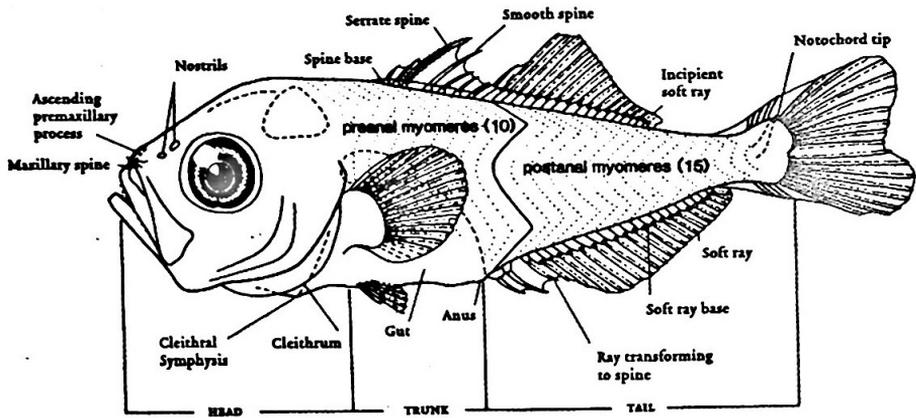


Figure 2. The major morphological characters of fish larvae used in this book (hypothetical postflexion larva).

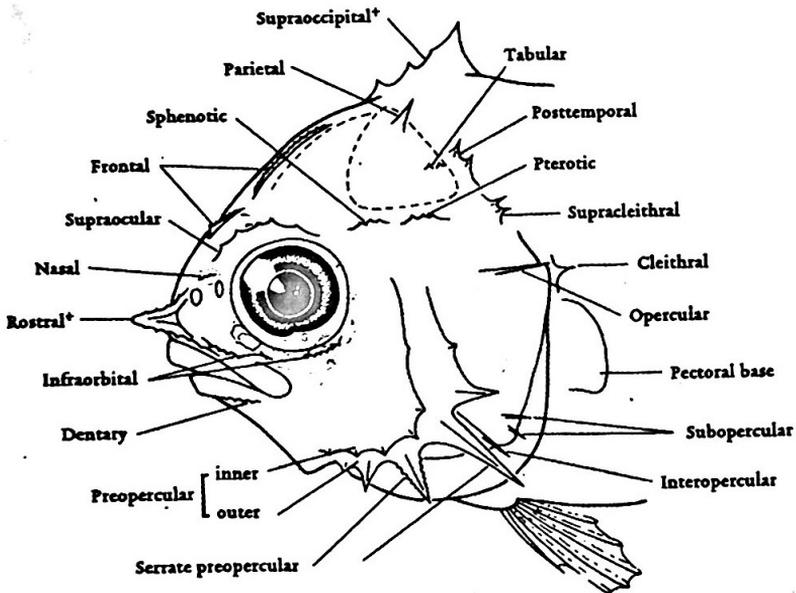


Figure 3. Head of a hypothetical larva showing head and pectoral girdle spination; spines marked with '+' are unpaired medial spines.

## **Antennariidae: Frogfish**

---

Antennariidae type 1

### **Meristic**

D III, 12; A 7; P<sub>1</sub> 10; P<sub>2</sub> I, 5; C 9; M 20+

### **Morphometric**

BD: 0.55 - 0.62, HL: 0.37 - 0.54, PAL: 0.74 - 0.84, ED: 0.27 - 0.43.

### **General morphology**

Larvae have deep body, robust head and trunk. The large head deeply rounded and the short snout blunt and broadly convex. Visible gas bladder. Initially, small mouth and large eyes. Caudal develop very early and the pectoral large. Short anal base.

### **Head spination**

No head spination.

### **Pigmentation**

Lightly pigmented. Melanophores internally over the gut. Some small melanophores on the trunk.

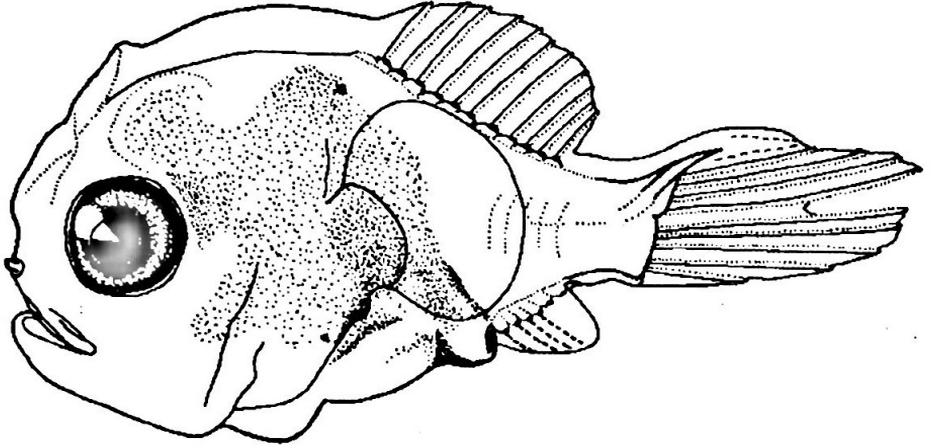
### **Diagnostic characters**

Deep bodied and robust, with large head, skin inflated like balloon. Large pectoral and early developed caudal. Short anal base.

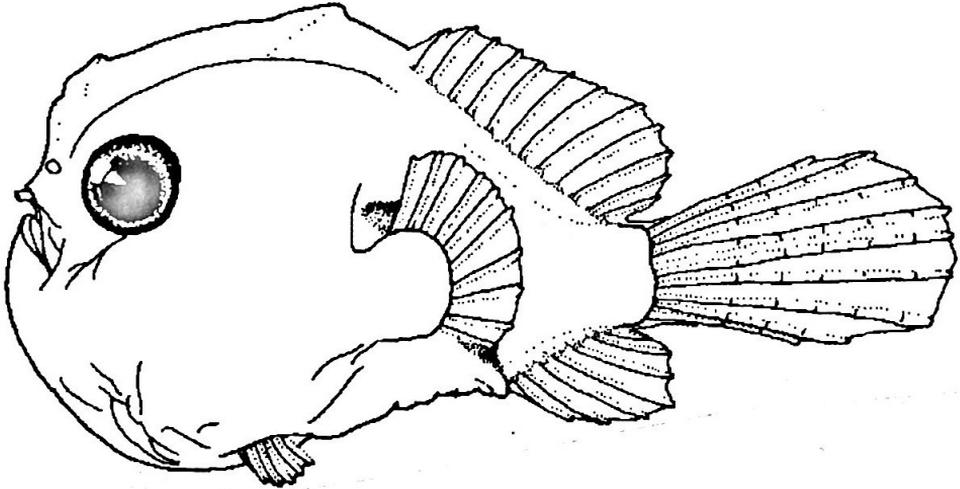
### **Similar groups**

Antennariid larvae are similar to tetraodontiform and other lophiiform larvae. In tetraodontiform larvae, the gill opens anteriorly to the pectoral base. Most lack pelvic fins and almost equal size of dorsal and anal base. The other lophiiform larvae can be distinguished by length of anal base and size of pelvic fin.

A



B



**Figure 4.** Antennariid type 1 larvae from Sarawak waters. A, 2.3mm flexion larva and B, 3.8mm postflexion larva.

## **Apogonidae: Cardinalfishes**

---

### **General Morphology**

The general body shape varies from slightly laterally compressed and elongate to strongly laterally compressed and deep bodied. The head shape is variable as some species have a large, deep, laterally compressed head with a short, round to truncate snout while other species have a head of moderate size with an elongate snout.

### **Head Spination**

The presence of head spination varies among species: it may be completely lacking but may present in the form of spines on the preopercle, interopercle, subopercle, opercle, supracleithrum, posttemporal, pterotic, or supraocular ridge, and a small supraoccipital crest with a single spine may be present. In general, head spination appears during the preflexion stage and disappears or is greatly reduced immediately prior to settlement.

### **Pigmentation**

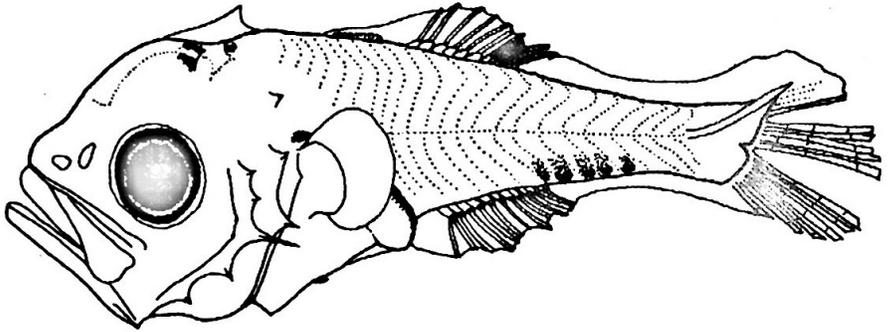
Pigment varies from being light and restricted, to being heavy and spread over most of the body. Pigmentation is consistently present on the dorsal surface of the gas bladder.

### **Diagnostic Characters**

Larvae of apogonid have 23-24 myomeres, coiled gut, a large and conspicuous gas bladder, large mouth, rounded eye and fin development is extremely variable.

### **Similar Groups**

Apogonid larvae are likely to be confused with acropomatids, ambassids, berycids, carangids, gerreids, kyphosids, lactariids, lethrinids, leptobramids, opistognathids, pempheridids, plesiopids and serranine serranids.



**Figure 5.** 4.4mm postflexion apogonid larva collected from Terengganu waters.

## **Bothidae: Left-handed Flounders**

---

### **General Morphology**

Larvae of bothids are extremely laterally compressed and vary in body shape both ontogenetically and among species. Larvae are initially elongate and bilaterally symmetrical, but changes shape with growth. They may become broadly pinnate, ovate or deep and round. The trunk and tail usually become considerably deeper than the head. The head is moderate to small and initially squarish but becomes more rounded and relatively smaller with development.

### **Head Spination**

Depending on genus, minute to small spines can be found along the edges of the urohyal, posterior pelvic process and cleithrum.

### **Pigmentation**

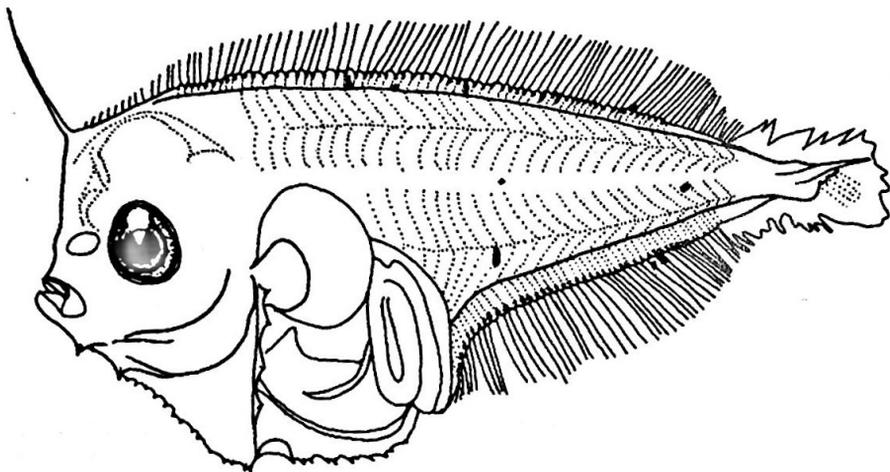
Pigmentation in bothids larvae varies among taxa but is generally sparse to absent. In some taxa, pigment can also occur along both the dorsal and ventral margins of the head and fins, and also spots or blotches laterally on the body. Pigmentation generally develops only on the sinistral side, although some larvae are pigmented similarly on both sides.

### **Diagnostic Characters**

There are 33 to 59 myomeres. The gut tube is of small diameter and shortly after hatching, develops a single coil which elongates vertically with growth. The small to moderate gas bladder is usually inflated at night. Initially, it is located dorsal to the anterior portion of the gut coil, or slightly anterior to this.

### **Similar Groups**

Bothids larvae are likely to be confused only with other flatfish larvae like Cynoglossidae, Pleuronectidae, Psettodidae, Paralichthyidae, Chitaridae and Soleidae.



**Figure 6.** 5.9mm preflexion bothid larvae collected from Terengganu waters.

## **Bregmacerotidae: Codlet**

---

*Bregmaceros* spp.

### **Meristic**

Type I - D: 1+40; A: 42; P1: -; P2: 3; C: 22+; M: -.

Type II - D: 1+51; A: 47; P1: -; P2: 3; C: 20+; M: 48+

### **Morphometric**

Type I - BD: 0.3 - 0.25, HL: 0.32 - 0.29, PAL: 0.53 - 0.50, ED: 0.35 - 0.26

Type II - BD: 0.26 - 0.18, HL: 0.30 - 0.22, PAL: 0.49 - 0.44, ED: 0.33 - 0.26

### **General Morphology**

Larvae body is moderately compressed. The gut is tightly coiled. The head changes from rounded to nearly straight. The mouth is oblique. The eye is round and moderate. Pelvic fin rays become thick and very elongated, reaching well past the anus. Dorsal and anal fin rays are formed from anterior and posterior leading toward the middle of the fin which will be the shortest in the adult fish. Pectoral fin is paddle-like and located well above the lateral midline.

### **Head Spination**

No head spination.

### **Pigmentation**

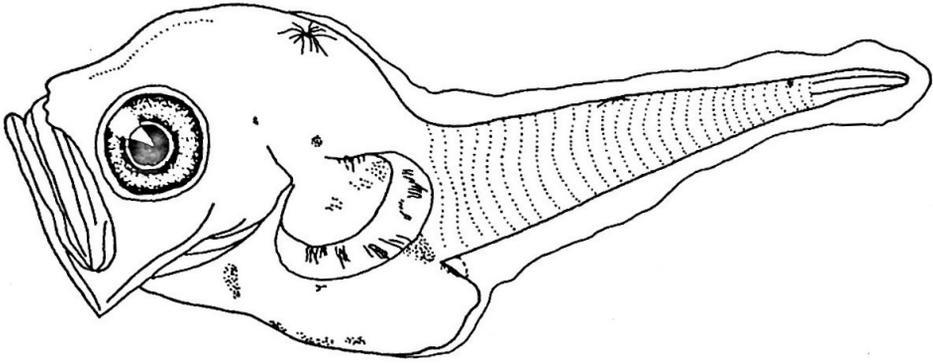
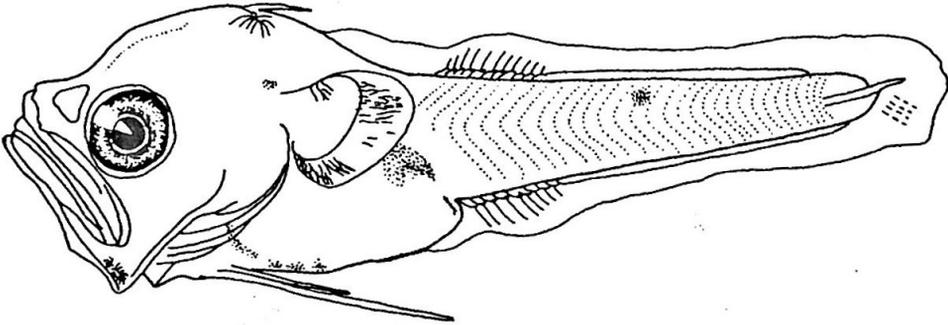
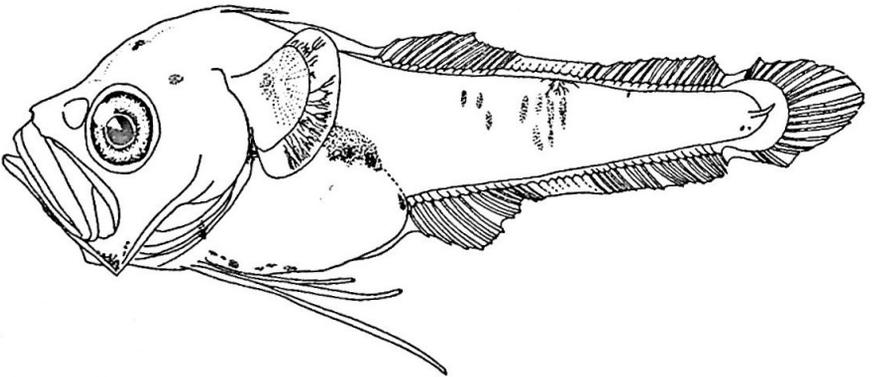
Bregmacerotid larvae vary in pigmentation from nearly absent to heavy depending on species and stages. Most species have pigment on their gas bladder. Pigments also present at the angle of the lower jaw. Bregmacerotid larvae have many internal pigmentation especially on their gas bladder, tail portion and at the peduncle caudal. Pigment generally increases as the larva is growing.

### **Diagnostic characters**

Paddle-like pectoral fin and early forming pelvic fins.

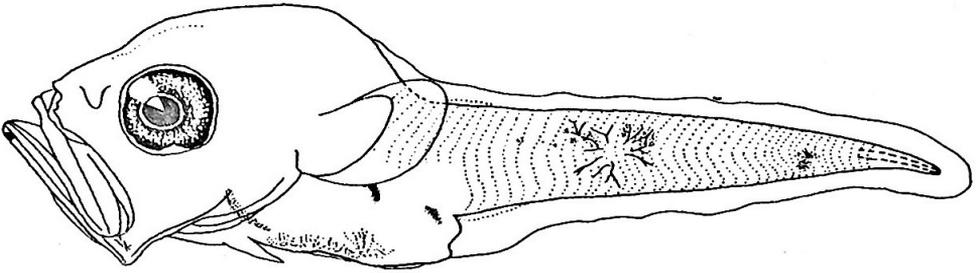
### **Similar group**

Bregmacerotid larvae are similar with Stylephorids. Stylephorids can be distinguished from Bregmacerotids because they have fewer anal fin-rays and a much smaller mouth.

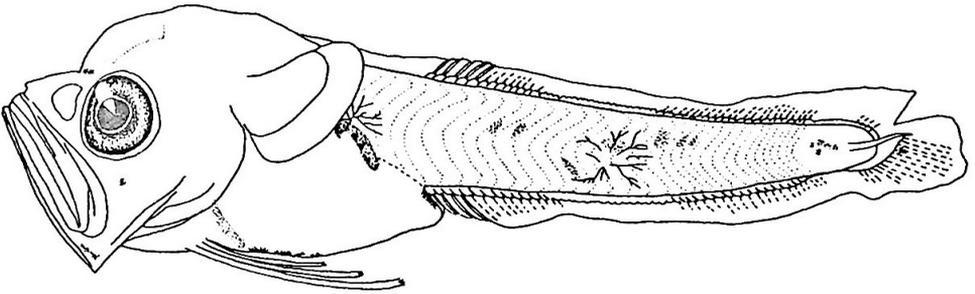
**A****B****C**

**Figure 7.** *Bregmaceros* sp. 1 larvae collected from Terengganu waters. A, 2.5mm preflexion larva; B, 4.3mm flexion larva and C, 6.5mm postflexion larva.

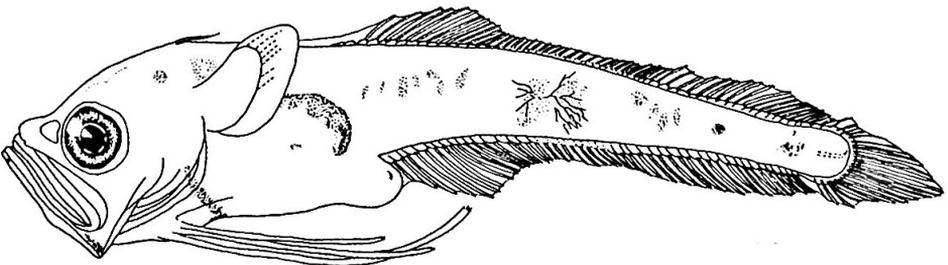
A



B



C



**Figure 8.** *Bregmaceros* sp. 2 larvae collected from Terengganu waters. A, 3.02mm preflexion larva; B, 4.3mm flexion larva and C, 8.5mm postflexion larva.

## **Carangidae: Jacks, Pompanos, Trevally**

---

### **General Morphology**

Carangid larvae are strongly compressed and initially range from moderately deep bodied to almost elongate. Many species become deeper with growth. Head shape varies widely among species but in postflexion larvae it is usually roundly triangular.

### **Head Spination**

Preopercular and supraoccipital spination are distinctive. The spine at the angle is almost always the longest, and its maximum relative size varies among taxa from small to large. A supraoccipital crest is present from the early preflexion stage but varies in size and shape. A low to very low supraocular ridge forms in late preflexion stage.

### **Pigmentation**

Pigment in carangid larvae varies, but most taxa initially relatively lightly pigmented. Pigment usually occurs on the snout and brain, along the lower jaw, over the gas bladder, and on the notochord tip.

### **Diagnostic Characters**

Carangids are characterized by 24-26 myomeres, head spination, particularly preopercular and supraoccipital spination, absence of interopercular or opercular spination, large head and mouth, moderate to large gut which is initially straight, but which coils in small larvae and becomes triangular and a general visible gas bladder.

### **Similar Groups**

Families most likely to be confused with carangids are Nomeidae, Chaetodontidae, Pomacanthidae, Menidae, Pempheridae, Toxotidae, and certain members of the families Terapontidae, Leiognathidae, Apogonidae, and the serranid subfamily Anthiinae.

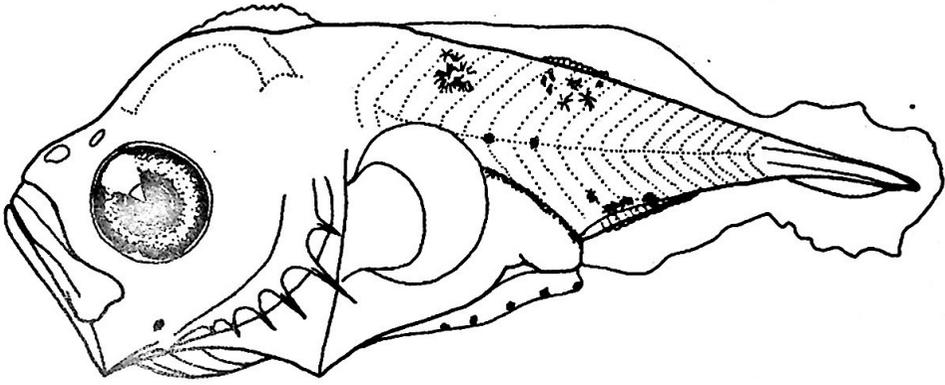


Figure 9. 3.55mm preflexion carangid larvae collected from Terengganu waters.

## **Cepolidae: Snake Fish, Band Fish**

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Acanthocepola spp.

### **Meristic**

Types 1, 2: M 67+

Types 3: M 76; A 70+; P<sub>1</sub> 18; P<sub>2</sub> 1,5; C 13

### **Morphometrics**

BD: 0.26-0.27, HL: 0.29-0.32, PAL: 0.36-0.41, ED(to HL): 0.36-0.38

### **General Morphology**

The trunk has moderate depth. The tail elongate, compressed and tapering. Anus located at the anterior part. Large head with a prominent jaw angle. Snout short and initially slightly concave. Large oblique mouth and eye. The long dorsal and anal fins develop incipient rays anteriorly during the preflexion stage.

### **Head Spination**

Very heavy spination. The large can-opener like supraoccipital spine with serrate edges. The supraocular ridge with a serration. Preopercular spines including a very long, serrate spine; and a rugose frontal region. The dentary ridge serrate. Supracleithrum and posttemporal with spines.

### **Pigmentation**

Lightly to moderately pigmented, with melanophores on the head, gut and dorsal gas bladder, operculum and along the ventral midline of the tail.

Type 1: No pigment on the dorsal notochord tip.

Type 2: A few distinctive melanophores on the dorsal notochord tip.

Type 3: Pigmentation at the caudal peduncle.

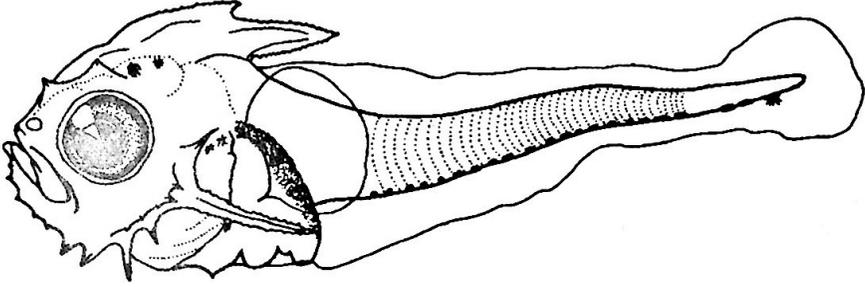
### **Diagnostic Characters**

Robust head with extensive supraoccipital and preopercular spines. Elongate, compress and tapering tail. Many myomeres and fin rays.

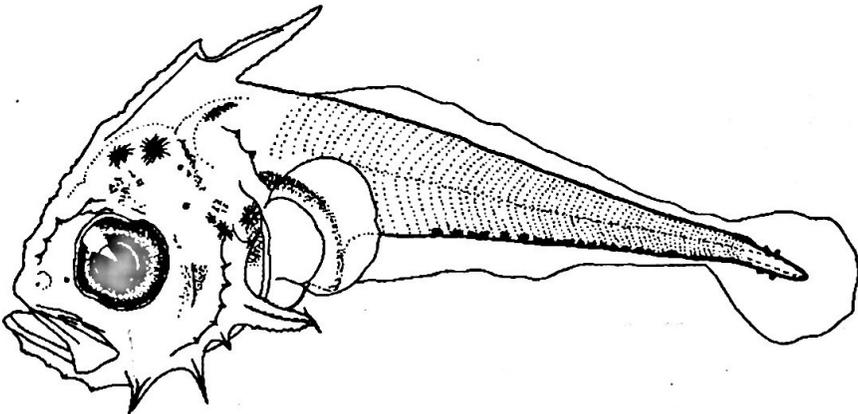
### **Similar group**

Similar families may be caproids, priacanthids, lethrinids, scombropids, acropomatids, leiognathids, ehippidids, drepaneids, holocentrids, lobotids and some haemulids. All these families have 23 – 26 myomeres, but cepolines, 48–79 while owstoniines, 28-31.

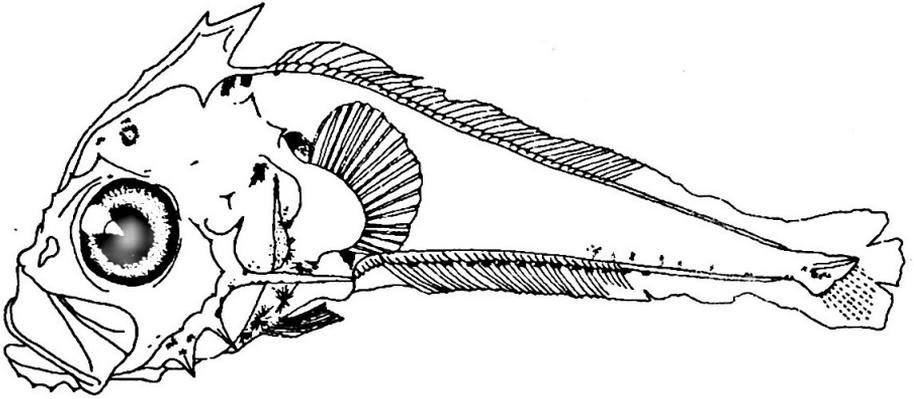
A *Acanthocephala* sp. - type 1



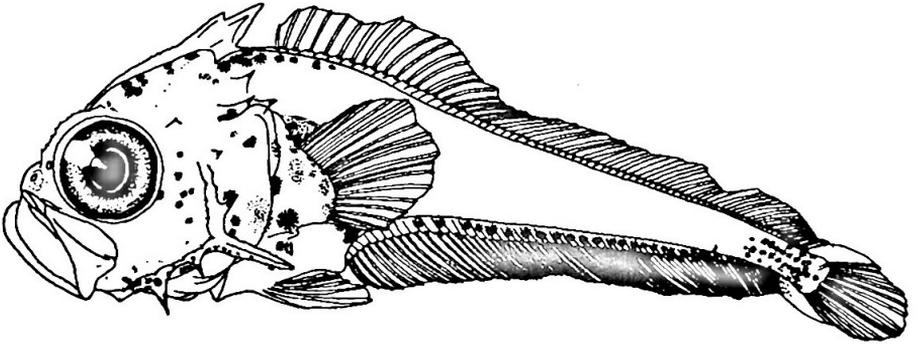
B *Acanthocephala* sp. - type 2



**C** *Acanthocephala* sp. - type 3



**D**



**Figure 10.** A, type 1, 3.1mm preflexion larva; B, type 2, 3.6mm preflexion larva; C, type 3, 6.5mm flexion larva; D, type 3, 9.3mm postflexion larva. A collected from Sarawak waters; B, C and D from east coast of Peninsular Malaysia.

## **Champsodontidae: Gapers**

---

Champsodon spp.

### **Meristic**

D 17+ (Types 1,5); A 16+ (Types 1,5); P<sub>1</sub> 18 (Type 1); P<sub>2</sub> 1,5 ((Type 5); C 8+7 (Types 1,5); M 31+

### **Morphometrics**

BD: 0.17 - 0.26, HL: 0.24 - 0.31, PAL: 0.42 - 0.54, ED: 0.21 - 0.28 (to HL)

### **General Morphology**

Larvae moderately elongate and slender, or more robust, depending on types. The thick gut relatively short, but anus located near middle of body. The large head roughly triangular initially. The snout initially slightly concave but straighter and longer in postflexion. The mouth very large. Teeth in both jaws even during the preflexion stage. The eye large. The spinous opercular appendage develops, subsequently like sail persists into the postflexion stage, and the pelvic bud during the late flexion stage. The pelvic fin becomes long and reach a maximum 25% – 29% BL.

### **Head Spination.**

Moderately preopercular spine as well as low, serrate nasal, serrate supraocular and serrate frontal. Most of them very small in juveniles except the preopercle.

### **Pigmentation**

Lightly pigmented initially, but more heavily during the postflexion stage. Heavy pigments along the dorsal surface of the gut and gas bladder. Tail pigment in preflexion and flexion larvae consists of 1–5 melanophores ventrally. Some pigmentation on the trunk or tail.

- Type 1: Two (or one in ventral) large pigmentation on the dorsal and ventral margin of tail.
- Type 2: Two small pigmentation on the ventral margin of tail and small one under notochord tip.
- Type 3: Three small pigmentation on the ventral margin and internal one in posterior tail.
- Type 4: No pigmentation on the tail.
- Type 5: Large pigmentation on the posterior edge of appendage, and no pigmentation on the tail.

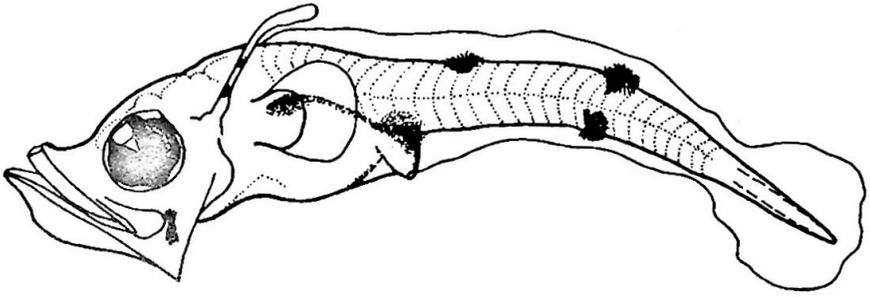
**Diagnostic Characters**

A distinctive operculum appendage and large mouth with teeth.

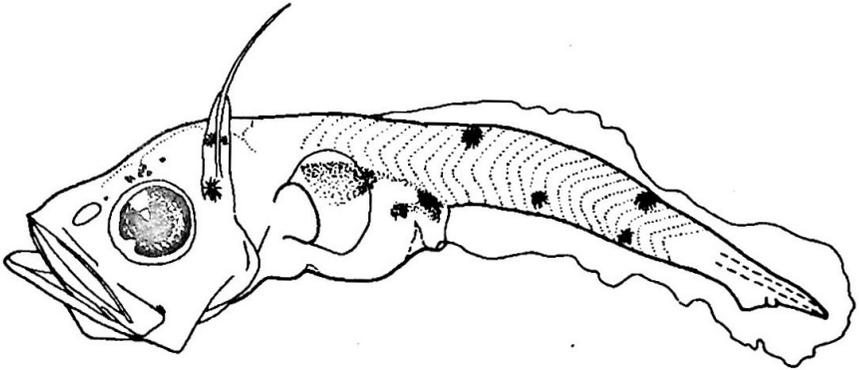
**Similar Group**

Champsodontid larvae are likely to be confused with some Scombridae by large mouth and spiny ridges on the head, but the opercular appendage is unique and distinguish champsodontid larvae from them.

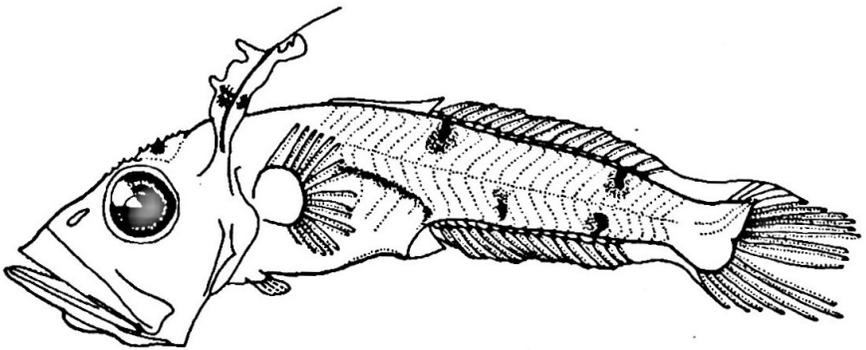
A *Champsodon* sp. - type 1



B

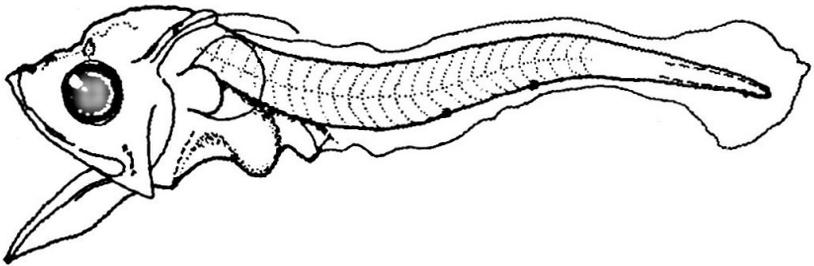


C

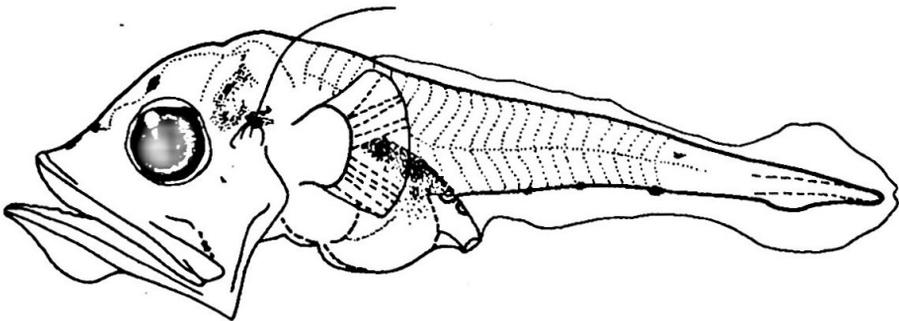


**Figure 10.** *Champsodon* sp. type 1 larvae collected from Sarawak waters. A, 4.3mm preflexion larva; B, 5.7mm flexion larva and C, 6.4mm postflexion larva.

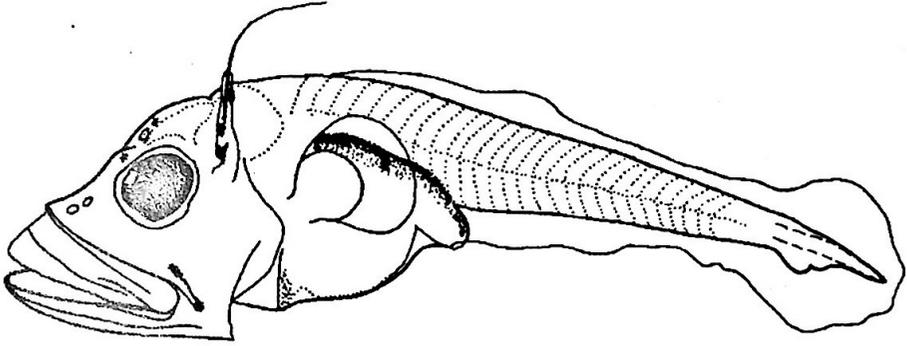
**A** *Champsodon* sp. - type 2



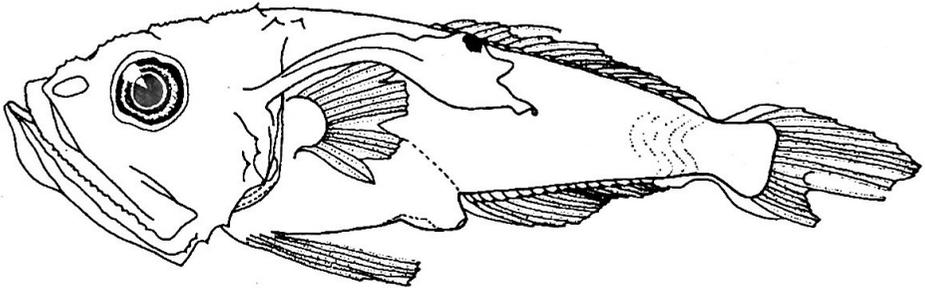
**B** *Champsodon* sp. - type 3



C *Champsodon* sp. - type 4



D *Champsodon* sp. - type 5



**Figure 11.** *Champsodon* types 2-5 larvae and juvenile. A, type 2, 2.9mm preflexion larva; B, type 3, 3.8mm flexion larva; C, type 4, 4.0mm flexion larva and D, type 5, 6.3mm juvenile. A and B collected from the east coast of Peninsular Malaysia. C and D collected from Sarawak waters.

## **Chandidae: Glass Perchlets**

---

Chandidae type I

### **Meristic**

D VII, 11; A III, 11; P<sub>1</sub> 17; P<sub>2</sub> I, 5; C 15; M 24

### **Morphometric**

BD: 0.27 – 0.38, HL: 0.32 – 0.37, PAL: 0.41 – 0.49, ED(To HL): 0.35 – 0.39

### **General morphology**

Larvae of moderate depth and compressed. Head initially round but becomes slightly elongate at later stage. The short steep snout slightly concave. The mouth small and oblique. Minute teeth are present. The eye is round.

### **Head Spination**

No head spination found during larval stage.

### **Pigmentation**

Lightly pigmented. Closely spaced melanophores on the ventral midline. 2-3 prominent melanophores ventrally on the gut. Melanophores also appear on the dorsal part of the brain and on the caudal base.

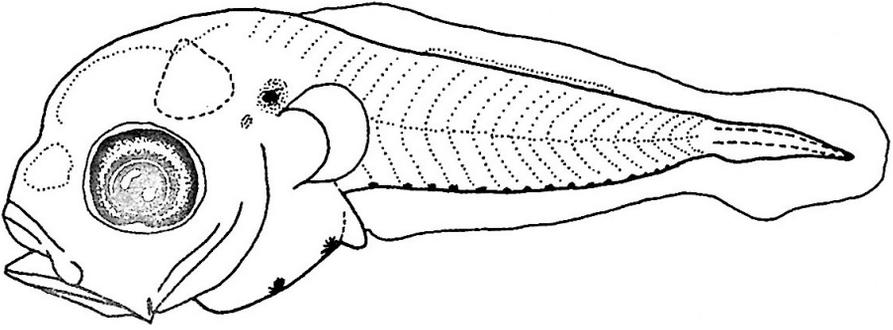
### **Diagnostic Characters**

Tightly coiled gut, strongly compressed head and trunk, conspicuous gas bladder and pigment on tail and angle of jaw.

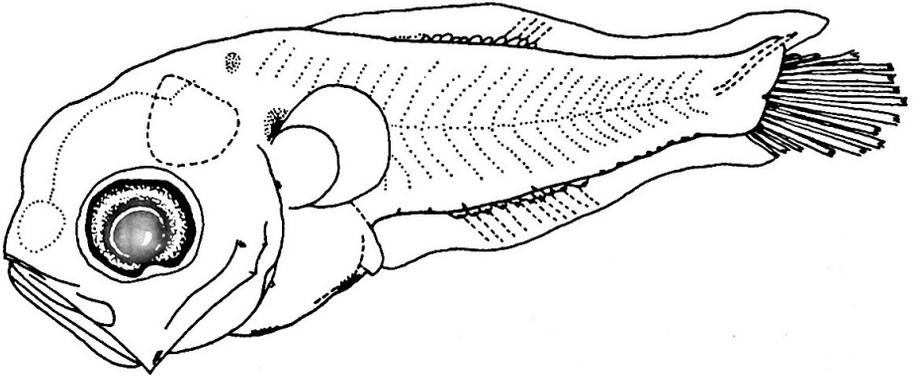
### **Similar Group**

Chandids could be confused with apogonids, gerreids, pomacentrids, sparids, terapontids and nemipterids. Apogonids have two separate dorsal fins while ambassids have a deeply-notched continuous one. Apogonids have a much larger mouth and are not as compressed as chandid. Nemipterids differ from chandid in several ways; nemipterids don't have melanophore on the angle of lower jaw, no conspicuous gas bladder and their heads are less compressed than chandids. The remaining families do not have conspicuous gas bladder.

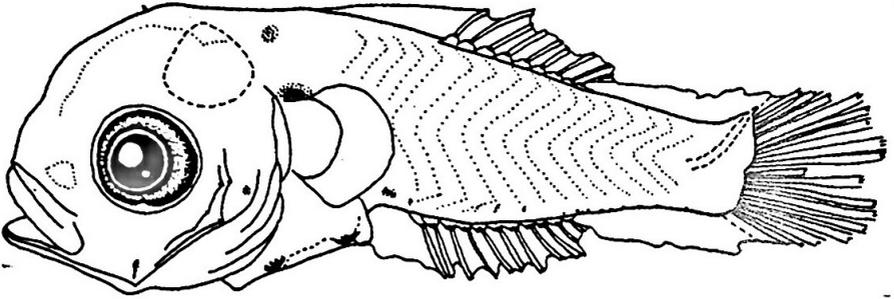
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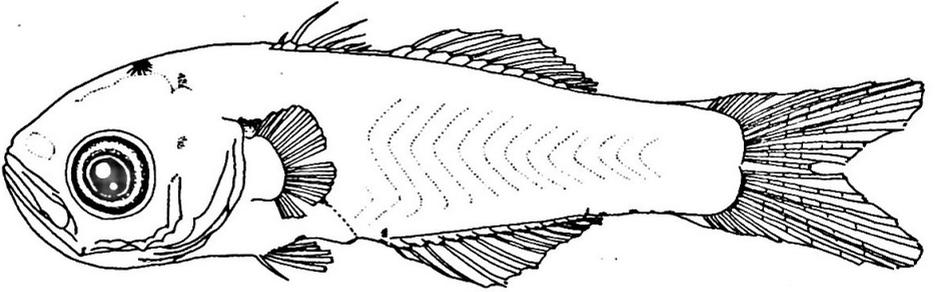
B



C



D



**Figure 12.** Chandid type 1 larvae from east coast of Peninsular Malaysia waters. A, 2.25mm preflexion larva; B, 2.62mm flexion larva; C, 3.0mm early post-flexion larva and D, 6.3mm post-flexion larva.

## **Dussumieriidae: Round Herring, Rainbow Sardine**

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Dussumieria sp.

### **Meristics**

M: 55+

### **Morphometrics**

BD: 0.03-0.07; HL: 0.16-0.19; PAL: 0.90-0.93; ED: 0.16 (short axis), 0.22 (long axis)

### **General Morphology**

Body cylindrical and very elongate. The long, straight gut and the anus very posteriorly under 52<sup>nd</sup> myomere. The small head initially broad and horizontally depressed. The mouth initially very large, reaching to the posterior edge of the pupil. The broad snout very elongate. Large lateral teeth present in both jaws. The eye initially slightly narrow. The ceratohyal angle prominent.

### **Head Spination**

No head spination.

### **Pigmentation**

Distinctive branched melanophores along the lateral midline and the ventral gut and at the anus. Small melanophores on dorsal and ventral on the notocord tip. Melanophores along the cleithrum.

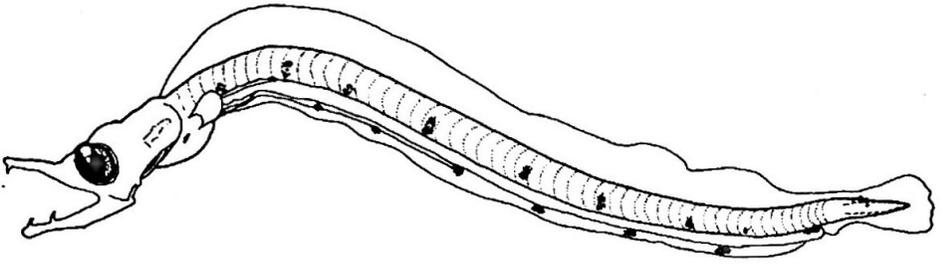
### **Diagnostic Characters**

Distinctive melanophore series along the lateral midline and ventral gut. Very posterior anus. Large mouth with strong teeth. Depressed head with narrow eye and long snout.

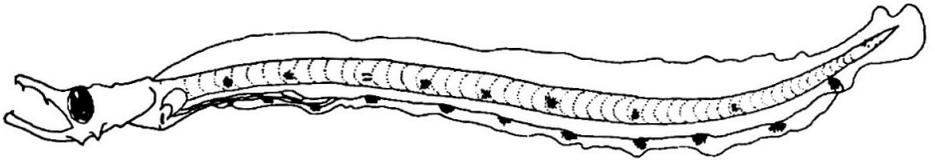
### **Similar Group**

These larvae may be confused with other Clupeiform and Gonorynchiform. However it is easy to distinguish all of them by the depressed head with the long snout, the large mouth with strong teeth and conspicuous melanophore series.

A



B



**Figure 13.** Larvae of *Dussumieria* sp. A, 5.6mm preflexion larva from east coast of Peninsular Malaysia and B, 9.8mm flexion larva from Sarawak waters.

## **Leiognathidae: Ponyfishes**

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### **General Morphology**

Larvae of leiognathids are moderate to deep and strongly compressed laterally. PAL length never exceeds 50 percent of BL. The moderate to large head is initially deeply ovate with a steep, slightly concave snout. There are two distinct morphology of leiognathids larvae, differing in pigmentation and head spination.

### **Head Spination**

Leiognathids larvae have very special characters of head spination. Head spination first appears shortly after hatching. At 1.8 mm the preopercular spines and serrate supraoccipital crest are present. The reduced, smooth supraoccipital crest is retained in adults as a nuchal crest.

### **Pigmentation**

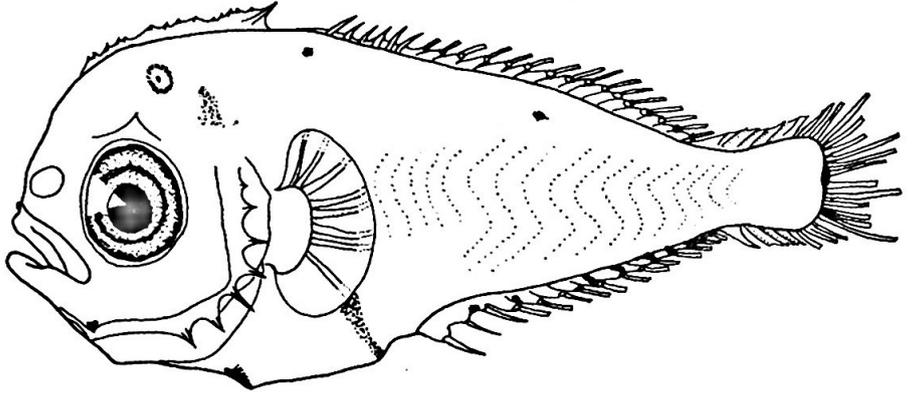
Leiognatids are relatively lightly pigmented. Preflexion larvae have characteristic ventral pigment along the midline of the tail which consists of vertically elongate embedded melanophores with one to three melanophores per myomere. Melanophores are also present on the isthmus, finfold anterior to the anus, over the gut and gas bladder, and often on the cleithral symphysis.

### **Diagnostic Characters**

Larvae of leiognathids have 23-25 myomeres. The gut is compactly coiled in our smallest specimen. The gas bladder is dorsal to the apex of the gut and become conspicuous in postflexion larvae. The mouth is small and reaches to the anterior edge of the eye. The eye is round.

### **Similar Groups**

Leiognatids may be confused with a number of taxa with compressed bodies and serrate supraoccipital crests including acanthurids, carangids, caproids, cepolids, priacanthids, siganids and lethrinids.



**Figure 14.** 4.4mm postflexion leiognathid larva collected from Terengganu waters.

## **Lutjanidae: Snappers and Fusiliers**

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### **General Morphology**

Lutjanid larvae are initially elongate, but quickly become moderate to deep bodied and laterally compressed. The head is moderate to large and moderately compressed.

### **Head Spination**

Head spination is especially well developed in caesionines and some lutjanines; in some of these, the spines at the preopercular angle may develop fine serrations. Much of the head spination may have disappeared by the time of settlement.

### **Pigmentation**

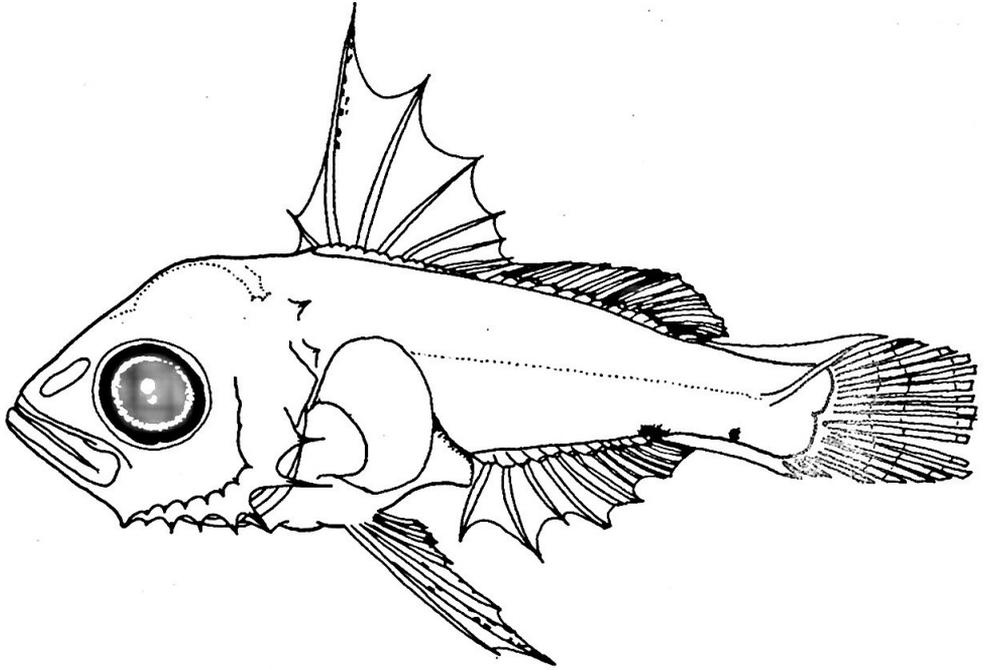
Lutjanid larvae are lightly pigmented initially. Melanophores are present on the dorsal surface of the gut and gas bladder, along the membranes of the dorsal- and pelvic-fin spines and along the ventral edge of the tail.

### **Diagnostic Characters**

Larvae of lutjanid have 24 myomeres, tightly coiled gut, small gas bladder, pigment pattern, early-forming head spination and early-forming spines of the pelvic fin and dorsal fin.

### **Similar Groups**

Lutjanid larvae are likely to be confused with siganids, serranids, some melamphoids, gempylids and trichiurids.



**Figure 15.** 6.95mm postflexion lutjanid larva collected from Terengganu waters.

## **Mullidae: Goatfishes, Mulletts**

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Mullidae type 1

### **Meristic**

D VIII-1,8; A I,6; P<sub>1</sub> 13; P<sub>2</sub> I,4; M 24+

### **Morphometric**

BD: 0.22-0.23, HL: 0.23(preflexion), 0.28-0.3(flexion to juvenile), PAL: 0.44 (preflexion to flexion), 0.49 (postflexion), 0.58 (juvenile), ED (to HL): 0.36-0.44.

### **General Morphology**

The body laterally compressed and moderately elongate. The head rounded dorsally. The snout short and steeply slope. The profile of the snout gradually less steep, but remains rounded. The mouth small to moderate. The short gut distant to the origin of anal base.

### **Head spination**

Almost no head spination.

### **Pigmentation**

Fundamentally pigmentation scarce. Pigment on the dorsal and lateral gut (lateral ones spotted) and small ones at some intervals along the ventral midline of the tail in preflexion. These pigments generally disappear before postflexion. Head pigmentation and more extensive during development. A stripe with internal melanophores along the mid-lateral of the tail in flexion. In postflexion distinctive melanophores along the dorsal margin of tail. In juvenile, heavy pigmentation with growth.

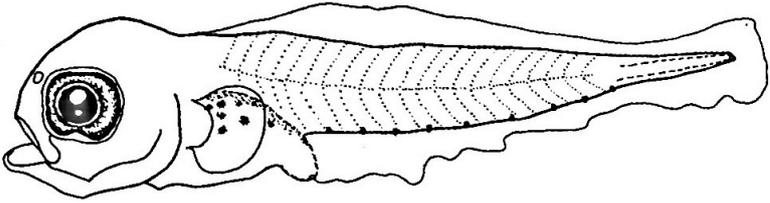
### **Diagnostic Characters**

The anus distant from the origin of anal base. Mid-lateral pigmentation on the tail and pigment regularly arranged at some intervals on the ventral margin of tail.

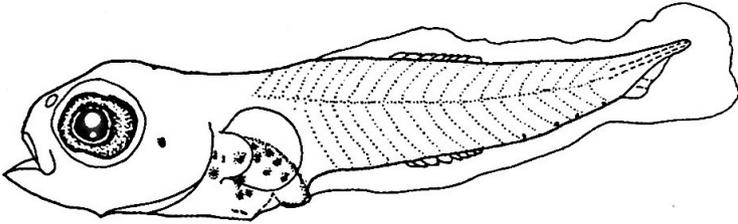
### **Similar Group**

Early mullid larvae are similar to pomacentrids, nemipterids, gerreids, teraponids, sparids and haemulids. The distinctive pigment pattern on the lateral surface and ventral margin of the tail is distinguished from nemipterids, gerreids, sparids and haemulids. Some of teraponids have this pigmentation, but distinguished from mullids by distance between anus and origin of anal base. From postflexion, no head spines in mullids is an important character.

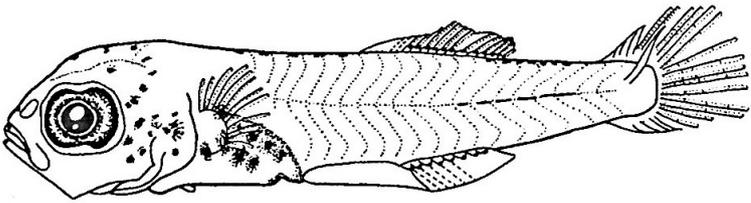
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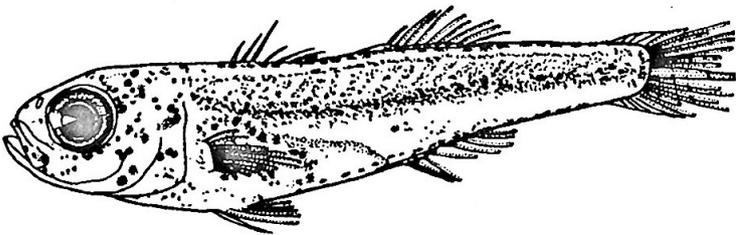
B



C



D



**Figure 16.** Mullid type 1 larvae from east coast of Peninsular Malaysia. A, 2.7mm preflexion larva; B, 3.8mm flexion larva; C, 4.1mm postflexion larva and D, 10.0mm juvenile.

## **Mycthopidae: Lanternfishes**

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### **Meristic**

D 12 (Type 1); A 12 (Types 1,2); P<sub>1</sub> 15 (Type 1), 11 (Type 2); C 10+9 (Types 1,2); M 28+

### **Morphometrics**

BD: 0.12 - 0.24, HL: 0.17 - 0.30, PAL: 0.55 - 0.63, ED(to HL): 0.26 - 0.37, 0.20 - 0.23 (Short axis), 0.37 - 0.40 (Long axis)

### **General morphology**

Body fusiform and moderately compressed. Anus located at about middle of the body. All fin rays soft. Pelvic fin abdominal. Most of dorsal fin base situated above interval between pelvic fin and anus. Eyes are elliptical in Myctophinae and round and nearly round in most Lampanyctinae. Round or keyhole shaped photophores are found on the head and ventral body surface. Br<sub>2</sub> photophore being the first to form.

### **Head Spination.**

No head spination.

### **Pigmentation**

Most myctophids larvae have a unique melanophore pattern that allows their identification and recurring pattern of pigment loci can be recognize for most genera. Smaller larvae often have melanophores along ventral midline of the tail.

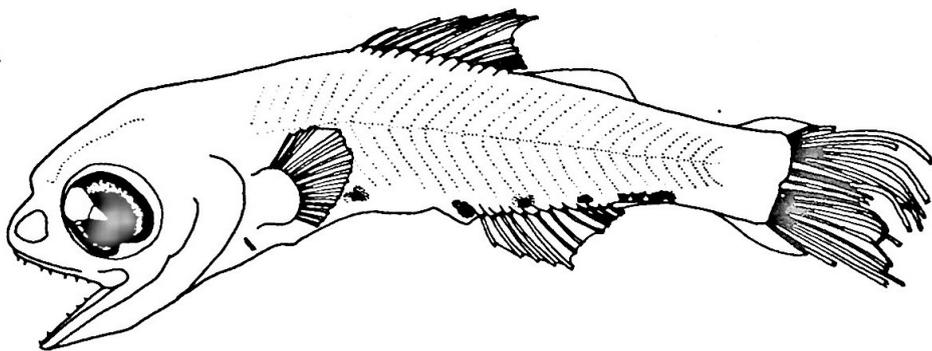
### **Diagnostic Characters**

No head spine. Adipose fin present. Gut slightly sigmoid, extends to midbody. Photophores on the head and ventral body surface.

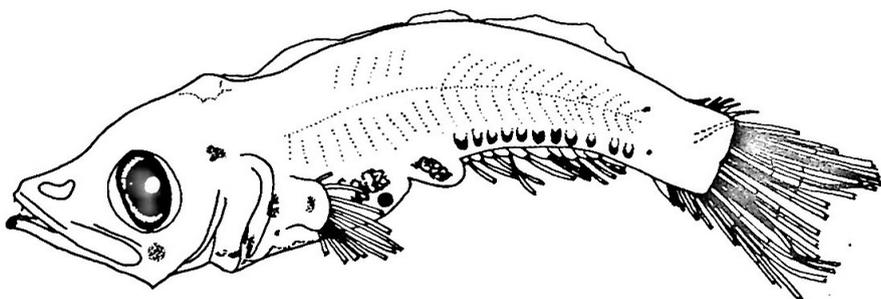
### **Similar group**

Some myctophids, particularly of the genus *Lampanyctus* are very similar to scombrids particularly in head shape, but lack preopercular spines. The mycthopid *Diogenichthys atlanticus* may be confused with cirrhitid larvae due to similar body shape and presence of a chin barbell, however cirrhitids have 25-27 myomeres, small round eyes, long gut with conspicuous gas bladder and different pigmentation. Preflexion larvae of Scaridae can be confused with myctophids but the scarids have 25 myomeres. Mycthopid larvae may also be confused with tripterygiids but can be differentiated by the longer gut of the former. Preflexion blenniid may occasionally be confused with mycthopid, the blenniids have elaborate preopercular spination, large teeth and very long pectoral fin rays.

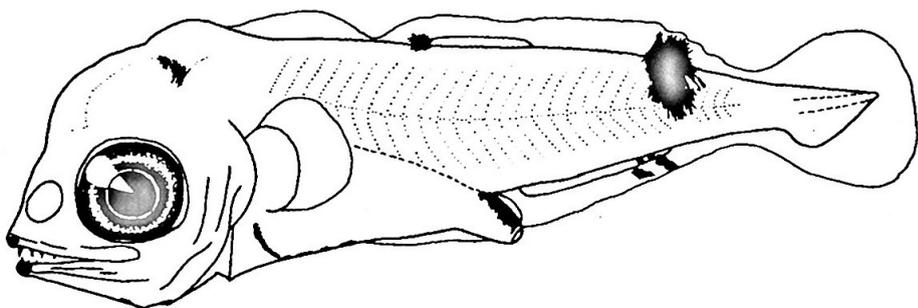
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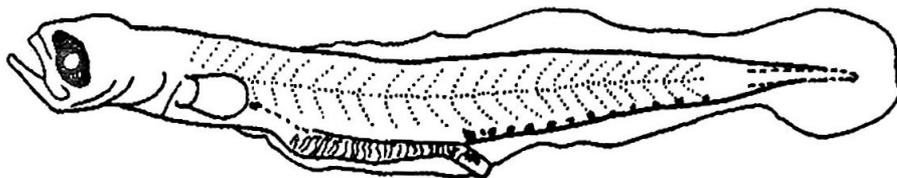
B



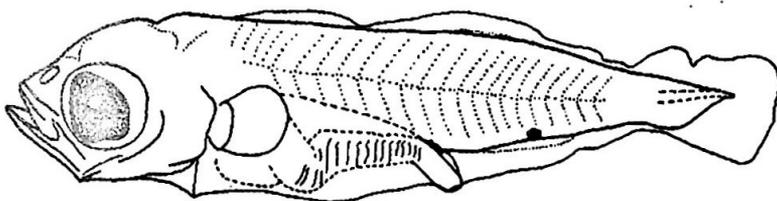
C



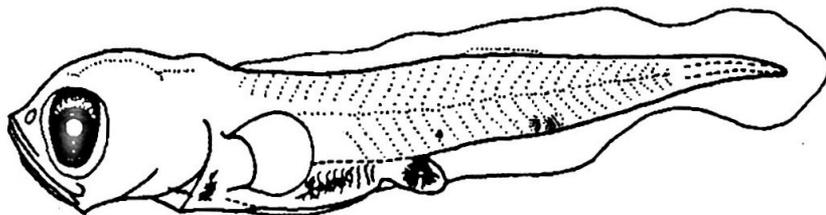
D



E



F



**Figure 17.** Myctophid larvae collected from Sarawak waters. A, type 1, 5.0mm postflexion larva; B, type 2, 5.3mm postflexion larva; C, type 3, 4.7mm flexion larva; D, type 4, 3.4mm preflexion larva; E, type 5, 3.3mm flexion larva and F, type 6, 4.3mm preflexion larva.

## **Nemipteridae: Thread-fin Breams, Monocle Breams**

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### **General Morphology**

Larvae are of moderate depth and laterally compressed. The head is moderate to large with a steeply sloped, short, rounded snout.

### **Head Spination**

Head spination is very limited. Most species have none and when spination is present, it forms late and is weak.

### **Pigmentation**

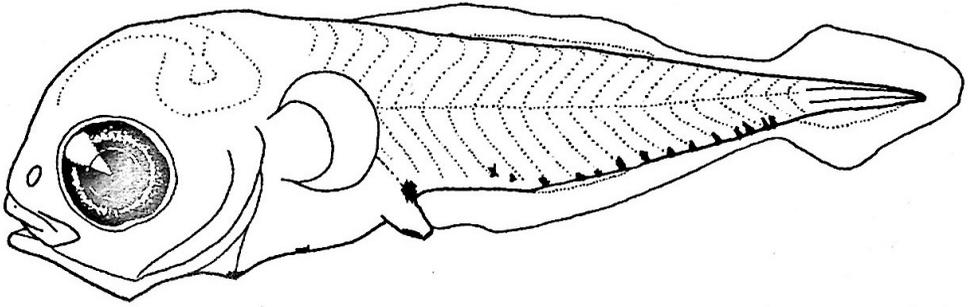
Prior to anal fin formation, nemipterid larvae have many tiny, evenly spaced melanophores extending along the entire ventral midline of the tail. Pigment generally occurs on the dorsal surface of the gas bladder, just anterior to the anus, and ventrally on the gut.

### **Diagnostic Characters**

Characteristic of the nemipterids are the tightly coiled gut, small gas bladder, 23-24 myomeres, large eye, and ventral midline pigment.

### **Similar Groups**

Nemipterid larvae are likely to be confused with scombrid (*Rastrelliger* sp.), ambassid, pinguidid, sparid, pomacentrid or mulled larvae.



**Figure 18.** 3.5mm preflexion nemipterid larva collected from Terengganu waters.

## **Scombridae: Mackerels, Spanish Mackerels, Bonitos, Tunas**

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### **General Morphology**

Scomberids are generally elongate to moderate in depth and laterally compressed, and are abruptly deeper in head and gut than in tail. The proportion of PAL to BL generally increases as larvae grow due to posterior migration of the anus. Similarly, the number of preanal myomeres increases at the expense of postanal myomeres.

### **Head Spination**

Head spination completely absent in *Rastrelliger*. Moderate to long preopercular spines are present in larvae of other scomberids from shortly after yolk-sac absorption.

### **Pigmentation**

In the preflexion stage, all scomberid larvae develop pigmentation dorsally on the gut and all but *Rastrelliger* develop pigmentation over the midbrain. Many taxa have a series of melanophores midventrally on the tail, these tend to decrease in number with growth.

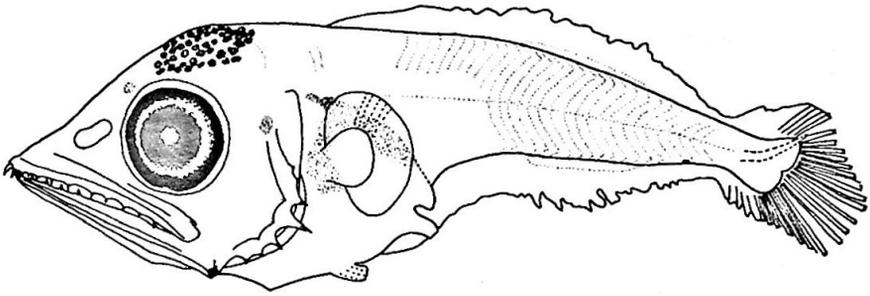
### **Diagnostic Characters**

Scomberids are characterized by large head, large eye, myomere number, pigmentation pattern, and with the exception of the Scombrini, head spination and compact triangular gut. Scomberid larvae have 31-56 myomeres.

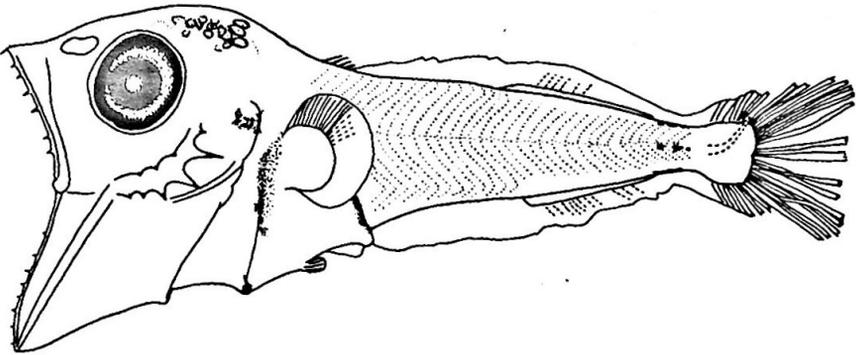
### **Similar Groups**

Families most likely to be confused with scomberids were nemipterids, sparids, microcanthids, pinguipedids, blenniids and some myctophids.

A



B



**Figure 19.** Scombrid larvae collected from Sabah waters. A, type 1, 6.5mm flexion larva and B, type 2, 7.05mm postflexion larva.

## **Synodontidae: Lizardfishes and Bombay Ducks**

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### **General Morphology**

Synodontid larvae are elongate to very elongate and round to ovoid in cross-section. The head is small to (barely) moderate in size. In younger larvae the head is round with a short, rounded snout, but by the mid postflexion stage the head becomes dorsoventrally flattened, and the snout becomes longer and may become pointed before settlement.

### **Head Spination**

There is no head spination.

### **Pigmentation**

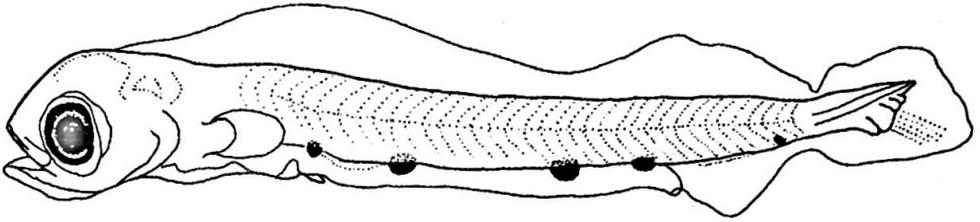
Synodontid larvae have 3-13 paired, large, distinctive, peritoneal pigment patches lying dorsolaterally along the length of the gut (these are retained internally following settlement). Pigment generally occurs along the base of the anal anlage or fin and along the tip of the notochord or caudal-fin base. Dorsal pigment is rare except at the notochord tip.

### **Diagnostic Characters**

Larvae of synodontid have 39-67 myomeres, long and straight gut with rugae, absence of a conspicuous gas bladder, a large mouth, the small to large eye is round to narrow, and there is no apparent gas bladder.

### **Similar Groups**

Synodontid larvae are likely to be confused with other elongate larvae having long guts and high myomere counts (for instance, clupeiform fishes).



**Figure 20.** 6.1mm preflexion syndontid larva collected from Terengganu waters.

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