# A Guide to Commonly Occurring Larval Stages of Fishes in Kenyan Coastal Waters

Prepared by:

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WIOMSA Western Indian Ocean Marine Science Association
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KENYA MARINE AND FISHERIES RESEARCH INSTITUTE K.M.F.R.I
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This publication is available electronically at the following website: www.wiomsa.org



This publication is made possible by the generous support of the Government of Sweden through the Western Indian Ocean Marine Science Association (WIOMSA). The contents do not necessarily reflect the views of Government of Sweden.

**ISSN:** 0856-7972

**Citation:** Mwaluma, J.M., Kaunda-Arara, B., and Strydom, N.A. (2014) **A Guide to Commonly Occurring Larval Stages of Fishes in Kenyan Coastal Waters**. WIOMSA Book Series No. 15. xvi + 73pp.

**Cover design by:** Gordon Arara

**Design and layout:** Gordon Arara

**Printed by:** Jamana Printers Limited

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# Acknowledgements

This work would not have been possible without the generosity and assistance of many people who helped in various ways. We would like to thank Dr Julius Francis and WIOMSA for taking an interest in this work and for supporting the work through MASMA and MARG II grants of WIOMSA. Analysis of material and photography was conducted at the Nelson Mandela Metropolitan University in Port Elizabeth, South Africa. We thank Tim Vink and Paula Pattrick for assistance with photography.

We are grateful to the Wardens of Kenya Wildlife Service at Mombasa, Malindi and Watamu Marine National Parks for logistical support. We thank the Kenya State Department of Fisheries in Shimoni and Kilifi for allowing us to use their boats for collection of samples. Field and laboratory support was provided by technical staff of Kenya Marine and Fisheries Research Institute (KMFRI) including; Dickson Odongo, Masudi Zamu, and Joseph Kilonzo, and the various students on attachment at KMFRI. We appreciate the useful comments and input by Jeff Leis on the manuscript versions.

We acknowledge the support provided by the Director and staff of KMFRI Mombasa station who assisted in various ways during the preparation of this guide.

# Foreword

The early life stages of most fish represent developmental intervals that are ecologically distinct from each other and especially from their later juvenile and adult stages. Knowledge of the changing ecological requirements and limitations, population dynamics, and behavior of the early stages of fish facilitates effective monitoring and management of fish populations and their habitat(s). Field research in fish larvae and early juvenile stages depends on accurate identification of, at least, the targeted species among collected specimens. The use of meristic and morphological characteristics for taxonomic identification requires knowledge of the appearance of the targeted species and similar-looking species in an aquatic area to enable diagnostic segregation. Since these characteristics dramatically change as fish grow, diagnosis becomes difficult and complicated. Although taxonomic guides on fish larvae are readily available for other Ocean areas of the world, they are lacking for the Western Indian Ocean (WIO) area. This disparity could, perhaps, explain the paucity of work on the dynamics of marine fish larvae from the WIO area despite the importance of such studies towards understanding the factors that affect population changes. As such, this guide, the first of its kind in the WIO region, will be of interest to marine scientists. Due to the high diversity of fish species in the WIO region a description of their larvae is both challenging and daunting. Nonetheless, the authors of the guide have put in commendable effort by describing the larvae of over 40 genera in 37 families of marine fishes. Of great importance is that the guide has been designed to allow investigators, even those with limited taxonomic experience, to identify the larvae commonly encountered in the Kenyan coastal waters. The specimens have mostly been described to the genera level which displays a necessary caution given the difficulties that exist in taxonomic identification of such stages to species level; a task that other investigators can pursue. The guide, therefore, not only fills an existing gap in taxonomic material necessary for identifying various stages of marine fish larvae in the WIO area, but will also facilitate studies in marine fish larval ecology.

Prof. Micheni. Japhet Ntiba, CBS
September 2014
Nairobi, Kenya

# Introduction

Studies on early life history stages are important for understanding the biology of fishes and mechanisms that regulate fish populations. While significant work has been done on the functional biology of fishes in the Western Indian Ocean (WIO), relatively little work has been undertaken on the ichthyoplankton, especially their taxonomy and systematics. A major reason for this situation is that larvae of the diverse assemblage of tropical marine fishes are often difficult to identify. The lack of suitable identification guides, especially from the WIO is another major contributing factor. Despite the constraints, some useful taxonomic descriptions of fish larvae are available from the Indo-Pacific region (e.g. Leis and Rennis, 1983; Leis and Trnski, 1989; Leis and Carson-Ewart, 2000) and temperate Australian waters (Neira *et al.*, 1998) amongst others.

The goal of this guide is to provide a laboratory and field identification tool for the commonly occurring fish larvae of coastal Kenya. Photographs of larvae were generated from materials archived from a previous MASMA project in Kenya (WIOMSA/MASMA/AG/2004/03) and from fresh samples collected using plankton tows along the Kenyan coast. A total of 37 fish families (mostly identified to genus, though to species in some cases) are presented usually in lateral view (unless indicated), with their body size and name of the location from where they were collected. The families are organized in alphabetical order and the descriptions include morphological and meristic characteristics of the fish.

The guide includes larvae of fishes that live on or near the coral reefs of the coastal waters of Kenya, and are most representative of the nearshore larval pool. The lagoonal and nearshore areas collected included; Shimoni, Tudor Creek, Vipingo (Kuruwitu area), Kilifi, Watamu and Malindi (Fig. 1). Additional samples were obtained from three cruises made in the Ungwana Bay area, north of Malindi.

This guide represents the first descriptive work for the early life history stages of fishes in the wider WIO region. It certainly does not provide descriptions of all the larvae on the Kenyan coast, but serves as a first introduction to larval stages of common genera of the major fish families along the Kenyan coast. The guide should complement the available records of postlarval stages of bony fishes on the Kenyan coast comprising of 95 families and 633 species (Anam and Mostarda, 2012). However, these species are mostly of the adult stages.

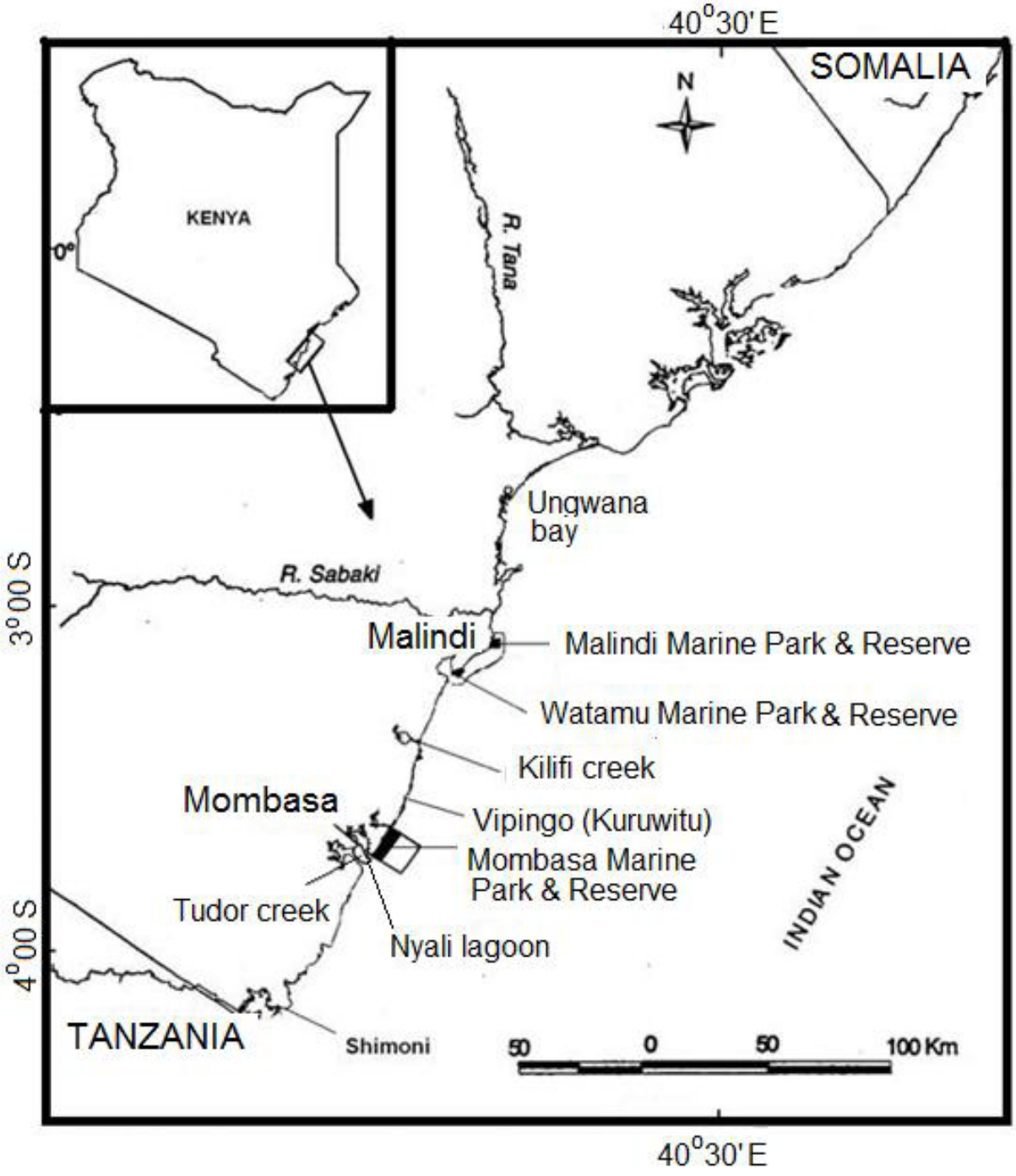



*Fig. 1: The Kenya coast showing the sites from which fish larvae described in the guide were collected.*

# Terminology and characters used in identifying fish larvae

Terminologies for developmental stages used in this guide (Figure 2) follow that of Kendall *et al*. (1984). These include:

**Preflexion larva:** Developmental stage beginning at hatching through egg yolk absorbtion and ending at the start of upward flexion of the notochord.

**Flexion larva:** Developmental stage beginning with flexion of the notochord, development of the caudal fin and fin rays in majority of species, together with supporting bones and cartilages of the homoceral fin.

**Postflexion larva:** Developmental stage from formation of the caudal fin(distal margin of the hypural elements vertical) to attainment of full external meristic complements (fin rays).

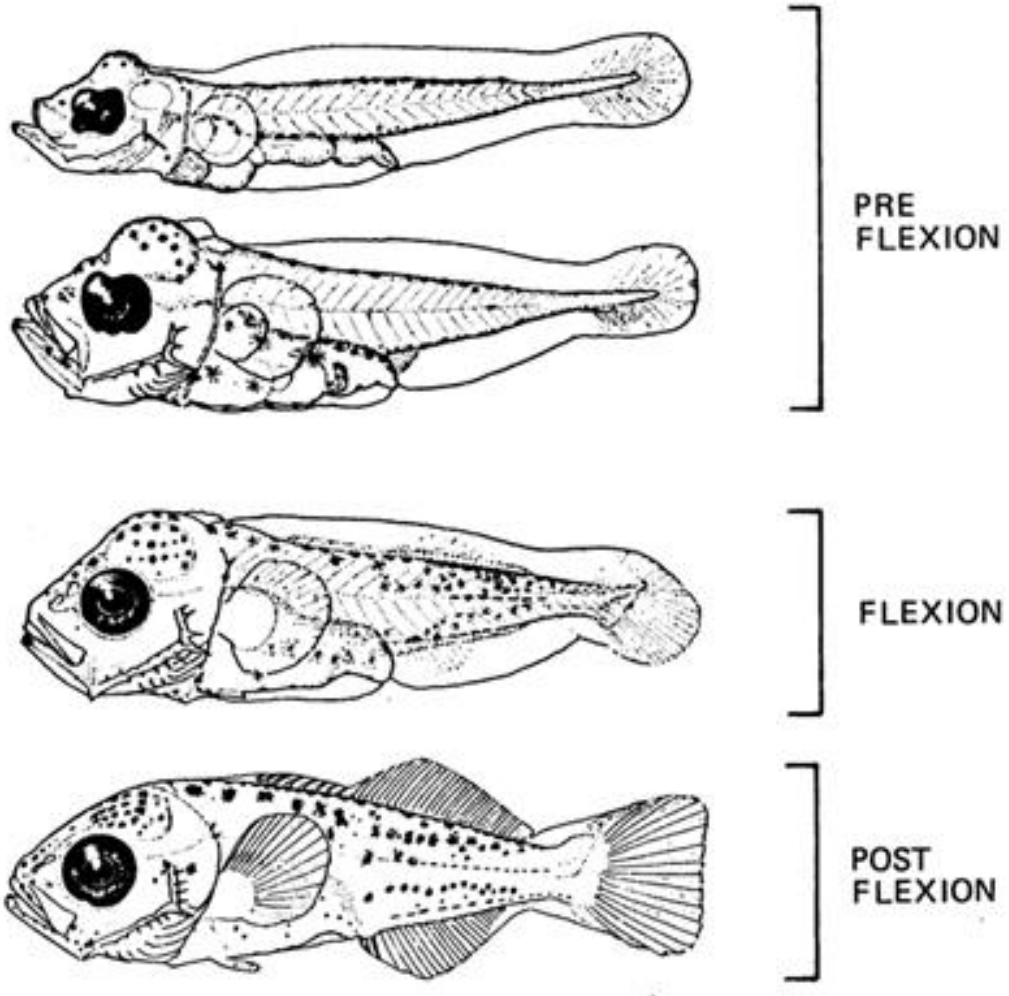



*Fig. 2: Developmental stages of Trachurus symmetricus (modified from Ahlstrom and Ball,1954; cited in Kendall et al., 1984)*

# Abbreviations

The following common abbreviations (Figure 3) and morphometrics are used to describe fish larvae in this guide.

### Morphometrics:

| | | | |
|---|---|---|---|
| BL: | Body length (mm) | PAL: | Preanal length (mm) |
| ED: | Eye diameter (mm) | P1: | Pectoral fin |
| BD: | Body depth (mm) | P2: | Pelvic fin |
| HL: | Head length (mm) | | |

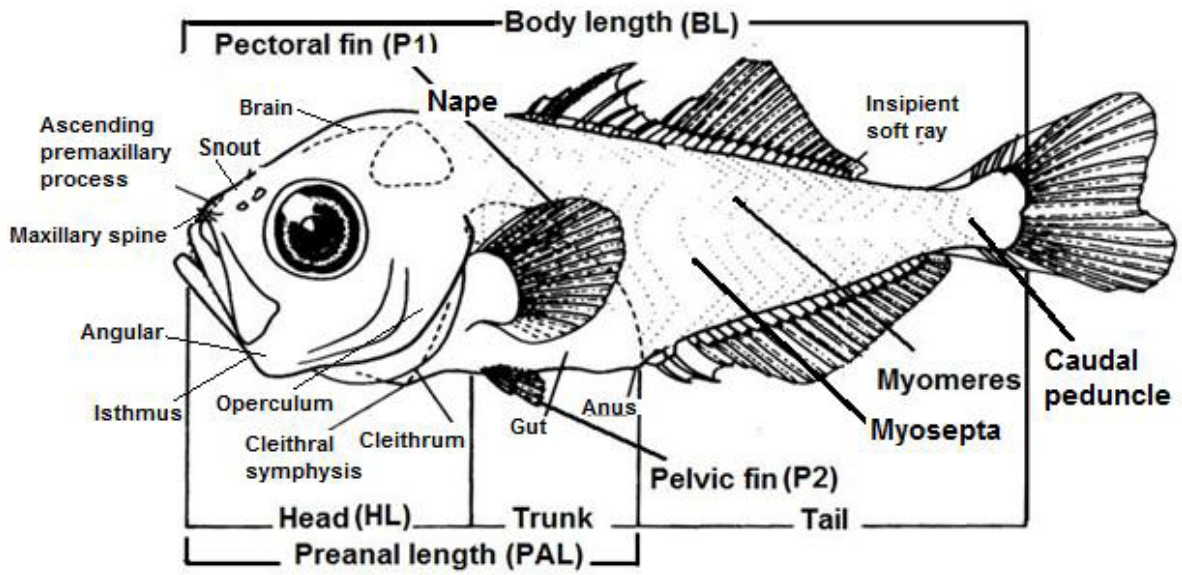



*Fig. 3: Hypothetical larval fish showing the major morphological characters measured to describe the larvae (modified from Leis and Trnski,1989).*

# Morphometric and meristic characters used in descriptions of fish larvae

### Body Shape

The following broad categories that relate body depth (BD) to body length (BL) are used to describe the fish larvae (Leis and Carson-Ewart, 2000):

Very Elongate.....BD < 10% BL

Elongate .....BD 10-20% BL

Moderate .....BD 20-40% BL

Deep .....BD 40-70% BL

Very Deep.....BD > 70% BL

### Head size

Categories used to define head size relate head length (HL) to BL:

Small Head .....HL < 20% BL

Moderate Head .....HL 20-33% BL

Large Head.....HL > 33% BL

## Eye size

Categories used to define eye size relate eye diameter (ED) to HL:

Small Eye..... ED < 25% HL

Moderate Eye..... ED 25-33% HL

Large Eye..... ED>33% HL

## Myomere count

Myomere counts include all myomeres bounded anteriorly by a myoseptum. There is a near one-to-one correspondence between total number of myomeres and number of vertebrae in the fish.

## Gut

The functionally different sections of the gut may be visibly discernible in growing larvae and were used as characters in identification, e.g. a portion of the gut may be striated, folded or coiled into loops, thereby increasing its length without increasing body length. The timing of folding and its extent are species-specific and therefore useful taxonomic characters.

## Head spination

The sequence of development, degree of elongation, placement, number, and ornamentation of the spines are important characters for identification of fish larvae. Head spine identification in this guide is based on Leis and Trnski (1989). The most widespread type of head spination is that on the inner and outer preopercular borders. However, spines may appear on any part of the head. Head spination in many species appears during larval stages but then disappears in adults, with some remaining well into the juvenile and adult stages. The head spination characteristics used in describing the larvae are shown in Figure 4.

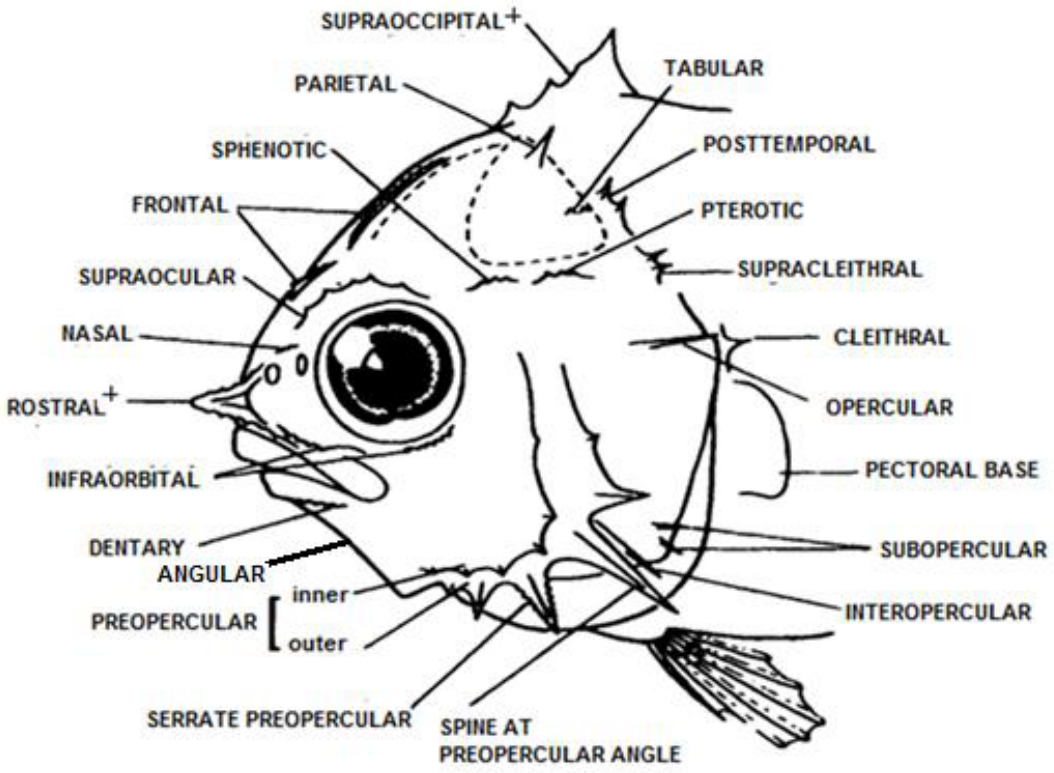



*Fig.4: Head spination characteristics used in describing fish larvae in this guide. "+" indicates an unpaired, medial spine (Leis and Trnski, 1989).*

## Fin formation

Fin meristics are key characters used in identification of older larval stages of fishes. Counts of the dorsal (D), pectoral (P1), pelvic (P2), anal (A) and principal caudal (C) fin rays; those caudal fin rays supported by the hypural and parhypural bones and spines are used. In developing larvae, fin spines and rays or even whole fins may become very long or become ornamented in a taxon-specific manner, and therefore become quite useful in identification. Number of fin rays and spines are presented in roman and numeric format, respectively (e.g. IV, 8).

## Size

Body length is a very useful character to use in descriptions of larvae as certain characters are present at specific sizes. Body length is reported for each specimen as notochord length for preflexion and flexion stages, and standard length for postflexion stages of fish larvae.

## Pigmentation

In this manual, melanophore pigment patterns are described. Melanophores contain the black/brown pigment called melanin. The black pigment of the melanophore is the only colour remaining after fixation in formalin and preservation in ethanol. Melanophores are used as a standard reference to pigmentation pattern in this manual. Their occurrence on the body and appearance in shape are essential in larval fish identification, particularly at the family, genus and species level.

# Glossary of terms

We define only those terminologies of special application to fish larvae because we assume the user has a working knowledge of adult fishes. The general terminology mostly follows that of Leis and Carson Ewart (2000).

**A**

Angular ..... The angular is a large bone in the lower jaw which is connected to all other lower jaw bones.

Anterior ..... Relating to the front portion.

**B**

Body depth ..... The vertical distance between body margins (exclusive of fins) through the anterior margin of the pectoral-fin base.

Body length ..... Size of the larva; corresponds to notochord length in preflexion and flexion larvae and to standard length after flexion.

Body width ..... The transverse distance between body margins at the pectoral-fin base.

**C**

Caudal ..... Pertaining to the tail.

Caudal peduncle ..... The region of the body between the end of the anal fin and the base of the caudal fin.

Cleithrim ..... Prominent bone of pectoral girdle, clearly visible in many fish.

Compressed ..... Flattened laterally.

**D**

Dermersal eggs ..... An egg which remains on the bottom either free or attached to the substratum.

Dorsal ..... Pertaining to the back.

**E**

Eye diameter ..... The horizontal distance across the midline of the pigmented region of the eye.

**G**

Gas bladder ..... Membranous, gas-filled organ located between the kidneys and the alimentary canal in teleost fishes; also called air bladder or swim bladder.

**H**

Hindbrain ..... Posterior part of the brain, consisting of the medulla, pons and the cerebellum. In fishes, the hindbrain is also the largest portion of the three regions (forebrain, midbrain and hindbrain. The hindbrain is responsible for motor reflexes

Head length ..... The horizontal distance from the tip of the snout to posterior-most part of opercular membrane; prior to development of operculum, measured to the posterior margin of the cleithrum.

Homoceral fins (plates) ... Symmetrical tail fin extending beyond the end of the vertebral column as in most bony fishes.

Hypural elements ..... The flattened bony plates at the posterior end of the vertebra column, formed from parts of the posterior vertebrae.

**J**

Juvenile ..... Developmental stage from attainment of full external meristic complements and loss of temporary specialisations for pelagic life to sexual maturity.

**L**

Larva ..... Developmental stage between hatching (or birth) and attainment of full external meristic complements (fins and scales) and loss of temporary specialisations for pelagic life; yolk sac through postflexion stage inclusive.

Lateral ..... At or toward the side.

**M**

Melanophores..... Melanin bearing cells (brown to black); frequently capable of expansions and contractions which change their size and shape.

Meristic characters (counts)... Meristic characters are the countable structures occurring in series (e.g. myomeres, vertebrae, fin rays) in fish. These characters are among the characters most commonly used for differentiation of species and populations.

Myomeres ..... Serial muscle bundles of the body.

Myosepta..... Connective tissue partitions separating adjacent myomeres.

**N**

Nape ..... Upper surface of the body behind the head and before the dorsal fin.

Notochord ..... Longitudinal supporting axis of body which is eventually replaced as a support by the vertebral column in teleost fishes.

**P**

Pelagic..... Living on or in the open seas. In the water column as distinct from substrate associated; neither necessarily planktonic nor oceanic.

Preanal length (PAL)..... Distance from the tip of the snout along the midline to a vertical line through the posterior edge of the anus.

Posterior ..... Towards the hind end of the fish.

**S**

Snout ..... Prolongation of the anterior portion of the head consisting of nose and jaw.

Spine ..... Bony, pointed, elongate projections on the body, usually the head, which are often temporary specialisations for pelagic life.

Standard length ..... The length of a fish measured from the tip of the snout to the posterior extremity of the hypural plate, the expanded bones at the end of the backbone that support the caudal fin.

Symphysis..... Point of junction of the two sides of the jaw

Symmetrical: ..... similarly arranged on both sides.

**T**

Tail ..... In larvae - the portion of body posterior to the anus.

Truncate ..... Terminating abruptly, as if cut off square.

Trunk..... The region of a fish between the head and anus, or the last gill slit and vent.

Total length..... The length from the tip of the snout to the tip of the tail. For larvae: Distance from the tip of the snout along the midline to the posterior edge of the caudal finfold; body length is traditionally expressed as total length in the Japanese literature.

**V**

Vertebrae ..... The bones of the spinal column.

Villiform teeth..... Small, slender teeth forming velvety bands.

## Collection methods

Fish larvae described in this guide were collected using the standard plankton collection techniques. A plankton net measuring 0.5 m in diameter with mesh aperture of 500µm was towed at a speed of 1-2 knots near and over coral reefs for about 20 minutes. Ten oblique tows were made through the water column during the day at each site to approximate a representative sample. Larvae were immediately fixed in 5% formalin (in seawater) and labeled for laboratory work. Sampling was done during both the northeast and southeast monsoon seasons.

## Identification methods

Identification of fish larvae was made to the lowest possible taxon using available literature and the expertise of collaborators. In the laboratory, larvae were removed from samples, measured and identified to the lowest possible taxon using mostly identification guides by; Leis and Rennis (1983), Leis and Trnski (1989), Neira, *et al*.,(1998) and Leis and Carson-Ewart (2000) amongst others. Specimens were then preserved in 70% ethanol for photography. Larvae were photographed at Nelson Mandela Metropolitan University (NMMU), in Port Elizabeth, South Africa. Images were taken using a Leica M80 microscope fitted with a Leica DFC 290 HD camera. For each image, descriptions were refined and drawings made and stored in a database. All specimens are stored at the KMFRI, Mombasa, Kenya.

## Manual format

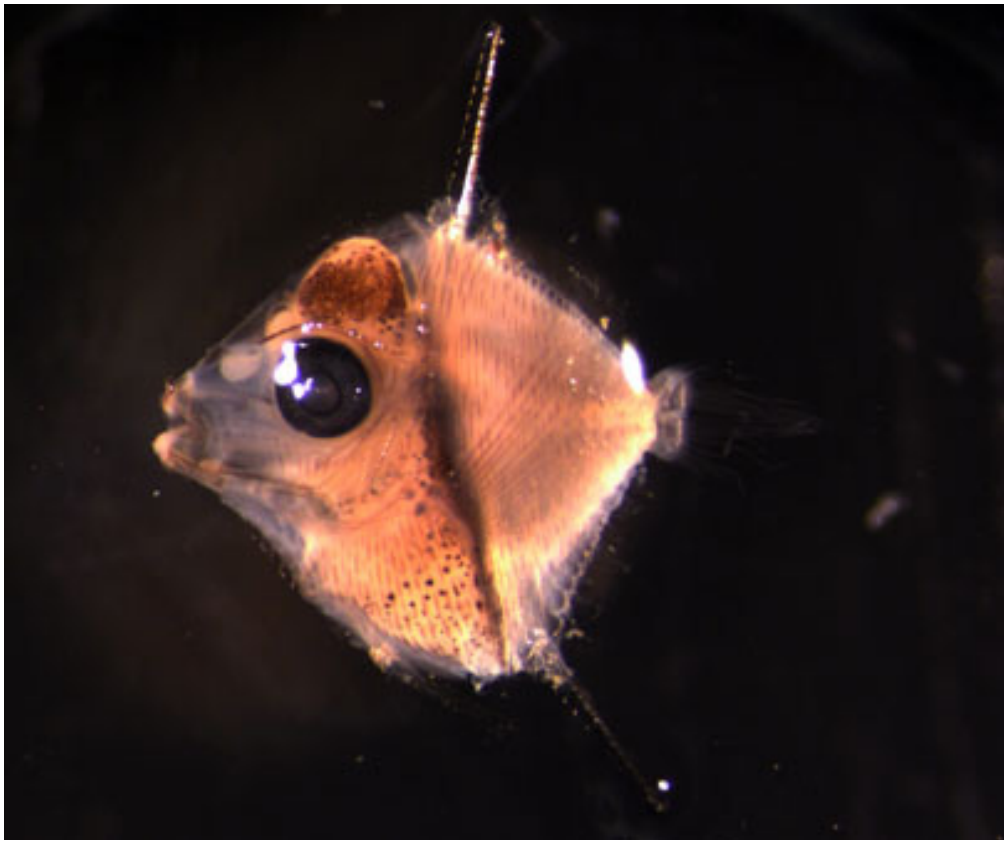
Larval stages of fishes commonly occurring in Kenyan coastal waters are arranged in alphabetical order according to fish families. A brief description of the ecology of adults of the species precedes description of the larval stages. A list of the common species within the fish families in Kenya is provided followed by specimen images of larvae encountered within the families. Standard systematic identification methods are used to describe the larvae. These include descriptions of the meristic counts, morphometrics, pigmentation, special characters.

## Descriptions of Larvae

# FAMILY: ACANTHURIDAE (Surgeonfishes)

Surgeonfishes are ovate, elongate, compressed fishes with a small terminal mouth containing a single row of small, close set teeth. Dorsal and anal fins are single (Lieske and Meyers, 1994). They are diurnal herbivores or planktivores. Most species have a long larval phase resulting in large size at settlement and therefore a broad distribution range (Lieske and Meyers, 1994). They are found typically in the coral reef zone where many species are harvested as commercially important food by artisanal fishermen along the Kenyan coast. The most commonly occurring genera are *Acanthurus* and *Naso*.

*Naso* sp.



*Naso* sp. (4.4 mm), Ungwana Bay.

## Larvae morphology

Deep bodied and strongly laterally compressed. Extensive head spination with long serrated snout. A prominent, serrated spine present in dorsal and anal fins. Each pelvic fin with a serrated spine. Supraocular serrations present above the eyes. Gut is coiled.

## Pigment description

Larva is moderately pigmented with external pigmentation present on the head and over the lateral surface of the gut. Light pigmentation occurs laterally on the body in the caudal region.

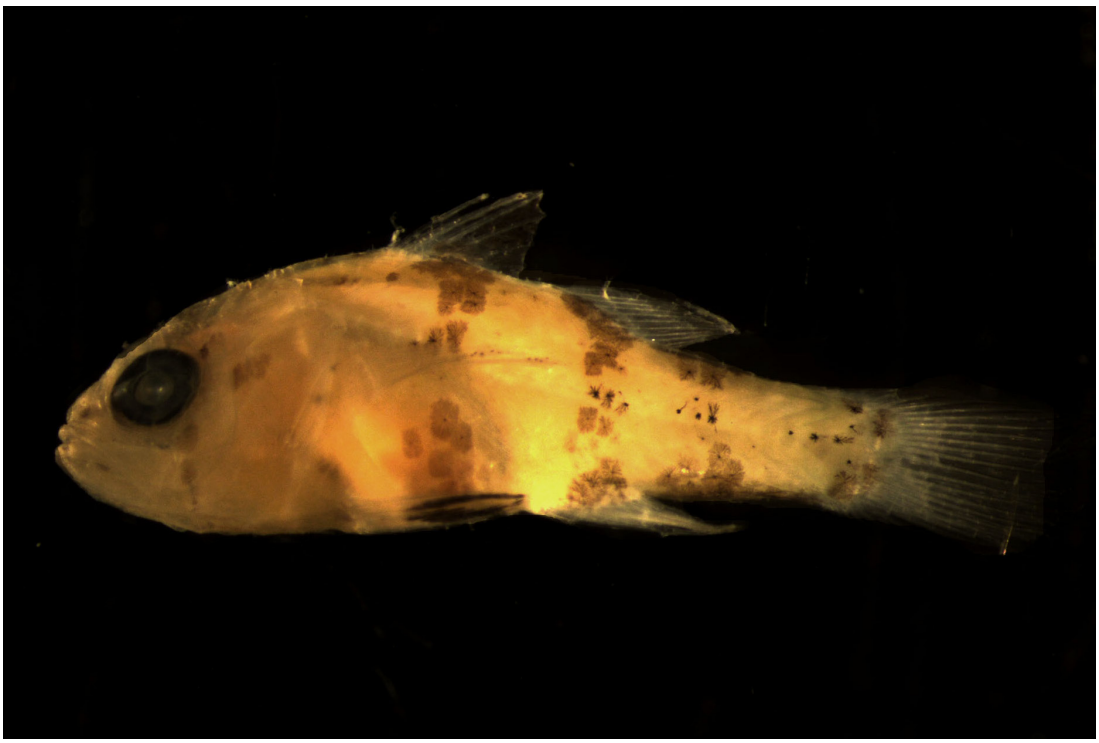
Meristic characters and morphometrics for *Naso* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 23 | BL | 4.4 |
| Dorsal fin | VII, 24 | PAL | 3.0 |
| Anal fin | II + 23 | HL | 2.0 |
| Caudal fin | 8+8 | ED | 0.8 |
| Pectoral fin | 15 | BD | 3.8 |
| Pelvic fin | I,3 | | |

# FAMILY: APOGONIDAE (Cardinal fishes)

Apognids are found in the Atlantic, Indian, and Pacific Oceans, they are chiefly marine, but some species are found in brackish water and a few (notably Glossamia) are found in fresh water. They are generally small fish, with most species being less than 10 cm (3.9 in), and are often brightly coloured. They are distinguished by their large mouths, and the division of the dorsal fin into two separate fins. Pigmentation may be highly variable within the family but usually not within species. Most species live in tropical or subtropical waters, where they inhabit coral reefs and lagoons (Johnson and Gill 1998).They are a morphologically diverse group of fish, mainly nocturnal and carnivorous (Leis and Rennis 1983), with common genera including *Gymnapogon, Archamia, Apogon* and *Fowleria*.

*Gymnapogon* sp.



*Gymnapogon* sp. (9.7 mm), Nyali lagoon.

## Larval morphology

Elongate body and slightly compressed. Preopercular spines absent. Mouth is large, extending to mid-eye. Gut extends to midbody. Eyes are large and round. Small villiform teeth visible in both jaws.

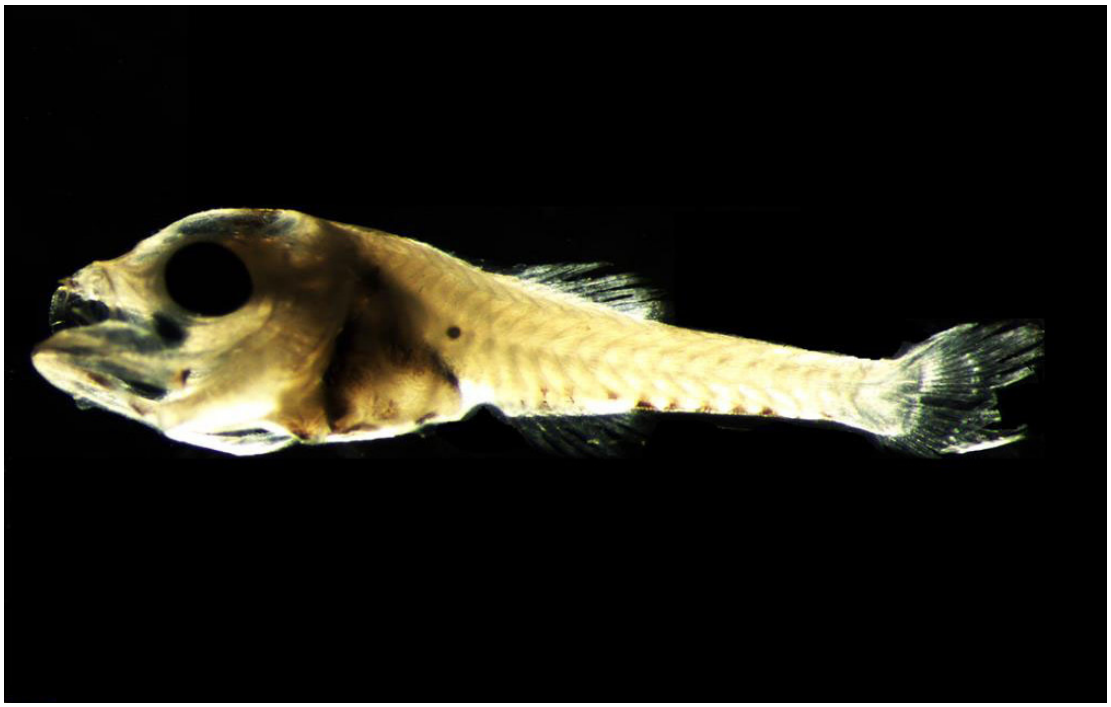
## Pigment description

Heavily pigmented larva. Melanophores forming a series of six dark-brown vertical bars of pigment on the body in late postflexion stage. Dorsal and pelvic fins pigmented.

Meristic characters and morphometrics for *Gymnapogon* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 9.7 |
| Dorsal fin | VI + I, 10 | PAL | 7.4 |
| Anal fin | II, 8 | HL | 4.0 |
| Caudal fin | 17 (9+8) | ED | 1.0 |
| Pectoral fin | 15 | BD | 3.7 |
| Pelvic fin | I,5 | | |

*Apogon* sp.



*Apogon* sp.(5.0 mm), Vipingo.

## Larval morphology

Larva is elongate and laterally compressed. Gut is coiled. Conspicuous gas bladder present anteriorly over gut. Mouth is large, reaching anterior portion of the eyes with small villiform teeth visible in both jaws. Small preopercular spine present.

## Pigment description

Larva is moderately pigmented. Row of eight melanophores on ventral margin of tail and internally above the fin base. Pigmentation present on the dorsal surface of the gas bladder and on anterior parts of the gut.

Meristic characters and morphometrics for *Apogon* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 5.0 |
| Dorsal fin | VI + I, 9 | PAL | 3.0 |
| Anal fin | II, 7 | HL | 2.3 |
| Caudal fin | 17 (9+8) | ED | 0.5 |
| Pectoral fin | 12 | BD | 1.7 |
| Pelvic fin | I,5 | | |

*Archamia* sp.

*Archamia* sp. (8.5 mm), Watamu.

## Larval morphology

Body elongate and strongly laterally compressed. Mouth is large, extending to mid-eye. Eye large and round. Gut is coiled and triangular, terminating near 40% of body length. Small preopercular spine present.

## Pigment description

Moderately pigmented with pale brown pigment mostly concentrated on the head and gut. Trunk and tail are devoid of pigmentation.

Meristic characters and morphometrics for *Archamia* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 8.5 |
| Dorsal fin | VI + I, 9 | PAL | 4.0 |
| Anal fin | II,13 | HL | 2.4 |
| Caudal fin | 17 (9+8) | ED | 0.8 |
| Pectoral fin | 13 | BD | 2.0 |
| Pelvic fin | I,5 | | |

*Fowleria* sp.

*Fowleria* sp. (12 mm), Kilifi.

## Larval morphology

Moderately deep-bodied and slightly compressed. Gut is coiled and extends to mid body. Mouth is large and extends to about the mid eye. Eye is large and round. Head spination is lacking.

Pigment description

Postflexion stage larva heavily pigmented with stellate melanophores spread over most of the body. These appear brownish in colour. Pigment streak also found on 1stdorsal fin and on pelvic fins. Pigment spots also on the anal fin.

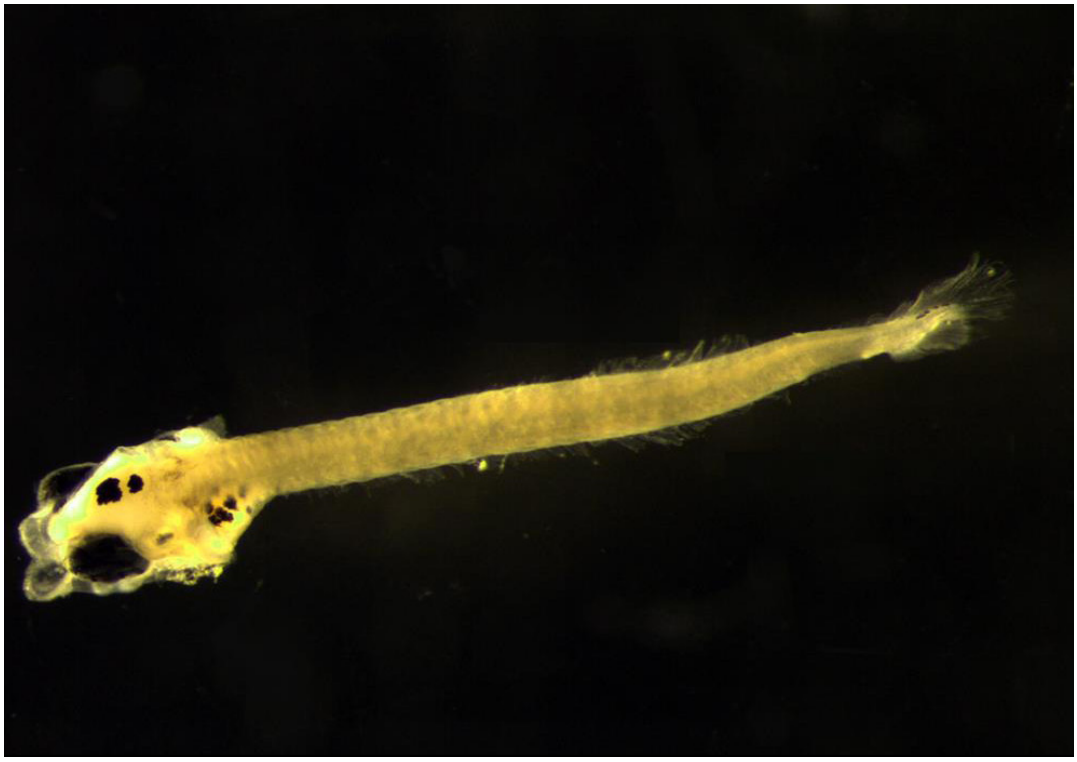
Meristic characters and morphometrics for *Fowleria* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 12.0 |
| Dorsal fin | VII + I, 9 | PAL | 8.0 |
| Anal fin | II,8 | HL | 5.8 |
| Caudal fin | 17 (9+8) | ED | 1.5 |
| Pectoral fin | 12 | BD | 5.0 |
| Pelvic fin | I,5 | | |

# FAMILY: ATHERINIDAE (Silversides)

Atherinids are small schooling fish closely associated with surface waters during all stages of life. Few species though, are found near coral reefs. They produce demersal eggs which are attached to algae and other substrates (Schmitt 1983). Common genera are *Atherinomorus* and *Hypoatherina*.

*Atherinomorous* sp.



*Atherinomorus* sp. (4.7 mm), Ungwana Bay.

## Larval morphology

Elongate, laterally compressed; head short with a small, terminal mouth that reaches the anterior portion of the eye. Gut is compact. No head spination.

## Pigment description

Larva is lightly pigmented except for stellate pigmentation on mid brain, dorsal surface of the gut and tip of the tail at this size.

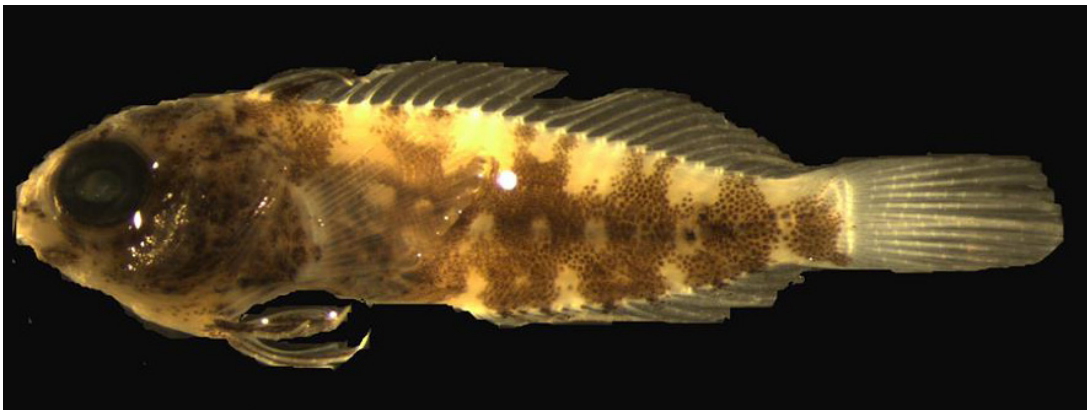
Meristic characters and morphometrics for *Atherinomorous* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 35 | BL | 4.7 |
| Dorsal fin | VI+I,9-11 | PAL | 2.9 |
| Anal fin | I,11-14 | HL | 2.6 |
| Caudal fin | 9+8 | ED | 0.5 |
| Pectoral fin | 15-19 | BD | 0.8 |
| Pelvic fin | I,5 | | |

# FAMILY: BLENNIIDAE (Combtooth blennies)

Blenniidae are a large and diverse group of benthic fish, usually closely associated with reefs, tide pools and the water column over reefs (Leis and Rennis 1983). Blenniids spawn small, slightly flattened eggs attached to substrates in nests guarded by the male. Combtooth blennies are the largest family of blennies with around 400 known species. They are found in tropical and subtropical waters in the Atlantic, Pacific and Indian Oceans; some species are also found in brackish and even freshwater environments (Froese and Pauly 2013). Commonly occurring genera in Kenya waters are *Petroscirtes, Omobranchus* and *Parablennius*, plus at least six others.

*Petroscirtes mitratus*



*Petroscirtes mitratus* (9.7 mm), Watamu.

*Petroscirtes mitratus* (10.0 mm) postflexion stage, Watamu.

## Larval morphology

Body moderately elongate, with compressed trunk. Rounded head with short snout. Gut is short and coiled. Preopercular spines absent. Elongate pelvic fins present.

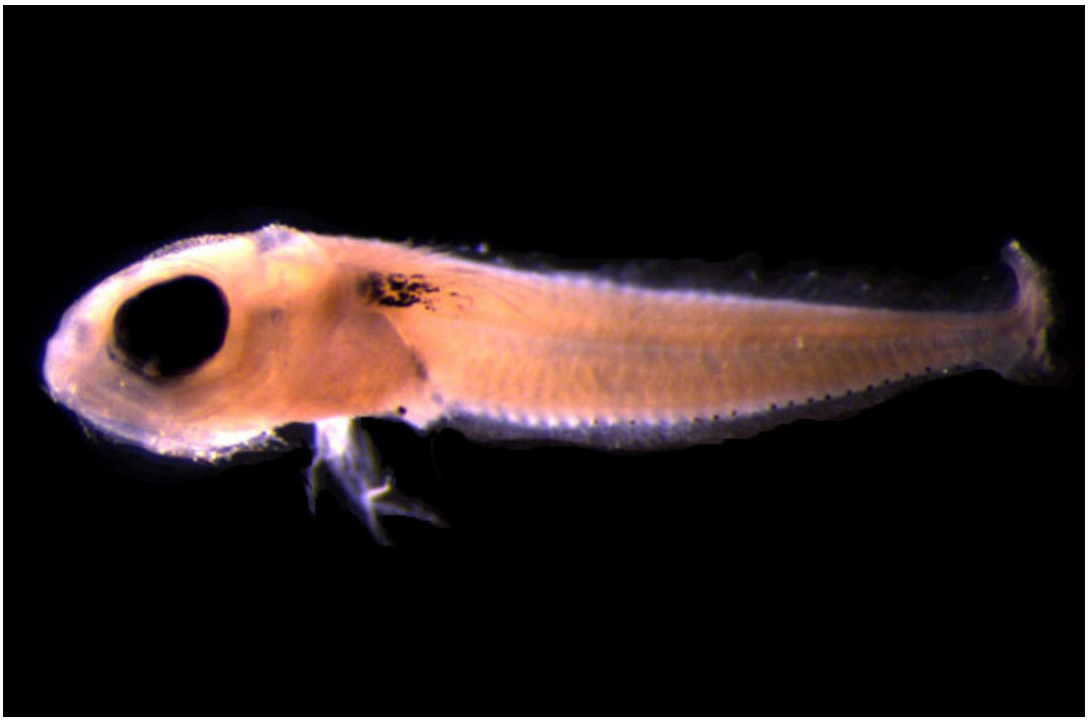
## Pigment description

Larvae moderate to heavily pigmented. Melanophores appear yellow brown with brown bars on the body late in postflexion stage. Dark spots on the head, gut and first few rays of the dorsal fin. Upper part of pectoral fin pigmented.

Meristic characters and morphometrics for *Petroscirtes mitratus*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 31 | BL | 9.7 |
| Dorsal fin | XII + 15 | PAL | 4.0 |
| Anal fin | II, 15 | HL | 3.0 |
| Caudal fin | 11 | ED | 1.0 |
| Pectoral fin | 15 | BD | 3.0 |
| Pelvic fin | 3 | | |

*Omobranchus* sp.



*Omobranchus* sp. (4.1 mm), Ungwana Bay.

## Larval morphology

Elongate with compressed trunk and tail. Short coiled gut, not reaching the midbody.

Head elongate and broad with small mouth. Eye is large and round. Preopercular spines prominently present. Spine at preopercular angle longer and broader than the rest.

## Pigment description

Larva is lightly pigmented. Heavy internal dorsal and anterior gut pigmentation. Rows of melanophores on the ventral midline of the tail.

Meristic characters and morphometrics for *Omobranchus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 36 | BL | 4.1 |
| Dorsal fin | X, 18 | PAL | 1.5 |
| Anal fin | II, 24 | HL | 1.0 |
| Caudal fin | 13 | ED | 0.3 |
| Pectoral fin | 12 | BD | 0.5 |
| Pelvic fin | - | | |

*Parablennius* sp.

*Parablennius* sp. (2.1 mm), Ungwana Bay.

## Larval morphology

Rounded and broad head. Larvae moderately elongate with a compressed trunk. Short rounded gut not reaching the midbody. Eye large and round. Small preopercular spines present.

## Pigment description

Lightly pigmented larva. Heavy pigmentation on the dorsal and ventral portions of the gut. Rows of melanophores on the ventral midline of the trunk.

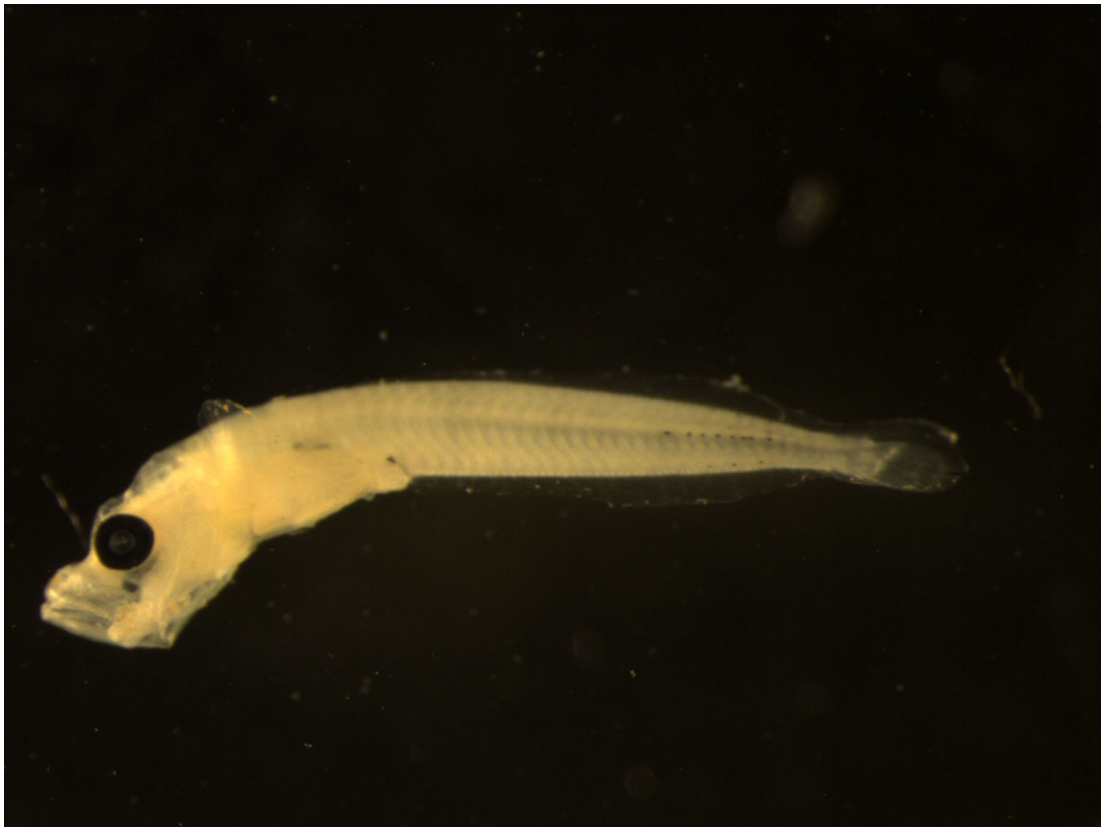
Meristic characters and morphometrics for *Parablennius* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 40 | BL | 2.1 |
| Dorsal fin | XII,17-19 | PAL | 1.0 |
| Anal fin | II, 17-19 | HL | 0.7 |
| Caudal fin | 13 | ED | 0.2 |
| Pectoral fin | 14 | BD | 0.4 |
| Pelvic fin | - | | |

# FAMILY: BYTHITIDAE
# (Brotulas)

The bythitids are found in shallow waters around coral reefs. They are small fish which bear live young (Leis and Rennis 1983). Bythitid fishes occur in the Atlantic, Indian, and Pacific oceans. Most species are from marine waters, but some species occur in brackish and fresh waters. Many members of the family occur in deep water; however a sizeable number occur in shallow waters, among rocky reefs (Baker 2008).

*Dinematichthys* sp.



*Dinematichthys* sp. (4.0 mm), Malindi.

## Larval morphology

Body elongate and compressed. Larva has a moderately long head with a snout that is truncated with small villiform teeth present on both jaws. Eye is round and moderate in size. Gut is coiled. No spines on the head.

## Pigment description

Lightly pigmented with paired melanophore series along the dorsal and ventral midlines of tail. A lateral midline series of melanophores present on the posterior part of the tail. Pigmentation on dorsal surface of the gut.

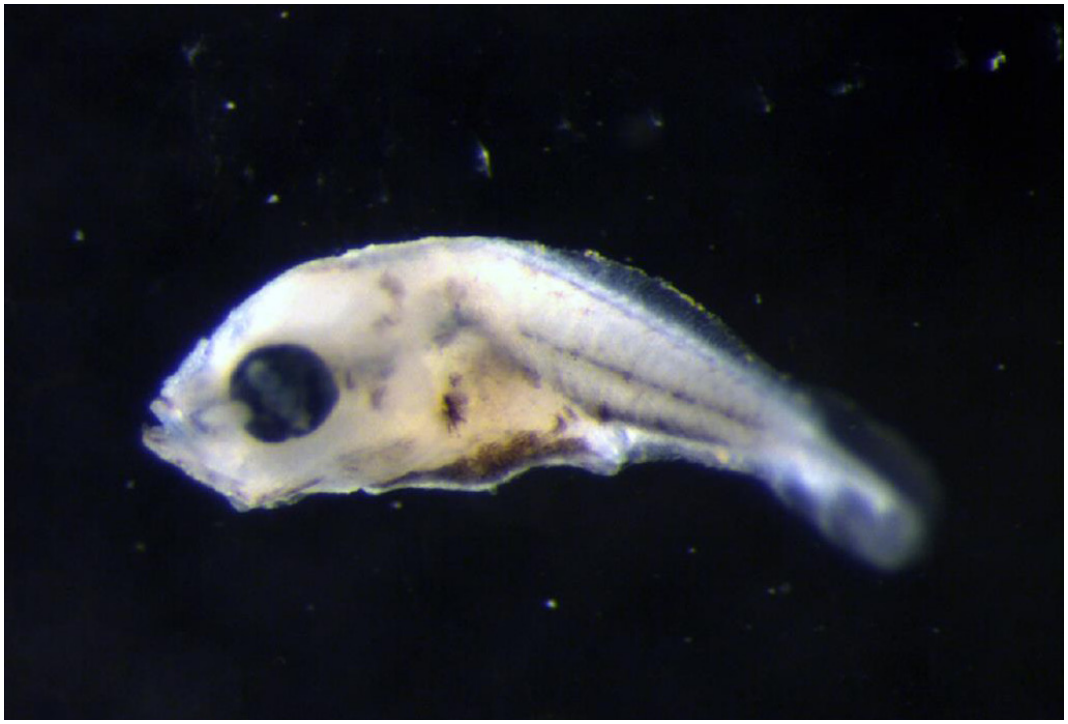
Meristic characters and morphometrics for *Dinematichthys* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 40 | BL | 4.0 |
| Dorsal fin | 75-88 | PAL | 1.7 |
| Anal fin | 59-69 | HL | 1.0 |
| Caudal fin | 7+7 | ED | 0.3 |
| Pectoral fin | 21-28 | BD | 0.5 |
| Pelvic fin | 2 | | |

# FAMILY: CALLIONYMIDAE (Dragonets)

Callionymids are small, scaleless, benthic fishes usually associated with sandy or muddy substratum (Leis and Rennis 1983). A large preopercular spine is characteristic of this group and has been reported to be venomous in some species. Dragonets spend most of their time on or near the bottom on sandy or rocky substrates. Not always easy to identify to genus, but common genera from Kenya include *Paradiplogrammus* and *Diplogrammus*.

Callionymid sp.



Callionymid sp. (2.8 mm), Malindi.

## Larval morphology

Deep-bodied, rounded in cross section. The notochord tip is distinctly elongate beyond the last myomere. Rotund gut extends to slightly beyond the midbody. Head is large with a small terminal mouth. Eye large and round.

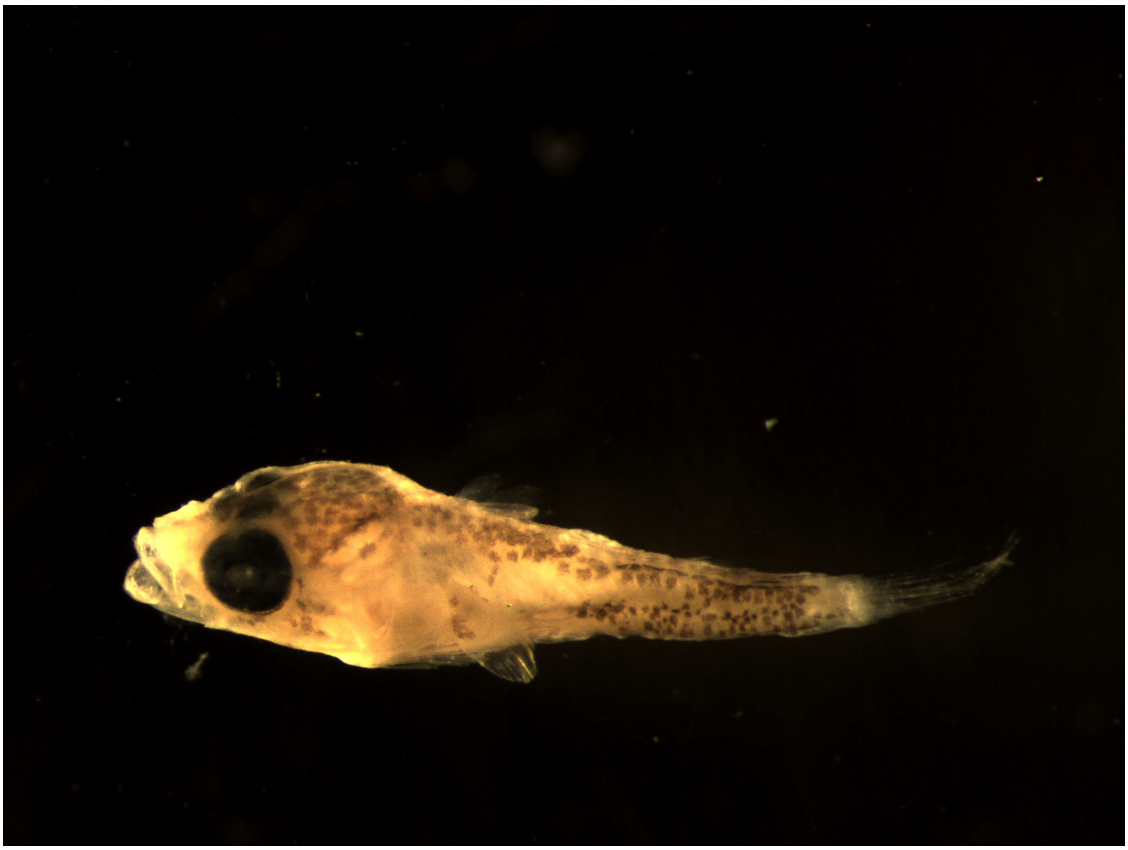
## Pigment description

Larva moderately pigmented with a row of melanophores on the mid and ventral margins of the trunk and tail. Pigmentmentation also present on the dorsal and lateral parts of the gut and gas bladder.

Meristic characters and morphometrics for Callionymid sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 19 | BL | 2.8 |
| Dorsal fin | IV, 8 | PAL | 1.2 |
| Anal fin | 8 | HL | 0.7 |
| Caudal fin | 10 | ED | 0.2 |
| Pectoral fin | 19-21 | BD | 0.8 |
| Pelvic fin | I,5 | | |

*Paradiplogrammus* sp.



*Paradiplogrammus* sp. (5.3 mm), Nyali.

## Larval morphology

Deep-bodied, round in cross-section. Head is large and dorsiventrally flattened. Body bulky anteriorly with tapering posterior parts; laterally compressed. Snout elongated with small protusible terminal mouth. Head lacking spination.

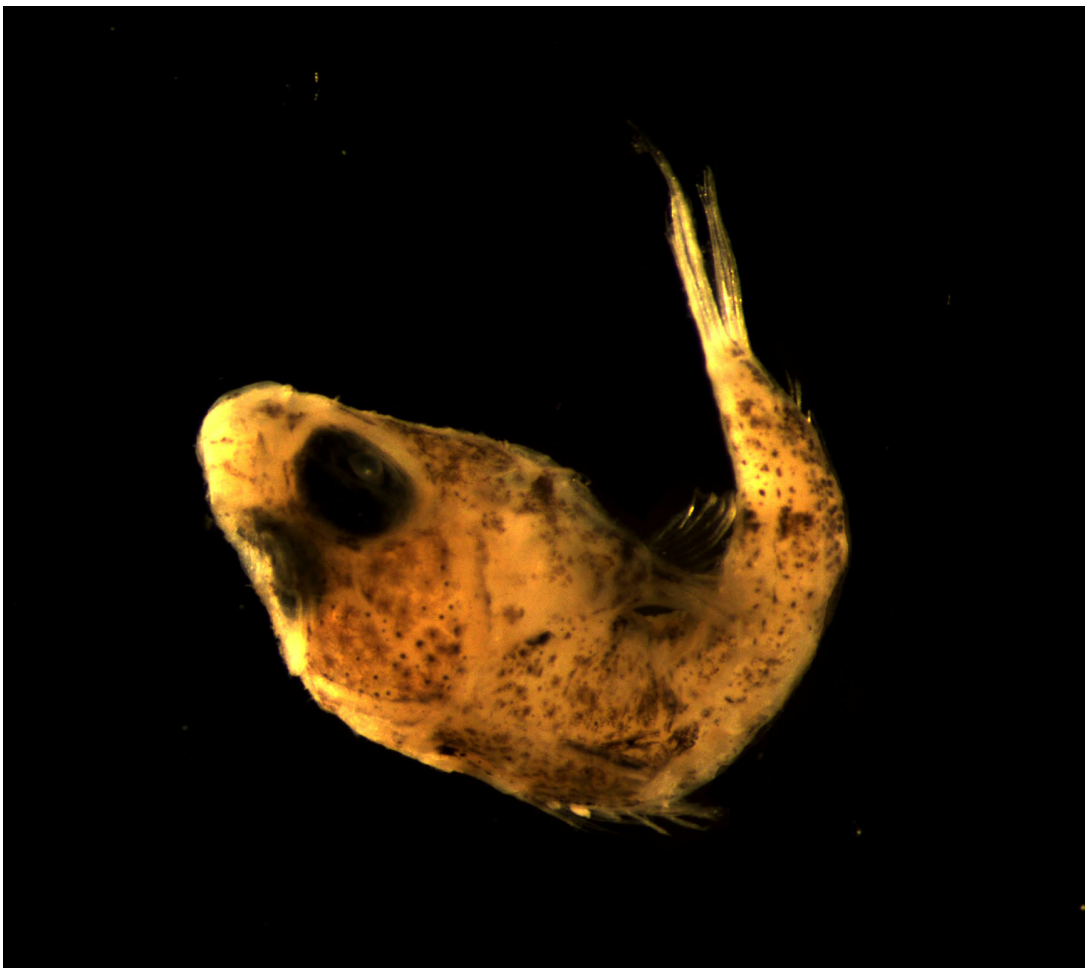
## Pigment description

Heavily pigmented with accumulations of melanophores on dorsal half of body, under dorsal fin and on caudal peduncle, on ventral half of body over anal fin base and on lower caudal peduncle; scattered spots occur on posterior head and on nape.

Meristic characters and morphometrics for *Paradiplogrammus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 22 | BL | 5.3 |
| Dorsal fin | IV, 8 | PAL | 2.8 |
| Anal fin | 7 | HL | 1.5 |
| Caudal fin | 10 | ED | 0.5 |
| Pectoral fin | 17 | BD | 1.6 |
| Pelvic fin | I,5 | | |

*Diplogrammus* sp.



*Diplogrammus* sp. (6.0 mm), Nyali.

## Larval morphology

Larva is deep bodied, initially round in cross section. Head is broad, and dorso-ventrally flattened. Eye large and dorsally oriented. Snout is elongated with a protrusible terminal mouth. Posteriorly-directed preopercular spines present.

## Pigment description

Heavily pigmented, with dense pigmentation on the ventral part of the body and gut. Banded pigmentation pattern beginning to develop. Prominent pigment spots at the bases of the pelvic fin rays. Other pigment accumulations occur on head, nape and on the opercle.

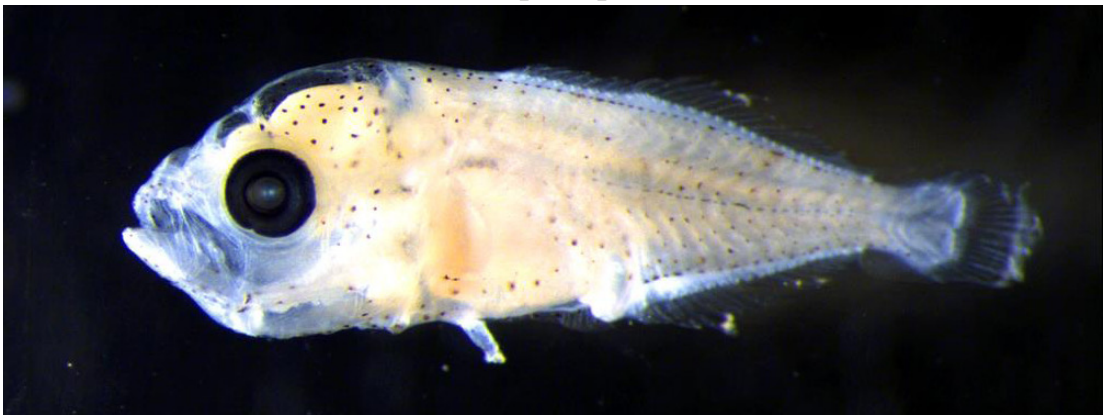
Meristic characters and morphometrics for *Diplogrammus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 22 | BL | 6.0 |
| Dorsal fin | IV, 8 | PAL | 3.2 |
| Anal fin | 7 | HL | 1.8 |
| Caudal fin | 10 | ED | 0.7 |
| Pectoral fin | 18 | BD | 2.0 |
| Pelvic fin | I,5 | | |

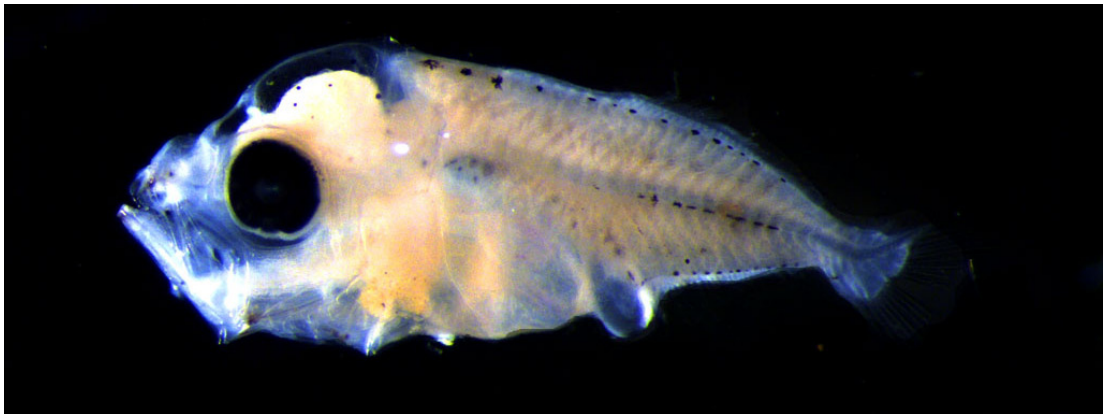
# FAMILY: CARANGIDAE
# (Jacks and Trevallies)

Carangids range from small, schooling planktivores to large, solitary piscivores. Many are of commercial value (Leis and Rennis 1983). They are composed of four tribes: Carangini, Naucratini, Scomberoidini and Trachinotini (Leis and Rennis 1983). Many commonly occurring genera, including *Alepes*, *Carangoides*, *Decapterus*, *Elagatis*, *Seriolina*, *Gnathandon*, *Scomberoides* and *Caranx*.

*Alepes* sp.



*Alepes* sp. (5.0 mm), Ungwana Bay.



*Alepes* sp. (6.5 mm) Ungwana Bay.

## Larval morphology

Body strongly laterally compressed and moderately deep. Gut coiled, reaching about 55% of body length. Preopercular spines are small. Mouth oblique and moderate in size. Eye is round and moderate in size. Low supraoccipital crest present in 5.0 mm larva, but disappears in the 6.5 mm larva.

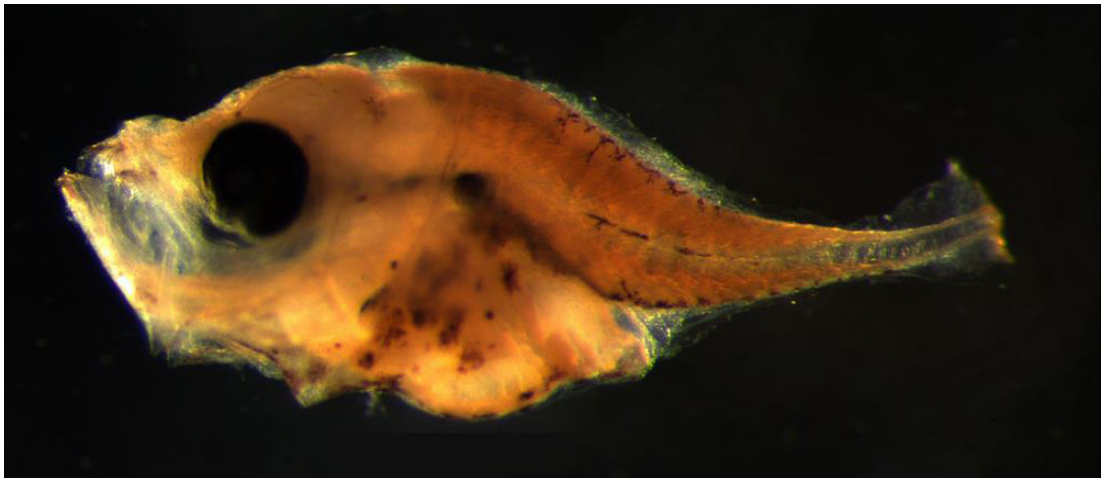
## Pigment description

Both larval stages are lightly pigmented. Rows of melanophores on the dorsal and ventral midlines of the trunk and tail. Pigmentation present dorsally on the gas bladder, and gut. Pigment also present on lower jaw and ventrally, anterior and posterior to the cleithral symphysis. The larger larva with heavier pigmentation on head and additional melanophores scattered laterally on the gut, trunk, and tail.

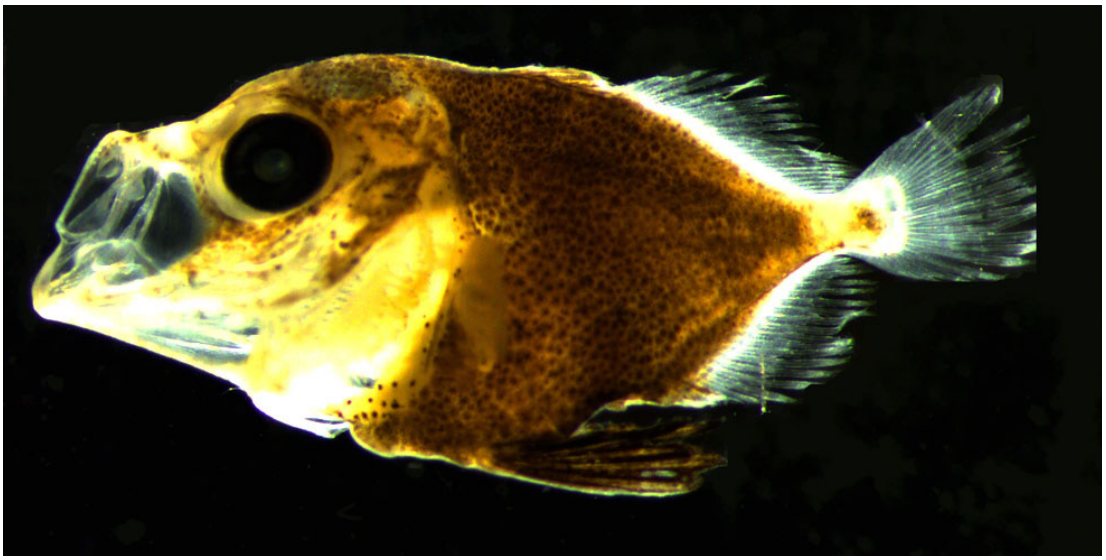
Meristic characters and morphometrics for *Alepes* sp. (larger specimen)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 6.5 |
| Dorsal fin | VIII + 22 | PAL | 2.5 |
| Anal fin | II + I, 18 | HL | 2.2 |
| Caudal fin | 17 (9+8) | ED | 0.6 |
| Pectoral fin | 20 | BD | 2.1 |
| Pelvic fin | I,5 | | |

*Carangoides* sp.



*Carangoides* sp. preflexion (2.8 mm) Ungwana Bay.



*Carangoides* sp. post flexion (9.6 mm) Nyali.

## Larval morphology

Moderately deep bodied and compressed with prominent preopercular spines (unserrated) in preflexion larva (2.8 mm). Has a conspicuous gas bladder above the gut. Gut is coiled and triangular. Mouth is oblique and moderate in size. Supraoccipital crest present and serrated. In postflexion larva (9.6 mm), the preopercular, opercular and supraoccipital spines and crest are absent. Head and mouth large.

## Pigment description

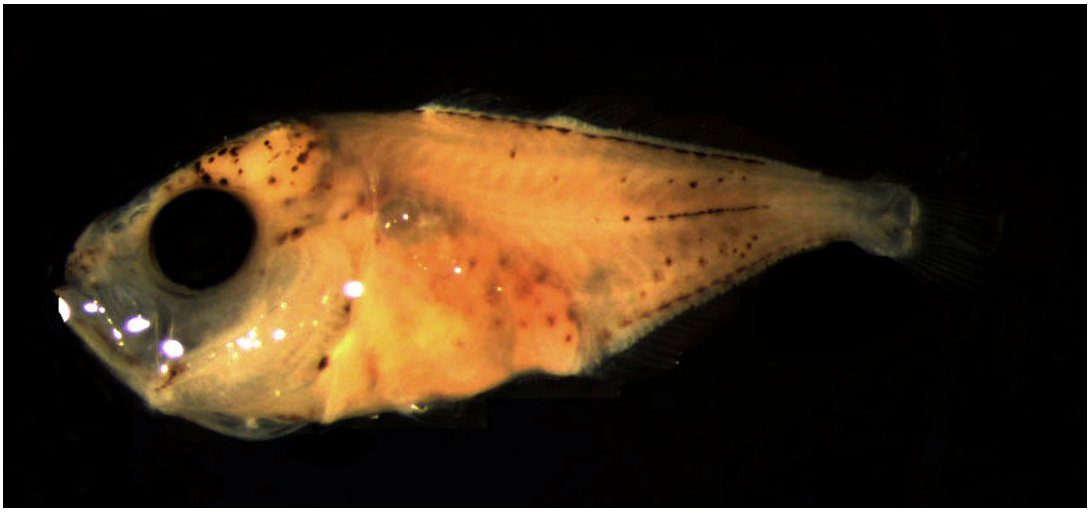
Lightly pigmented larva (2.8 mm). Series of melanophores present on the dorsal, lateral and ventral parts of the body. Heavy pigmentation on entire portion of the gut, isthmus, lower jaw, snout and brain. Postflexion larva (9.6 mm) has heavy pigmentation evenly distributed over most of the body; caudal peduncle unpigmented except for prominent midlateral patch. Pelvic fins more heavily pigmented than the rest of the body. Dorsal fin nearly completely pigmented as well.

Meristic characters and morphometrics for *Carangoides* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 9.6 |
| Dorsal fin | VIII + I, 20 | PAL | 4.5 |
| Anal fin | II + I, 18 | HL | 4.0 |
| Caudal fin | 17 (9+8) | ED | 1.0 |
| Pectoral fin | 18 | BD | 3.9 |
| Pelvic fin | I,5 | | |

*Decapterus* sp.

*Decapterus* sp. preflexion (3.8 mm), Nyali.



*Decapterus* sp. (8.3 mm), Ungwana Bay.

## Larval morphology

Moderately deep bodied and strongly laterally compressed. Mouth oblique and moderately large, reaching the anterior portion of the eye. Gut is coiled reaching about 65% BL in the prefelexion larvae (3.8 mm) and about 55% in the larger larvae (8.3 mm). Prominent preopercular spines and low serrated supraoccipital crest present in 8.3 mm larvae.

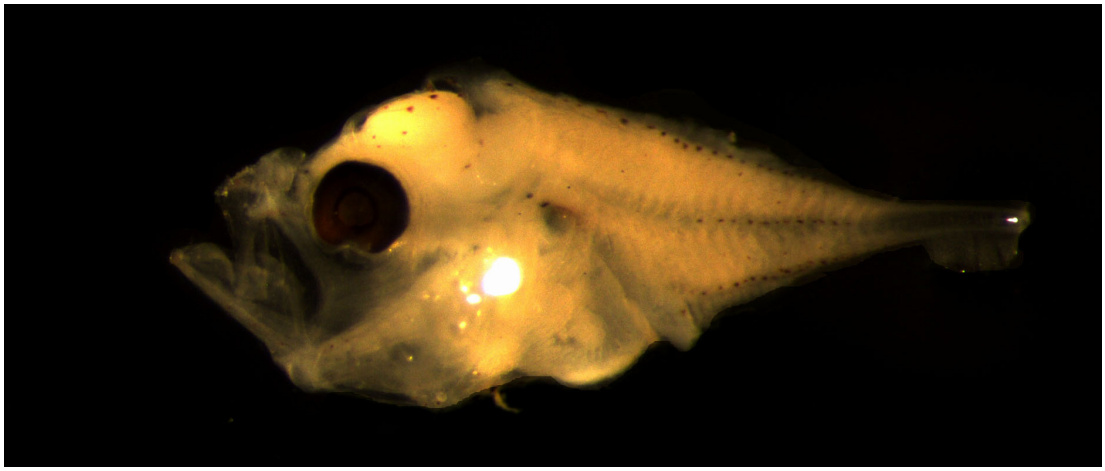
## Pigment description

Both larvae with melanophore series in rows along the dorsal and ventral midline of the tail and caudal peduncle remaining relatively unpigmented. Light pigmentation present dorsally and ventrally on the gut and on the isthmus near the cleithral symphysis. Prominent pigment spots on the head, and lateral midline of the tail in both larvae. Scattered melanophores however also present on the upper 70 % of gut in the 8.3 mm larvae,

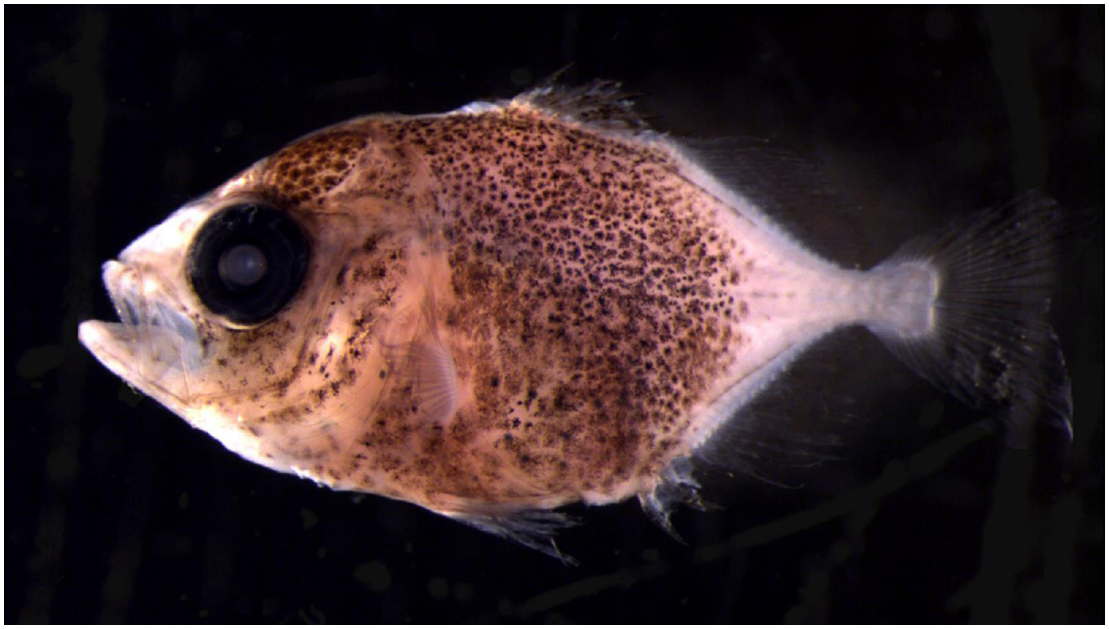
Meristic characters and morphometrics for *Decapterus* sp. (larger specimen)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 8.3 |
| Dorsal fin | VIII + I , 29 | PAL | 4.2 |
| Anal fin | II + I, 21 | HL | 3.0 |
| Caudal fin | 17 (9+8) | ED | 0.9 |
| Pectoral fin | 20 | BD | 3.0 |
| Pelvic fin | I,5 | | |

*Caranx* sp.



*Caranx* sp. preflexion (3.0 mm), Ungwana Bay.



*Caranx* sp. post flexion (9.4 mm), Ungwana Bay.

## Larval morphology

Body deep and moderately compressed. Supraoccipital crest initially very high and prominent in preflexion larva (3.0 mm), absent in postflexion larva. Preopecular spines very prominent in preflexion larvae, but reduced in postflexion larvae. Small villiform teeth visible on both jaws.

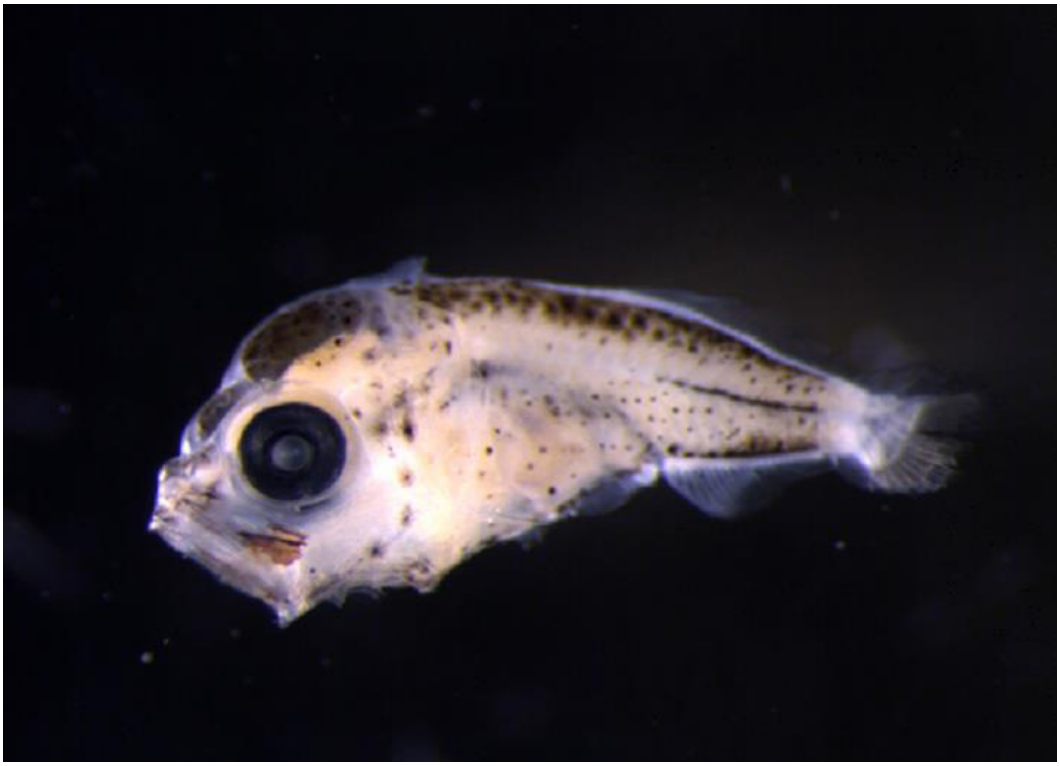
## Pigment description

Lightly pigmented initially in preflexion (3.0 mm) larva with melanophores dorsally on head, jaws, dorsally and ventrally on gut, and in series on dorsal, lateral and ventral midlines of the trunk and tail. At the postlfexion stage (9.4 mm) body becomes heavily pigmented with stellate melanophores on head and trunk with a sparsely pigmented caudal peduncle.

Meristic characters and morphometrics for *Caranx* sp.(post flexion)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 9.4 |
| Dorsal fin | VIII + I, 19 | PAL | 5.5 |
| Anal fin | II + I, 16 | HL | 4.0 |
| Caudal fin | 17 (9+8) | ED | 1.2 |
| Pectoral fin | 20 | BD | 4.5 |
| Pelvic fin | I,5 | | |

*Elagatis bipinnulata*



*Elagatis bipinnulata* (5.5 mm), Nyali lagoon.

## Larval morphology

Moderate and compressed body. Conspicuous serrated preopercular spines present. Supraoccipital crest prominent. Post-temporal spines and supraocular ridge present. Mouth oblique, with small villiform teeth visible in both jaws

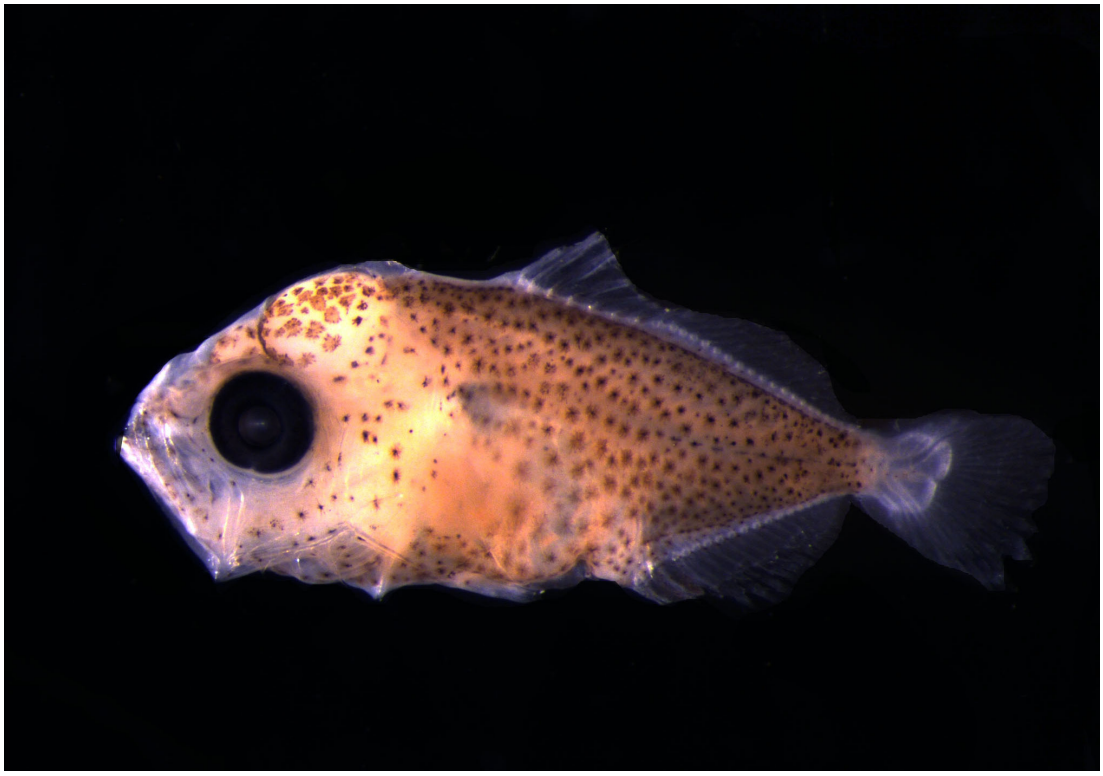
## Pigment description

Heavily pigmented with melanophore series along the dorsal midline of the trunk and on the dorsal, lateral and ventral midlines of the tail. Moderate dorso-and ventro-lateral pigmentation on trunk and tail. Pigmentation also occurs along the lower jaw, opercular area, gut and brain.

Meristic characters and morphometrics for *Elagatis bipinnulata*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 5.5 |
| Dorsal fin | VI +1, 24+2 | PAL | 2.7 |
| Anal fin | I +1, 18+2 | HL | 1.6 |
| Caudal fin | 9+8 | ED | 0.6 |
| Pectoral fin | 19-21 | BD | 1.8 |
| Pelvic fin | I,5 | | |

*Gnathandon speciosus*



*Gnathandon speciosus* (12.8 mm), Nyali lagoon.

## Larval morphology

Moderately deep bodied and compressed. Small preopercular spines present. Supraoccipital crest small.

## Pigment description

Heavily pigmented with stellate expanded melanophores covering the body, somewhat lighter on the lower half of head and in vicinity of pectoral-fin base.

Meristic characters and morphometrics for *Gnathandon speciosus*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 12.8 |
| Dorsal fin | VII + I, 19 | PAL | 6.5 |
| Anal fin | II + I, 16 | HL | 5.0 |
| Caudal fin | 17 (9+8) | ED | 1.5 |
| Pectoral fin | 20 | BD | 4.5 |
| Pelvic fin | I,5 | | |

*Scomberoides* sp.

*Scomberoides* sp. (8.2 mm), Ungwana Bay.

## Larval morphology

Larva is elongate and moderately compressed. Mouth moderate, reaching anterior portion of the eyes. Small villiform teeth visible on both jaws. Preopercular and supraopercular spines present and prominent. Robust dorsal- and anal-fin spines. Small supraoccipital crest present.

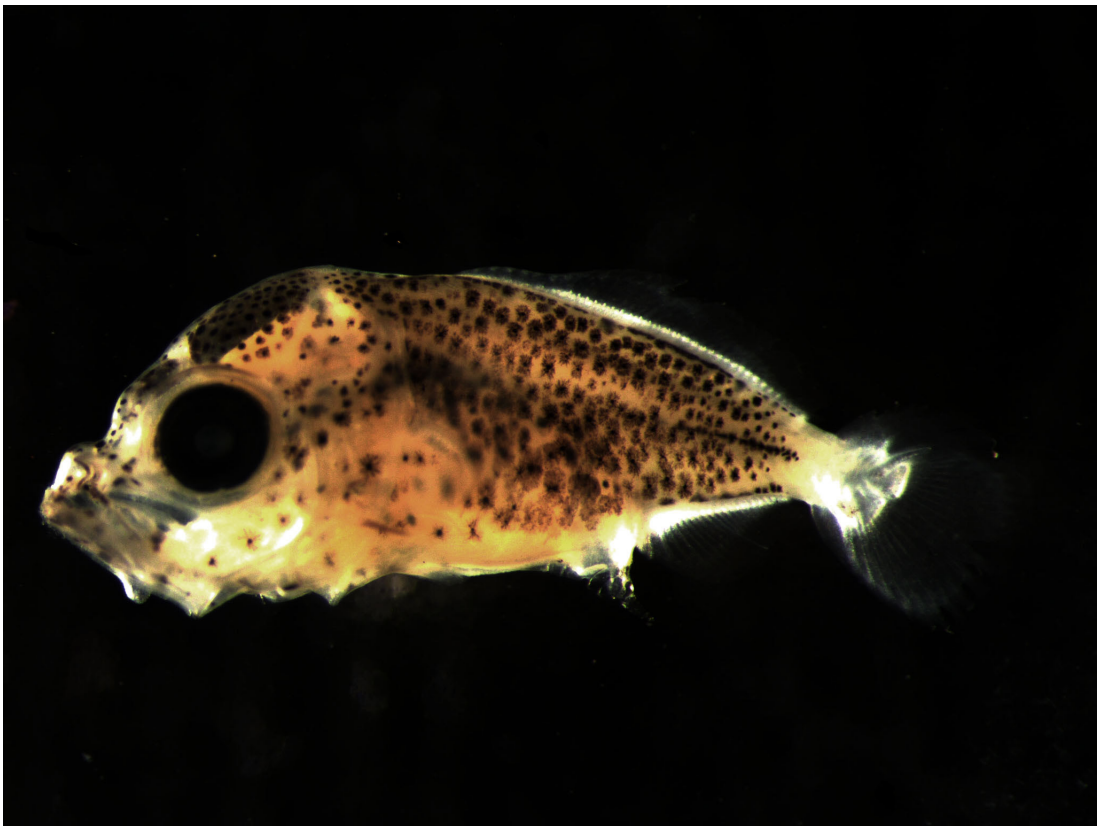
## Pigment description

Heavily pigmented larva from postflexion stage. Dense melanophore series on the dorsal and ventral midlines of the tail. Melanophores spread uniformly along the lateral surface of the larvae with a distinct row visible along the lateral midline of the tail. Sparsely pigmented on opercular area and caudal peduncle.

Meristic characters and morphometrics for *Scomberoides* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 8.2 |
| Dorsal fin | VI + I, 20 | PAL | 5.0 |
| Anal fin | II + I, 20 | HL | 2.5 |
| Caudal fin | 17 (9+8) | ED | 0.8 |
| Pectoral fin | 16-20 | BD | 4.5 |
| Pelvic fin | I,5 | | |

*Seriolina* sp.



*Seriolina* sp. (5.9 mm), Vipingo.

## Larval morphology

Moderately deep-bodied and moderately compressed. Prominent preopercular and cleithral spines present. No supraoccipital crest present. Mouth is large and oblique with visible villiform teeth. Snout is short and concave.

## Pigment description

Heavy pigmentation with stellate melanophores distributed over the body. Row of melanophores visible on the dorsal-, ventral- and midlateral parts of the tail. Caudal peduncle remains unpigmented.

Meristic characters and morphometrics for *Seriolina* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 5.9 |
| Dorsal fin | VII +1, 30 | PAL | 3.5 |
| Anal fin | 1+I, 18 | HL | 2.5 |
| Caudal fin | 9+8 | ED | 0.7 |
| Pectoral fin | 18-20 | BD | 2.2 |
| Pelvic fin | 1,5 | | |

# FAMILY: CYNOGLOSSIDAE (Tongue soles)

Tongue soles are benthic carnivores associated with soft- bottom marine habitats. There are three Indo-Pacific genera (including *Cynoglossus*) with approximately 60 species, many of which are of commercial importance (Leis and Trnski 1989).

*Cynoglossus* sp.

*Cynoglossus* sp. (6.5 mm), Malindi.

## Larval morphology

Body moderately deep and strongly compressed. Larva has elongate anterior dorsal rays (2), and a thick, coiled, protruding gut. Gas bladder over posterior portion of gut. No spines on the head.

## Pigment description

Lightly pigmented with longitudinal row of melanophores present in seven broad bars along the lateral surface of the body. Additional pigmentation present dorsally on the gas bladder, hind gut and ventrally on the gut.

Meristic characters and morphometrics for *Cynoglossus* sp.

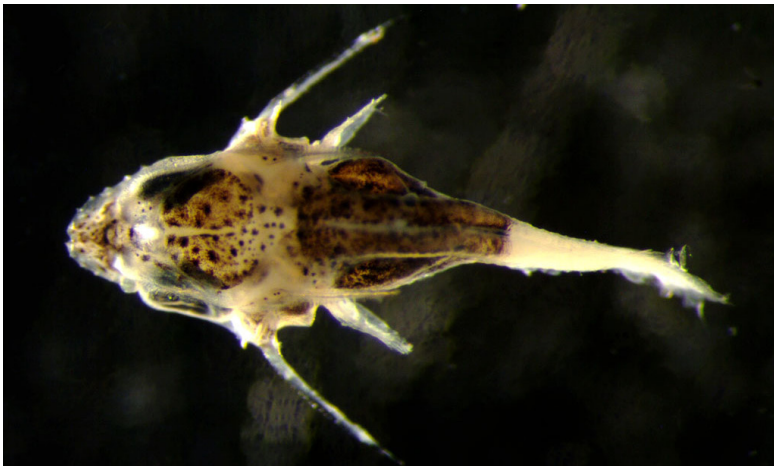
| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 55 | BL | 6.5 |
| Dorsal fin | 89 | PAL | 2.4 |
| Anal fin | 85 | HL | 1.7 |
| Caudal fin | 7-12 | ED | 0.3 |
| Pectoral fin | - | BD | 1.8 |
| Pelvic fin | 4 | | |

# FAMILY: DACTYLOPTERIDAE (Flying gurnards)

The flying gurnards are marine fish notable for their greatly enlarged pectoral fins, although they cannot literally fly. Most species live in the Indo-Pacific, but at least one is native to the Atlantic. The adults live on the sea bottom, but many species have an extended planktonic larval stage. (Eschmeyer, 1998).

*Dactyloptena* sp.

*Dactyloptena* sp. lateral view (4.0 mm), Vipingo.



*Dactyloptena* sp. dorsal view (4.0 mm), Vipingo.

## Larval morphology

Moderately deep-bodied and ovoid in cross section, with a tapering tail. Head is broad and rounded with a short snout, encased in a bony armor with two pre-opercular spines. One preopercular spine greatly enlarged on each side and located on the posterior margin and the much smaller spine on the anterior margin of each preopercle. A large posttemporal spine is also present on each side, and a small to moderate supraoccipital crest present. Eye is large and round. Serrate supraocular ridge present, with a short spine.

## Pigment description

Heavily pigmented over entire body with the exception of the tail.

Meristic characters and morphometrics for *Dactyloptena* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 22 | BL | 4.0 |
| Dorsal fin | 0-1+1+V-VI,6-8 | PAL | 2.8 |
| Anal fin | 5-7 | HL | 1.5 |
| Caudal fin | 5+5 | ED | 0.5 |
| Pectoral fin | 32-36 | BD | 1.2 |
| Pelvic fin | I,4-5 | | |

# FAMILY: EXOCOETIDAE (Flying fishes)

Flying fish live in all of the world's oceans, particularly in tropical and warm subtropical waters. Their most striking feature is their pectoral fins (Fish 1990), which are unusually large, and enable the fish to hide and escape from predators (Buller 1998) by leaping out of the water and flying through air a few feet above the water's surface. Their flights are typically around 50 meters (Ross 2007). Common genera include *Exocoetus, Cheilopogon, Cypselurus* and *Paraexocoetus*.

*Exocoetus* sp.

*Exocoetus* sp. (7.7 mm), Ungwana Bay.

## Larval morphology

Body elongate and slightly compressed. Head dorso-ventrally flattened with a large mouth. Mouth reaches anterior portion of eye. Eye is large and slightly elongate. Pelvic fin is located near mid-body. Gut is straight, extending two-thirds of the body length. No head spination.

## Pigment description

Heavily pigmented with dark brown melanophores over the body. Darker streaks on dorsal, lateral and ventral midlines of the body.

Meristic characters and morphometrics for *Exocoetus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 43-46 | BL | 7.7 |
| Dorsal fin | 13-14 | PAL | 6.0 |
| Anal fin | 12 | HL | 2.0 |
| Caudal fin | 7+8 | ED | 0.8 |
| Pectoral fin | 15 | BD | 1.7 |
| Pelvic fin | 6 | | |

# FAMILY: GERREIDAE (Mojarras)

Gerreids are small to moderately sized fish associated with sand or mud bottoms around coral reefs (Leis and Rennis 1983), feeding on small benthic invertebrates. They are commercially important in East Africa as they form part of the artisanal fish catch. Most species exhibit a schooling behavior and tend to exploit the shallow water refugia associated with coastal areas. Four species of *Gerres* are common in Kenya waters.

*Gerres* sp.

*Gerres* sp. (9.0 mm), Nyali.

## Larval morphology

Moderately deep bodied and laterally compressed. Gut is coiled, extending to about 45% of the body length. Head is moderately large with short and round snout. Mouth reaches anterior portion of the eye with small villiform teeth visible on the lower jaw. Small preopercular spines visible.

## Pigment description

Pigment present on the dorsal surface of the head and anal fin base. Row of melanophores also on lateral midline of the tail. Pigment present dorsally on gut.

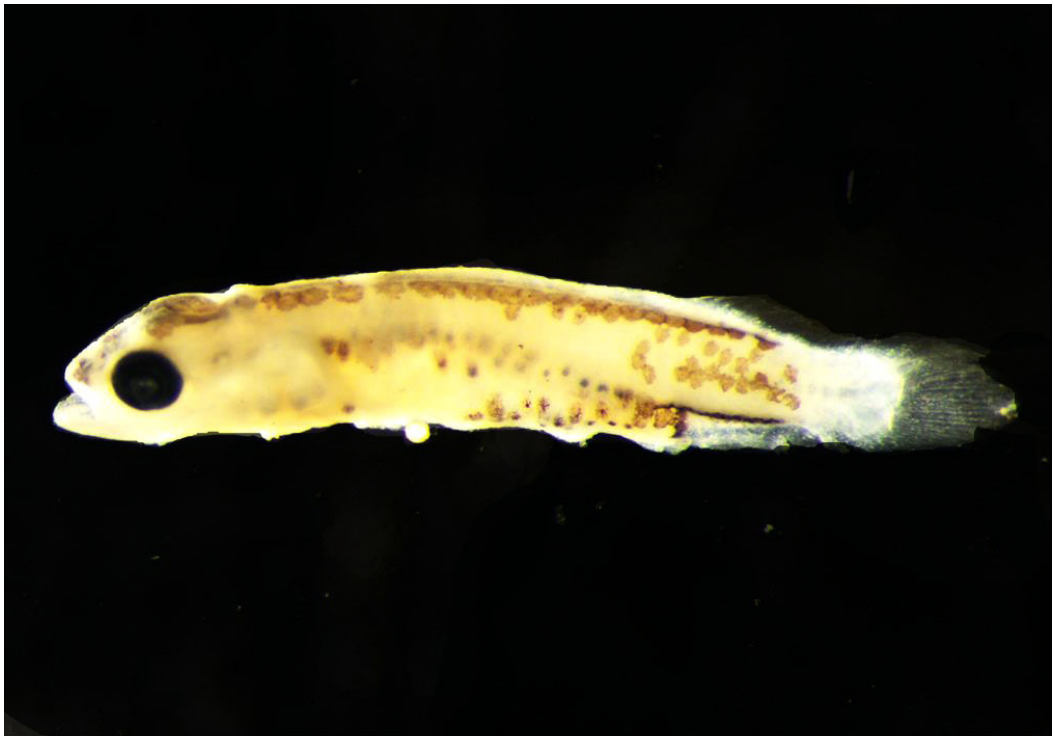
Meristic characters and morphometrics for *Gerres* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 9.0 |
| Dorsal fin | IX, 10 | PAL | 5.0 |
| Anal fin | II, 8 | HL | 2.0 |
| Caudal fin | 9+8 | ED | 0.8 |
| Pectoral fin | 16 | BD | 1.8 |
| Pelvic fin | 1,5 | | |

# FAMILY: GOBIESOCIDAE (Clingfishes)

The gobiesocids are small fishes usually found in shallow water attached to rocks or other substrates with their sucking discs (Leis and Rennis 1983). Some species are associated with long-spined sea urchins or branching corals on sheltered reefs. AT least six species of *Lepadichthys* occur in the region. They feed mainly on small crustaceans and molluscs

*Lepadichthys* sp.



*Lepadichthys* sp. (4.4 mm), Vipingo.

## Larval morphology

Elongate and slightly compressed. Gut is long and straight, extending to three-quarters of the body length. Head is small, round and dorso-ventrally flattened. Snout is short and blunt. There are no spines on the head.

## Pigment description

Heavily pigmented over much of the body. More heavily pigmented areas are the dorsal margin from the snout to mid-tail, the ventral and midlateral parts of the tail, and dorsally and ventrally over the gut. The caudal peduncle is devoid of pigmentation.

Meristic characters and morphometrics for *Lepadichthys* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 36-37 | BL | 4.4 |
| Dorsal fin | 11 | PAL | 3.5 |
| Anal fin | 8 | HL | 1.0 |
| Caudal fin | 18 | ED | 0.3 |
| Pectoral fin | 25-31 | BD | 0.8 |
| Pelvic fin | I, 4-5 | | |

# FAMILY: GOBIIDAE
# (Gobies)

Gobiidae is the largest family of marine fishes with about 500 Indo-Pacific species (Lieske and Myers 1994). Gobies occur in a wide variety of marine habitats with most being closely associated with the bottom (Leis and Rennis 1983), but some colourful species hover in the water. They predate on small invertebrates and lay demersal eggs guarded by the males. Common genera include *Ctenogobius*, *Coryphopterus* and *Fusigobius*.

*Ctenogobius* sp. 1

*Ctenogobius* sp. 1 (10.7 mm), Nyali.

## Larval morphology

Elongate and laterally compressed. Body long, and narrow with a small pointed head. Gut not fully coiled. Prominent gas bladder above gut. Head is small with large, rounded eyes. Mouth reaches anterior portion of the eye. No head spination.

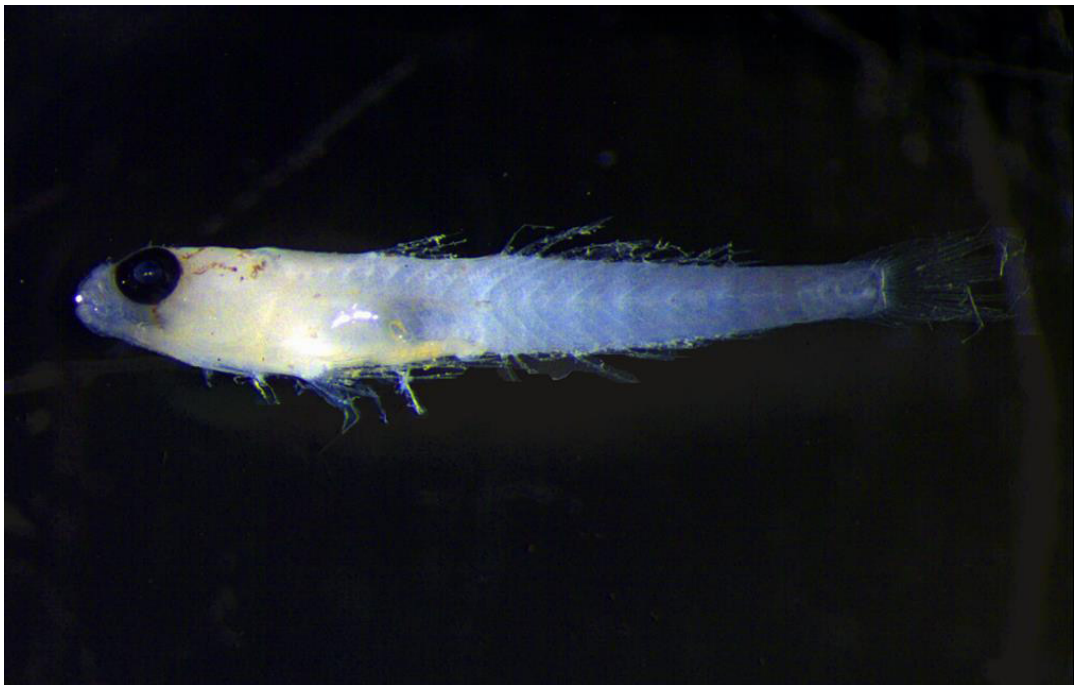
## Pigment description

Lightly pigmented. Eleven paired melanophores in a row on the ventral midline of the tail. Patch of melanophores on caudal peduncle. Pigment present on pelvic fin base.

Meristic characters and morphometrics for *Ctenogobius* sp. 1

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 10.7 |
| Dorsal fin | VI + 11 | PAL | 5.0 |
| Anal fin | 12 | HL | 2.0 |
| Caudal fin | 17 | ED | 0.5 |
| Pectoral fin | 18-22 | BD | 1.5 |
| Pelvic fin | I,5 | | |

*Ctenogobius* sp. 2



*Ctenogobius* sp. 2.(7.7 mm), Kilifi.

## Larval morphology

Elongate and laterally compressed. Prominent gas bladder above gut. Head is small with large rounded eyes, mouth reaches anterior portion of the eye. No head spination.

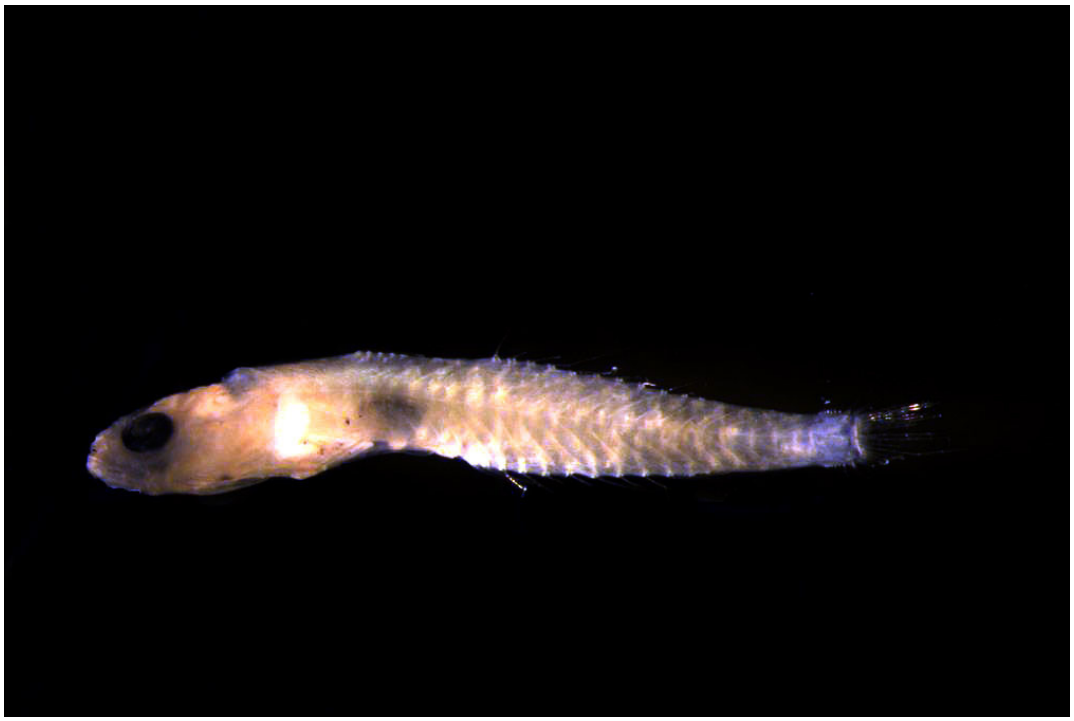
## Pigment description

Lightly pigmented with oblique bars of pigmentation emanating radially from the eye. Trunk and tail devoid of melanophores. Pigment present dorsally on the gas bladder.

Meristic characters and morphometrics for *Ctenogobius* sp. 2

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 7.7 |
| Dorsal fin | VI + 12 | PAL | 3.9 |
| Anal fin | 13 | HL | 2.2 |
| Caudal fin | 17 | ED | 0.6 |
| Pectoral fin | 18-22 | BD | 1.3 |
| Pelvic fin | I,5 | | |

*Coryphopterus* sp.



*Coryphopterus* sp. (7.5 mm), Nyali.

## Larval morphology

Elongate and laterally compressed. Prominent gas bladder above gut. Gut short with striations. No head spination.

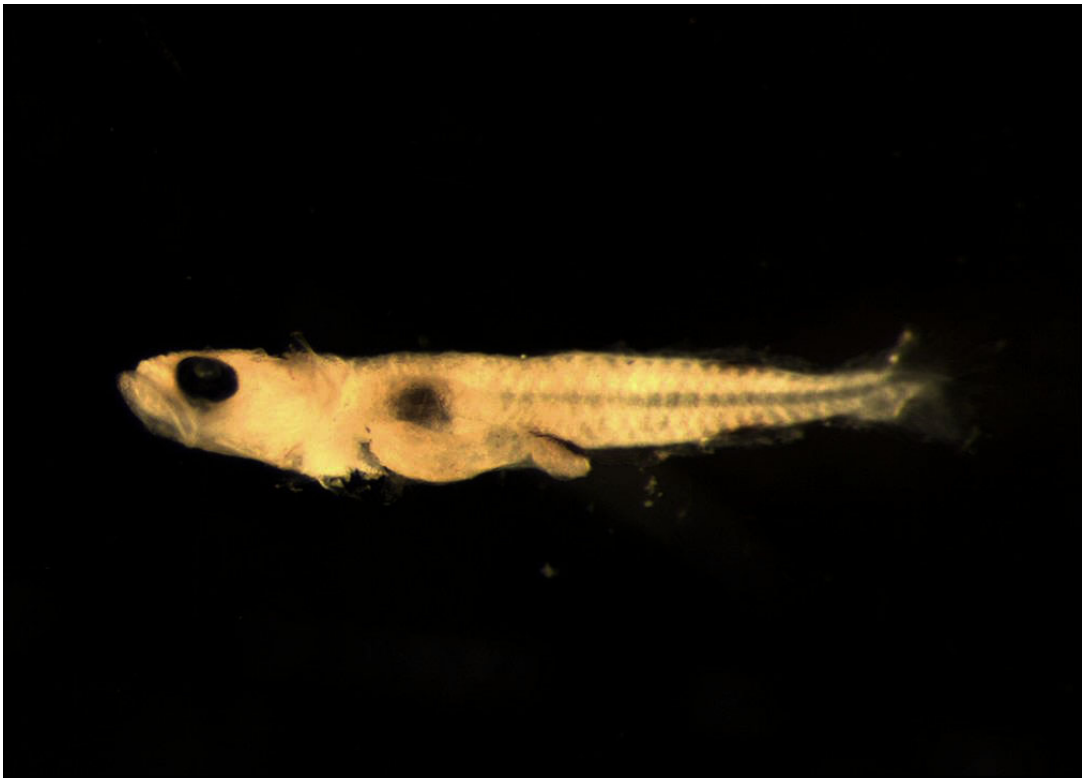
## Pigment description

Dorsal pigmentation of gas bladder and a ventral melanophore at the cleithral symphysis.

Meristic characters and morphometrics for *Coryphopterus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 7.5 |
| Dorsal fin | VI + 11 | PAL | 2.7 |
| Anal fin | 10 | HL | 1.2 |
| Caudal fin | 16 | ED | 0.6 |
| Pectoral fin | 18-22 | BD | 1.2 |
| Pelvic fin | I,5 | | |

Gobiid sp.



Gobiid sp. (2.9 mm), Vipingo.

## Larval morphology

Larva is elongate and laterally compressed. Gut is slightly coiled and extends to midbody. Head is small with rounded eye. No head spination.

## Pigment description

Lightly pigmented: melanophores on the dorsal surface of the gas bladder, hind gut anterior to the anus, dorsal and ventral margins of the tail.

Meristic characters and morphometrics for Gobiid sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 2.9 |
| Dorsal fin | VI-VII+I,9-11 | PAL | 1.9 |
| Anal fin | I,9-11 | HL | 0.7 |
| Caudal fin | 16-17 | ED | 0.3 |
| Pectoral fin | 18-22 | BD | 0.5 |
| Pelvic fin | I,4-5 | | |

*Fusigobius neophytus*

*Fusigobius neophytus* dorsal view (6.8 mm), Watamu.

## Larval morphology

Larva is elongate and ovoid in cross section. Head is small with rounded eyes. No head spination.

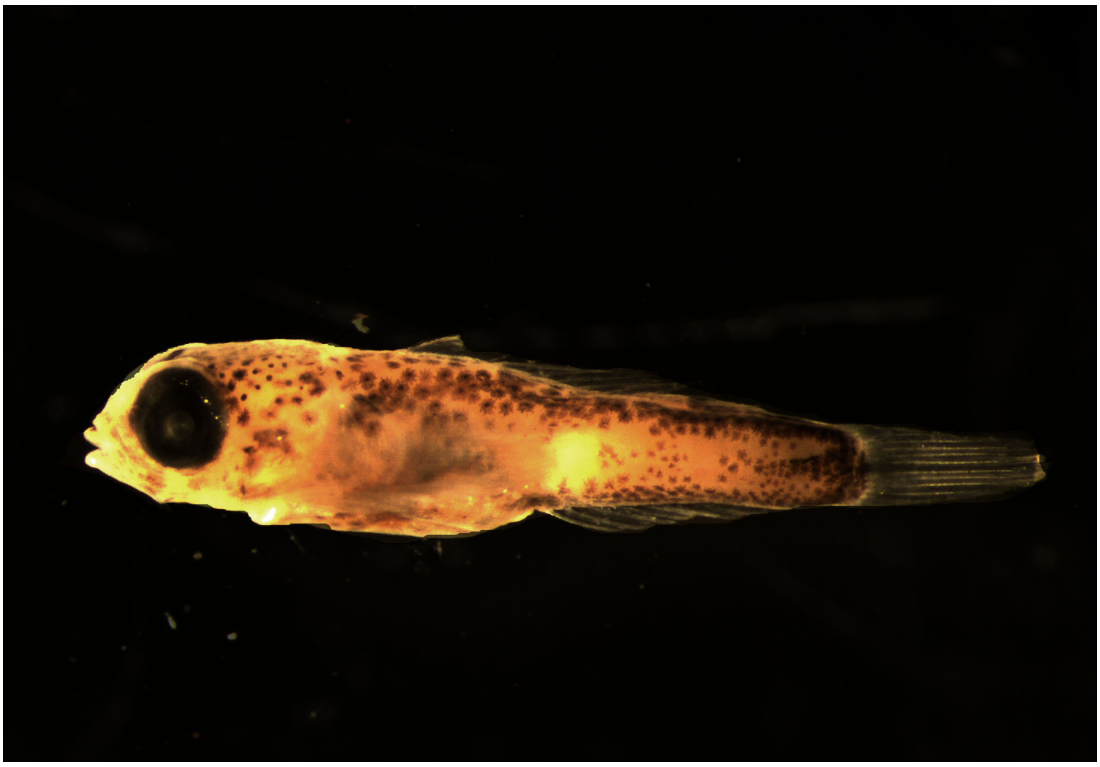
## Pigment description

Heavy pigmentation, with stellate melanophores evenly distributed throughout the body surface.

Meristic characters and morphometrics for *Fusigobius neophytus*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 6.8 |
| Dorsal fin | VII + 9 | PAL | 4.4 |
| Anal fin | I,8 | HL | 2.4 |
| Caudal fin | 16 | ED | 0.6 |
| Pectoral fin | 16 | BD | 1.8 |
| Pelvic fin | I,5 | | |

*Gnatholepis cauerensis*



*Gnatholepis cauerensis* (6.2 mm), Ungwana Bay.

## Larval morphology

Elongate, torpedo shape and slightly rounded. Gut straight, extending to slightly beyond the mid-body. Head is small and round with a blunt snout. Larva has distinctly large, round eyes and small mouth.

## Pigment description

Heavily pigmented over most of the body. Stellate melanophores more dense on dorsal surface and caudal section of tail.

Meristic characters and morphometrics for *Gnatholepis cauerensis*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 6.2 |
| Dorsal fin | VII +11 | PAL | 3.6 |
| Anal fin | I,11 | HL | 2.0 |
| Caudal fin | 16 | ED | 0.8 |
| Pectoral fin | 17 | BD | 1.3 |
| Pelvic fin | I,5 | | |

# FAMILY: HEMIRAMPHIDAE (Halfbeaks)

Hemiramphids are found within a few centimeters from the surface of water. They are omnivores, feeding on algae and zooplankton. The halfbeaks (family Hemiramphidae) are a geographically widespread and numerically abundant family of epipelagic fish inhabiting warm waters around the world. The halfbeaks are named for their distinctive jaws, in which the lower jaws are significantly longer than the upper jaws (Froese and Pauly 2013). Common Kenyan genera are *Hemiramphus* and *Hyporamphus*.

*Hemiramphus far*

*Hemiramphus far* (31.0 mm), Ungwana Bay.

## Larval morphology

Larva is elongate and squarish in cross section. Gut is thick and straight reaching 75% of total length. The snout is pointed and about 15% of the body length. Mouth is small and oblique, with the beak forming early in larval development and extending from the lower jaw. Larva lacks head spination.

## Pigment description

Heavily pigmented with melanophores primarily on myosepta and concentrated in a series of nine bars on trunk and tail. Pigmentation present on the dorsal surface of the head, on beak and both jaws.

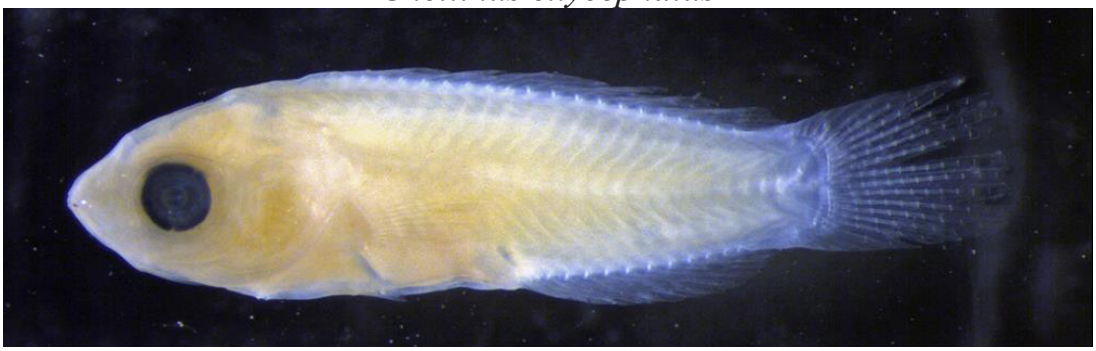
Meristic characters and morphometrics for *Hemiramphus far*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 56 | BL | 31 |
| Dorsal fin | 15 | PAL | 28 |
| Anal fin | 11 | HL | 11 |
| Caudal fin | 15 | ED | 1.7 |
| Pectoral fin | 13 | BD | 0.8 |
| Pelvic fin | I,6 | | |

# FAMILY: LABRIDAE
# (Wrasses)

They are a large and diverse group with extreme variation in body shape and habits (Leis and Rennis 1989). They are able to change sex from an initially drab female colour to a brilliant terminal male phase. All species are inactive at night with smaller ones sleeping in the sand. The group includes carnivores, herbivores and cleaners. Some of the common genera from Kenya waters include *Cheilinus*, *Cheilio*, *Thalassoma*, *Halichoeres*, *Holygymnosus* and *Oxycheilinus*.

*Cheilinus oxycephalus*



*Cheilinus oxycephalus* postflexion (8.6 mm), Watamu.

*Cheilinus oxycephalus* late larval/juveline stage (11.6 mm), Watamu.

## Larval morphology

Body elongate and laterally compressed. Caudal peduncle is broad. Head is triangular with a pointed snout. Eyes are large and mouth is small, not reaching the anterior margin of the eye. No head spination.

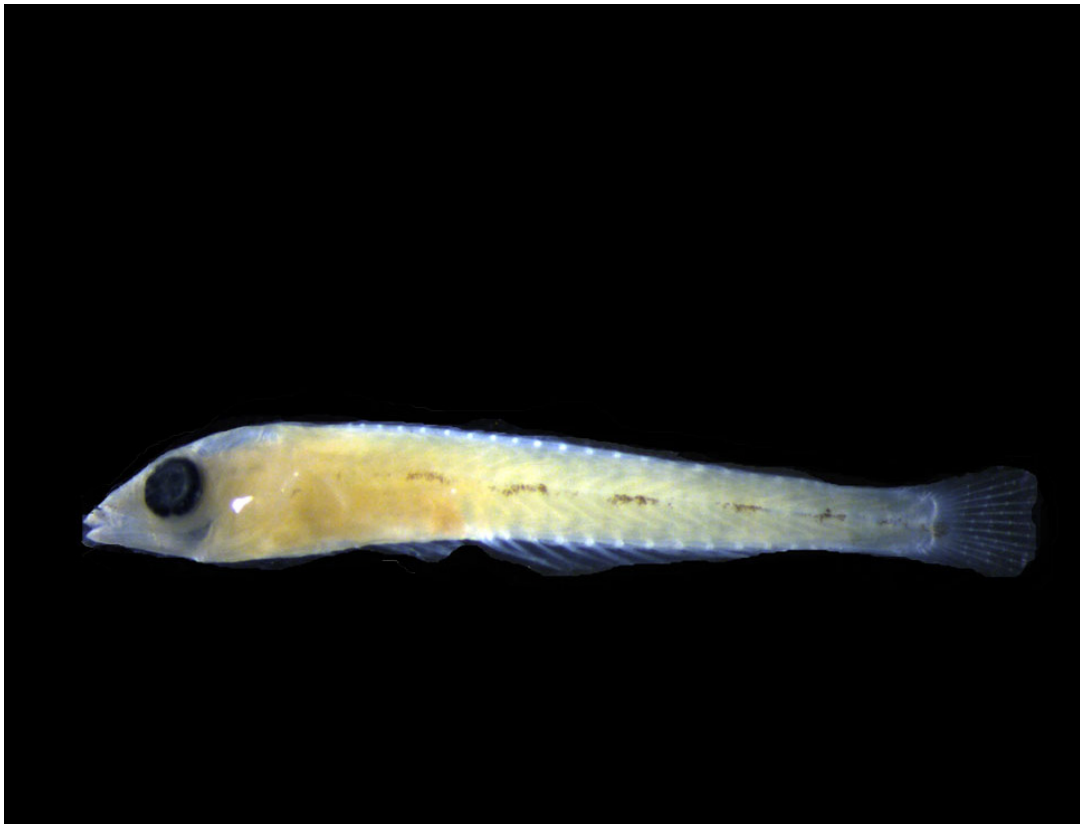
## Pigment description

Postflexion larvae (8.6 mm) are unpigmented, however, late larval/juvenile stage (11.6 mm) is heavily pigmented with brownish-green streaks across the body. Pigment present on the dorsal, anal and pelvic fins. Three dark pigment spots occur midlaterally on the tail.

Meristic characters and morphometrics for *Cheilinus oxycephalus* (late larval stage)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 25 | BL | 11.6 |
| Dorsal fin | IX,10 | PAL | 7.0 |
| Anal fin | III,9 | HL | 5.0 |
| Caudal fin | 14 | ED | 1.3 |
| Pectoral fin | 12 | BD | 4.0 |
| Pelvic fin | I,5 | | |

*Cheilio inermis*



*Cheilio inermis* (13.0 mm), Watamu.

## Larval morphology

Body elongate and laterally compressed. Caudal peduncle is broad. Head is elongate with no spination. Mouth small and not reaching anterior portion of the eye. Eye is large and round.

## Pigment description

Larva lightly pigmented with series of elongate bands of melanophores along lateral midline of the body, extending to the caudal peduncle.

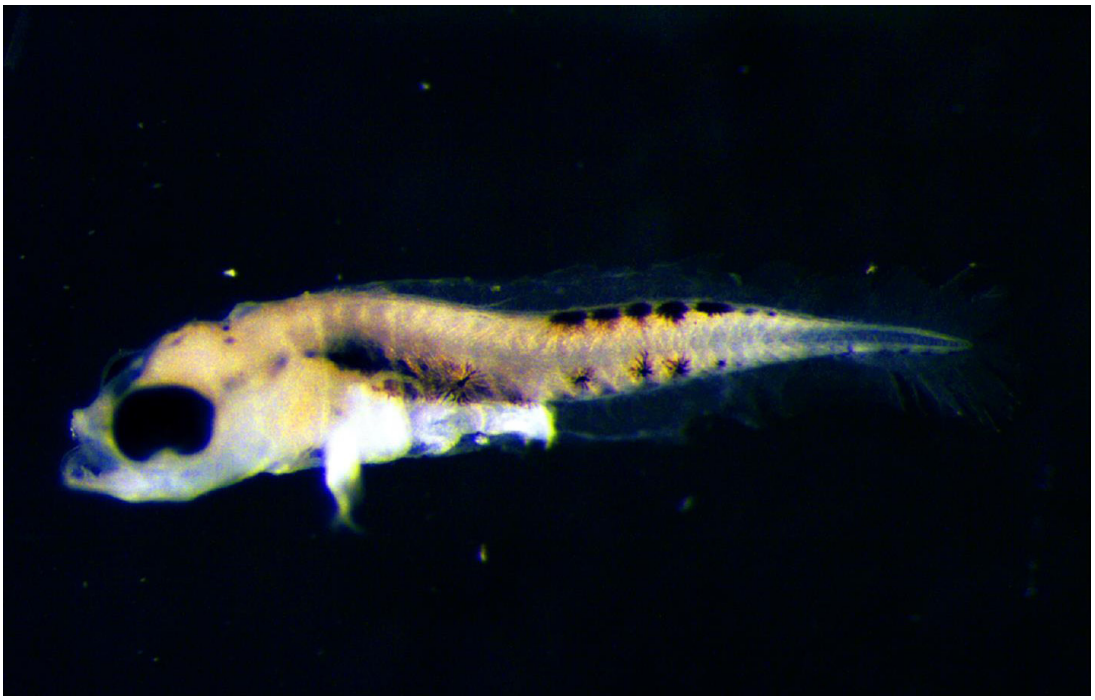
Meristic characters and morphometrics for *Cheilio inermis*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 28 | BL | 13.0 |
| Dorsal fin | IX, 12 | PAL | 6.0 |
| Anal fin | III, 10 | HL | 3.0 |
| Caudal fin | 12 | ED | 1.0 |
| Pectoral fin | 12 | BD | 1.8 |
| Pelvic fin | I,5 | | |

# FAMILY: LATIDAE
# (Barramundi)

Barramundi are found in coastal waters, estuaries and lagoons, in clear to turbid waters. They are diadromous fish, inhabiting rivers before returning to the estuaries to spawn. Larvae and young juveniles live in brackish temporary swamps associated with estuaries, and older juveniles inhabit the upper reaches of rivers. They are found in undercut banks, submerged logs and overhanging vegetation. They feed on fish and crustaceans (Larson, 1999).

*Lates calcarifer*



*Lates calcarifer* (2.8 mm), Vipingo.

## Larval morphology

Body elongate and laterally compressed. Conspicuous gas bladder anteriorly over gut. Head long with short snout. Gut is triangular, extending to about 50% body length. Mouth is large and reaches about mid-eye. Eyes are round and large. Small preopercular spine present.

## Pigment description

Moderate pigmentation with stellate melanophore row on dorsal, ventro lateral parts of the tail. A little pigmentation present dorsally over midbrain and anterior parts of the hindbrain. Pigment also present internally under mid and hindbrain giving the appearance of a stripe through the eye. Internal band of pigmentation present on dorsal margin of the gut.

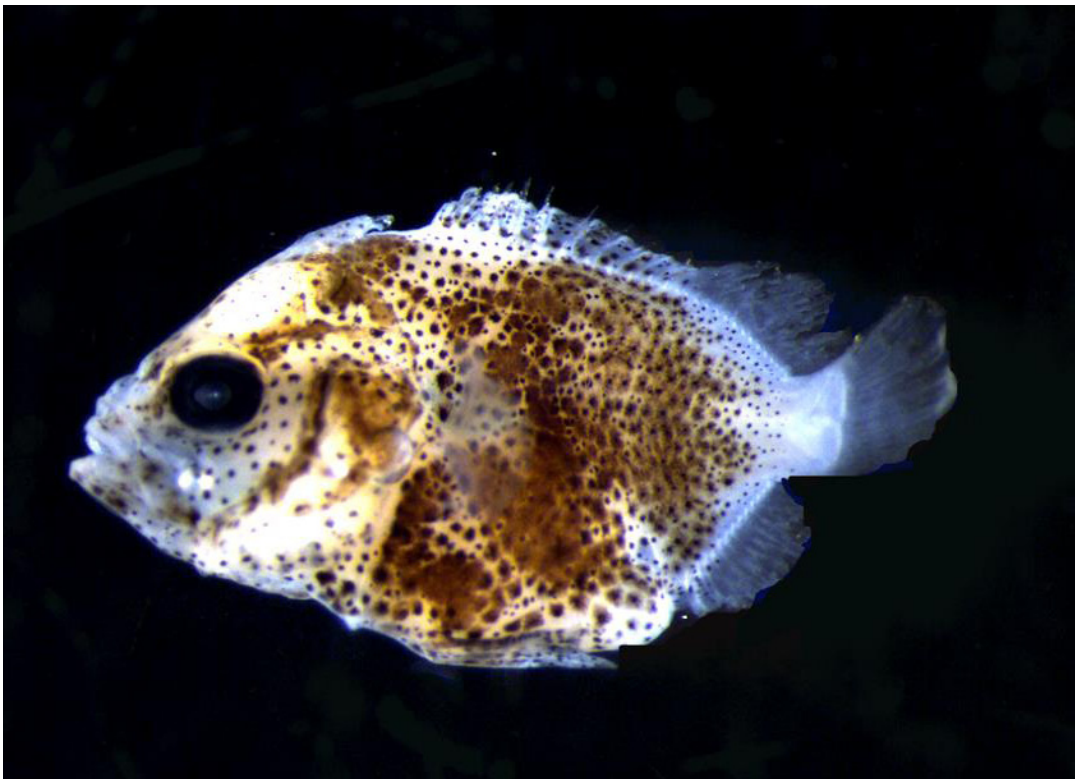
Meristic characters and morphometrics for *Lates calcarifer*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 25 | BL | 2.8 |
| Dorsal fin | VII-VIII + I,10-12 | PAL | 1.6 |
| Anal fin | III, 7-9 | HL | 0.6 |
| Caudal fin | 9+8 | ED | 0.3 |
| Pectoral fin | 16-18 | BD | 0.6 |
| Pelvic fin | I,5 | | |

# FAMILY: LOBOTIDAE (Tripletails)

Tripletails are perciform fishes in the genus Lobotes, the only genus in the family Lobotidae. They are semi-migratory, pelagic marine fish, found in coastal waters across the tropics. They can grow to 90 cm. They have triangular heads, and rounded anal, caudal and dorsal fins making the fish look triple-tailed. Juveniles sometimes float sideways like leaves as a form of camouflage (Breder 1949).

*Lobotes surinamensis*



*Lobotes surinamensis* (6.8 mm), Ungwana Bay.

## Larval morphology

Deep bodied and slightly compressed laterally, with prominent supraoccipital crest and preopercular spines. Gut is coiled, reaching about two-thirds body length. Head is triangular, laterally compressed, with small teeth in both jaws.

## Pigment description

Heavily pigmented with evenly distributed melanophores over the body, except for the caudal peduncle region which is devoid of pigmentation.

Meristic characters and morphometerics for *Lobotes surinamensis*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 27 | BL | 6.8 |
| Dorsal fin | XII, 14 | PAL | 4.0 |
| Anal fin | III, 11 | HL | 2.0 |
| Caudal fin | 17 | ED | 0.6 |
| Pectoral fin | 16 | BD | 4.0 |
| Pelvic fin | I,5 | | |

# FAMILY: LUTJANIDAE (Snappers)

Snappers are a family of perciformfish, mainly marine, but with some members inhabiting estuaries and also feeding in freshwater. In Kenya, they are important food fish. They inhabit tropical and subtropical regions of all oceans, feeding on crustaceans or other fish, though a few are plankton-feeders. They are mostly bottom dwellers, often associated with coral reefs (Leis and Rennis 1983). Common genera include *Lutjanus, Aphareus, Aprion, Pristipomoides* and *Etelis*.

*Lutjanus* sp.

*Lutjanus* sp.preflexion (3.0 mm), Ungwana Bay.

*Lutjanus* sp. postflexion (9.0 mm), Nyali.

*Lutjanus* sp. postflexion (16.0 mm), Nyali.

## Larval morphology

Larvae are deep bodied and laterally compressed. Gut is coiled and triangular and extends to about mid body. Head is large with tiny villiform teeth visible in both jaws. The eye is round and large. Preflexion larva (3.0 mm) with short rounded snout becoming more elongate in postflexion larvae (9.0 mm and 16.0 mm). Pelvic and dorsal fin spine begin to ossify early in preflexion larvae. Small smooth preopecular spine present in early preflexion larva becoming prominent smooth preopercular spines in postflexion larvae. Elongated pelvic spine and second dorsal fin in postflexion larvae.

## Pigment description

Preflexion larva lightly pigmented with melanophores present dorsally on the head, gut and along the ventral margins of the tail. Postflexon larva, moderately pigmented, internal melanophores present on the dorsal surface of the gut, gas bladder, and on the ventral edge of the tail. Melanophores also present on the head, along the membranes of the dorsal fin, and on caudal peduncle. Larger postflexion larvae (16.0 mm) have heavily pigmented melanophores appearing as bands on the head, trunk and dorso-lateral surfaces of the tail.

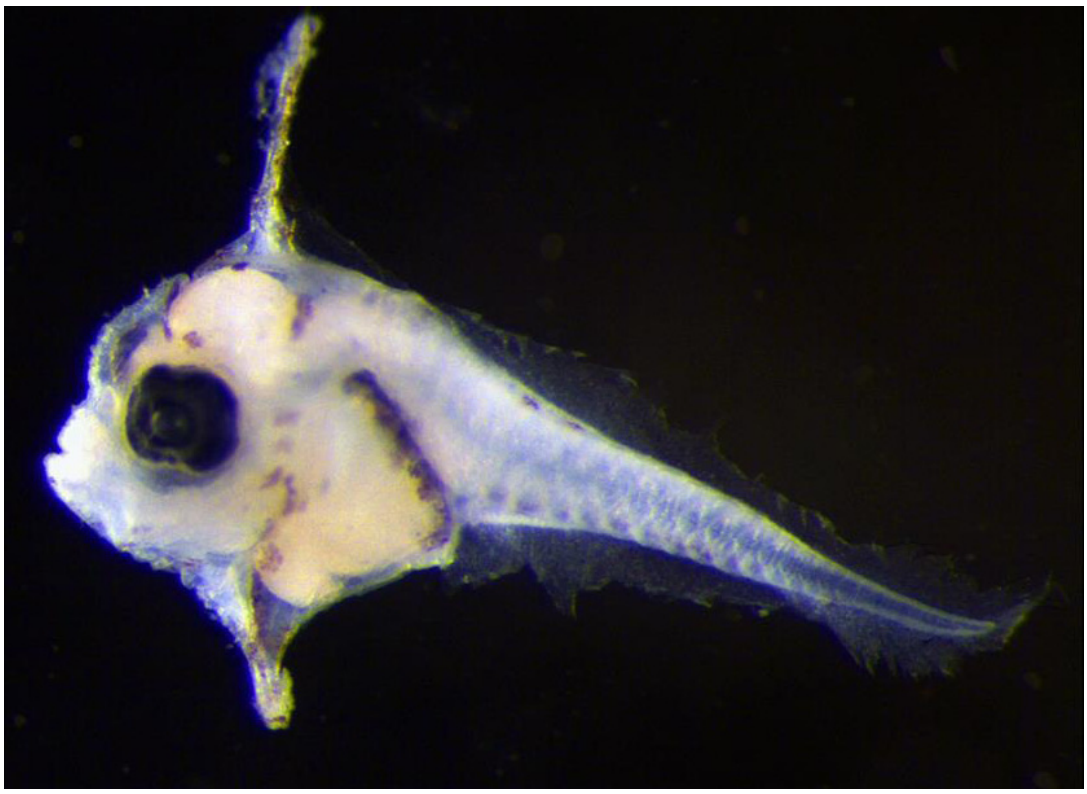
Meristic characters and morphometrics for *Lutjanus* sp.(smaller post flexion)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 9.0 |
| Dorsal fin | X, 14 | PAL | 6.0 |
| Anal fin | III, 8 | HL | 4.0 |
| Caudal fin | 9 +8 | ED | 1.1 |
| Pectoral fin | 15 | BD | 4.2 |
| Pelvic fin | 1,5 | | |

# FAMILY: MONACANTHIDAE (Filefishes)

Filefish are tropical to subtropical marine fish of the diverse family Monacanthidae. They are found in the Atlantic, Pacific and Indian Oceans. Adults are generally shallow water fish, inhabiting depths of no more than about 30 meters (FAO, 2011). They may be found in lagoons or associated with seaward reefs and seagrass beds while some species may also enter estuaries. Their laterally compressed bodies and rough, sandpapery skin inspired the filefish's common name. Filefish spawn at bottom sites prepared and guarded by the males. The young filefish are pelagic, frequenting the open waters.

Monacanthid sp.



Monacanthid sp. (2.7 mm), Shimoni.

## Larval morphology

Deep bodied and strongly laterally compressed. Gut is compactly coiled, with the anus reaching about 30% of total length. Head is large, ovate, with a slightly concave snout. The mouth is small, not reaching the eye. The eye is large and round. Small spinules present on the interorbit, together with barbed dorsal and pelvic spines.

## Pigment description

Larva is moderately pigmented. Heavy pigmentation present dorsally on the gut, and ventrally along the midline of the tail. Small pigmentation also scattered on the head.

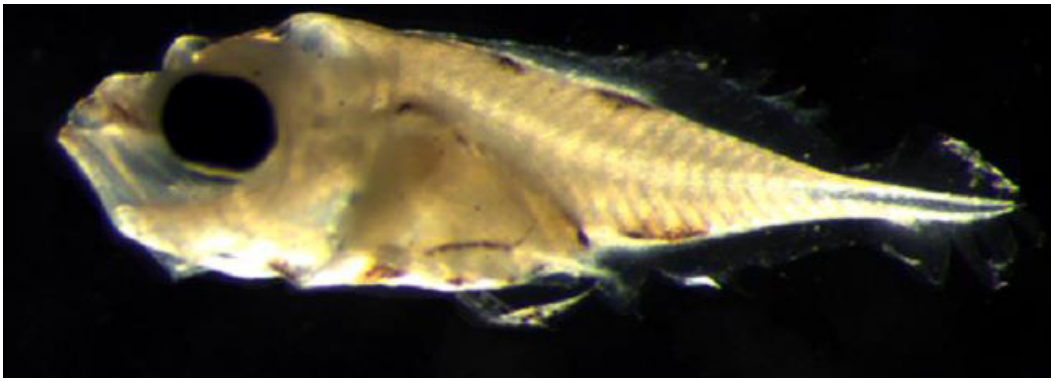
Meristic characters and morphometrics for Monacanthid sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 19 | BL | 2.7 |
| Dorsal fin | II+24-34 | PAL | 0.8 |
| Anal fin | 27-34 | HL | 0.5 |
| Caudal fin | 12 | ED | 0.2 |
| Pectoral fin | 11-13 | BD | 0.8 |
| Pelvic fin | - | | |

# FAMILY: MONODACTYLIDAE (Diamondfishes /moonyfishes)

Monodactylids are schooling fishes that occur in habitats ranging from coastal reefs to freshwater habitats (Leis and Trnski 1989). They are laterally compressed, with an approximately disc-shaped body and tall anal and dorsal fins. They are of moderate size, typically around 25 cm in length.

*Monodactylus* sp.



*Monodactylus* sp. (3.5 mm), Vipingo.

*Monodactylus* sp. flexion (4.0 mm), Ungwana Bay.

## Larval morphology

Larvae initially of moderate depth, in pre flexion stage (3.5 mm) and compressed becoming deeper with growth. Gut is coiled, with anus reaching the mid body. Head is large with an initially concave snout but becomes convex at flexion stage (4.0 mm), with the mouth reaching to mid eye. The eye is large and round with small viliform teeth visible at preflexion larvae (3.5 mm). Small preopercular spines present in preflexion larvae, while supracleithral spines present, together with a serrate supraocular ridge are present in the flexion larvae (4.0 mm). Pelvic fin well developed in early stages (3.5 mm), reaching the anus.

## Pigment description

Moderate to heavily pigmented in preflexion (3.5 mm) and flexion larvae (4.0 mm) respectively. Larvae with pelvic fins heavily pigmented from early stages. Preflexion larva with wide band of pigmentation from the snout, dorsal and ventral portions of the trunk. Pigmentation extends midlaterally to near mid-tail in flexion larvae. Gut is pigmented, dorsally and dorso-laterally. spreading to the head. Caudal peduncle largely unpigmented.

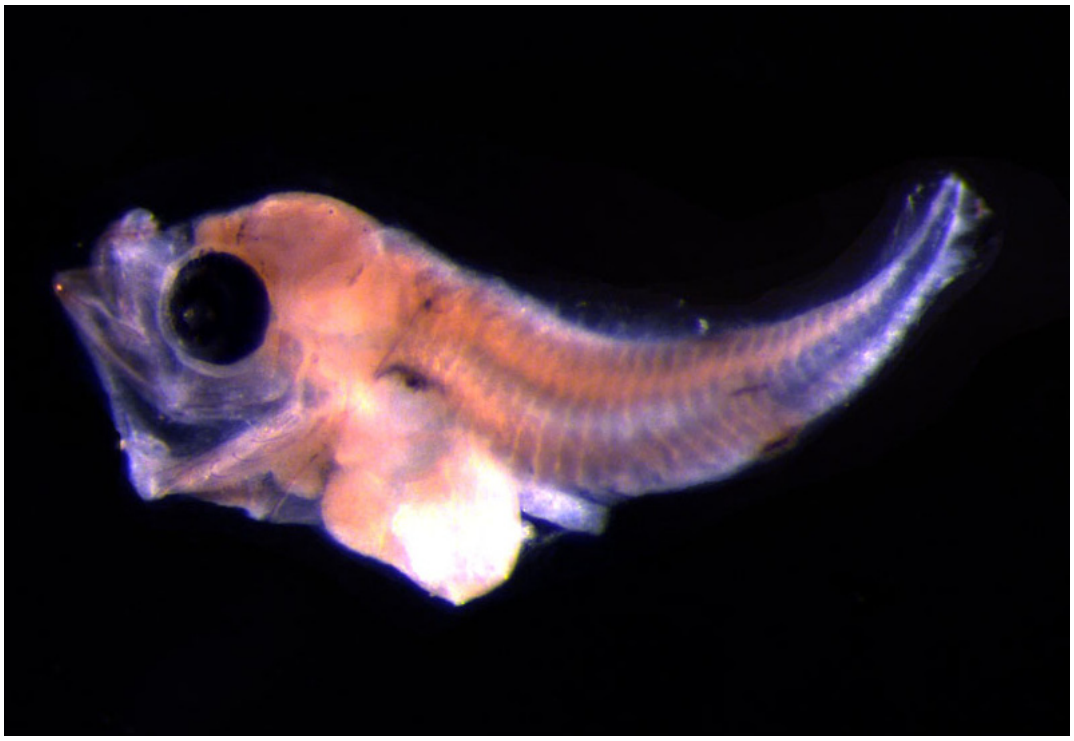
Meristic characters and morphometrics for *Monodactylus* sp.(flexion larvae)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 4.0 |
| Dorsal fin | VII, 31 | PAL | 2.3 |
| Anal fin | III, 28 | HL | 1.5 |
| Caudal fin | 9 +8 | ED | 0.5 |
| Pectoral fin | 16 | BD | 2.0 |
| Pelvic fin | 1,5 | | |

# FAMILY: NOMEIDAE (Driftfishes)

They are found in tropical and subtropical waters throughout the world. The largest species, such as the Cape fathead, *Cubiceps capensis*, reach one metre in length. Several species are found in association with siphonophores such as the Portuguese man of war (*Physalia physalis)*.The man-of-war fish, *Nomeus gronovii*, is known to eat its tentacles and gonads, as well as feed on jellyfishes. Other species of driftfishes are associated with the floating seaweed *Sargassum* (Froese and Pauly 2013).

*Cubiceps* sp.



*Cubiceps* sp. (4.7 mm), Ungwana Bay.

## Larval morphology

Body moderately deep and compressed, Mouth is large with a concave shaped snout. Gut is coiled; inconspicuous gas bladder present above anterior portion of the gut. Eye large and round.

## Pigment description

Larva is lightly pigmented. Pigmentation present on gut and gas bladder. Prominent mid-dorsal, midlateral, and mid-ventral melanophores at mid-tail are apparent. Also appears to be a prominent melanophore at the upper and lower end of the cleithrum and on the anterior margin of the midbrain. Melanophores also on the tips of the upper and lower jaws.

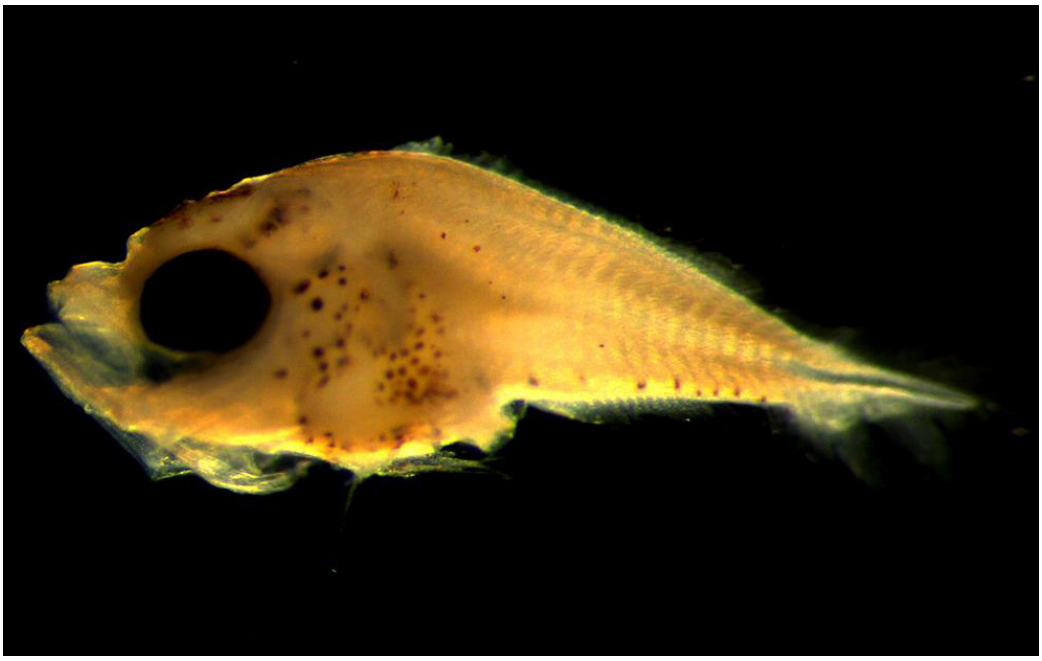
Meristic characters and morphometrics for *Cubiceps* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 31 | BL | 4.7 |
| Dorsal fin | X-XIII+15-17 | PAL | 2.8 |
| Anal fin | II-III,14-21 | HL | 1.5 |
| Caudal fin | - | ED | 0.3 |
| Pectoral fin | 17-20 | BD | 1.5 |
| Pelvic fin | - | | |

# FAMILY: PLATYCEPHALIDAE (Flatheads)

Platycephalidae are bottom dwellers found primarily on sand or muddy bottoms, but some are closely associated with coral reefs. They are small to medium size elongate fish with strongly depressed heads. (Leis and Rennis 1983). Common genera include *Papilloculiceps* and *Thysanophyrus*.

*Papilloculiceps longiceps*



*Papilloculiceps longiceps* (3.4 mm), Vipingo.

## Larval morphology

Body deep and slightly compressed. Gut is coiled and triangular. Snout is blunt, short and concave. Mouth is large and extends to anterior portions of the eye. The eye is large and round. Small preopercular spines present together with prominent serrated supraocular ridges above the eye.

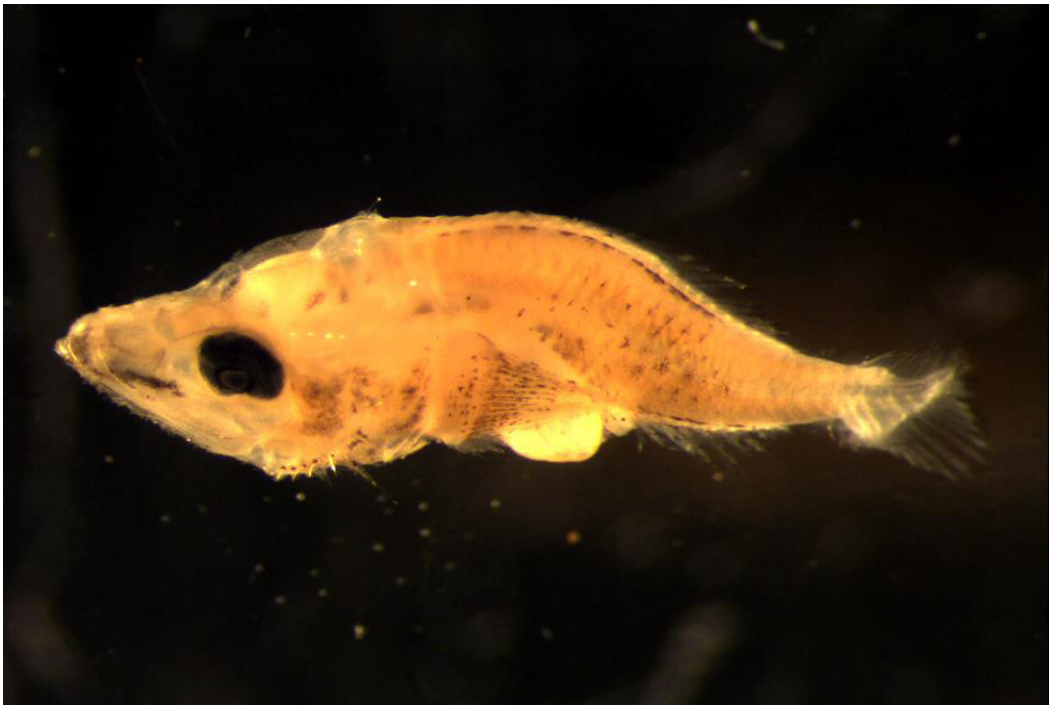
## Pigment description

Larva is lightly pigmented. Melanophores series scattered on the ventral midline of the tail, lower jaw and lateral parts of the upper jaw. Pigmentation also present on the dorsal parts gut, dorsolateral surface of the trunk, opercular area and the head.

Meristic characters and morphometrics *Papilloculiceps longiceps*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 27 | BL | 3.4 |
| Dorsal fin | IX+11 | PAL | 1.7 |
| Anal fin | 11 | HL | 1.2 |
| Caudal fin | - | ED | 0.4 |
| Pectoral fin | 21 | BD | 1.0 |
| Pelvic fin | I,5 | | |

*Thysanophrys* sp.



*Thysanophrys* sp. (5.1 mm), Ungwana Bay.

## Larval morphology

Body deep and ovoid, acquiring a hunched back appearance. Mouth is large with a large pointed snout. Small villiform teeth visible on both jaws. Gut is coiled. Preopercular spines, supraocular and supracleithal spines present. Large fan-shaped pectoral fin present. Eye large and round.

## Pigment description

Pigment present on the dorsal margin of the trunk extending posteriorly to about mid-tail and a little past mid-tail on the ventral margin. There is also dorso- and ventrolateral pigmentation on the myosepta of the posterior half of the trunk. Pigment also present on midbrain, and dorsal portions of the gut.

Meristic characters and morphometrics for *Thysanophrys* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 27 | BL | 5.1 |
| Dorsal fin | VIII+11 | PAL | 2.4 |
| Anal fin | 11 | HL | 1.5 |
| Caudal fin | 9+8 | ED | 0.4 |
| Pectoral fin | 21 | BD | 1.9 |
| Pelvic fin | I,5 | | |

# FAMILY: SCARIDAE (Parrotfishes)

Scarids are colourful herbivorous (or coralivorous), moderately-sized fish usually associated with coral reefs, with many species being commercially exploited (Leis and Rennis 1983). Scarids spawn pelagic eggs. Common genera are *Calotomus, Scarus, Cetoscarus, Leptoscarus, Hipposcarus* and *Bolbometon*.

*Leptoscarus vaigiensis*

*Leptoscarus vaigiensis* (10.5 mm), Ungwana Bay.

*Leptoscarus vaigensis* (15.5 mm), Watamu.

## Larval morphology

Body is elongate, laterally compressed with gut extending to slightly less than mid-body. Snout is pointed, with terminal mouth. Eye is large and round. Caudal peduncle is deep.

## Pigment description

Larvae are initially lightly pigmented (10.5) becoming moderately pigmented (15.5 mm) in postflexion stage. Oblique stripes extend from the eye across the opercular area. Scattered ventral and ventrolateral melanophores on the gut are observed in the 10.5 mm larva with four widely spaced melanophores midlaterally on the trunk and anterior half of the tail. In larger larva (15.5 mm), the melanophore clusters develop into about six bars running across the body.

Meristic characters and morphometrics for *Leptoscarus vaigensis* (larger specimen)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 28 | BL | 15.5 |
| Dorsal fin | IX, 10 | PAL | 8.0 |
| Anal fin | III, 9 | HL | 4.0 |
| Caudal fin | 13 | ED | 1.5 |
| Pectoral fin | 13 | BD | 3.7 |
| Pelvic fin | I,5 | | |

# FAMILY: SCHINDLERIIDAE (Infantfishes)

The Schindleriidae or infantfishes are so called because they retain many of their larval characteristics. All of the Schindleria species are reef fishes. They may be among the most common fish of the reefs of Kenya, based on the results of plankton tows, but because of their transparency and small size, they are infrequently seen.

*Schindleria praematura*

*Schindleria praematura* (9.4 mm), Vipingo.

## Larval morphology

Body is very elongate, compressed and transparent, with a thin, elongate caudal peduncle. Head is small, with short rounded snout. Mouth is moderate and reaches near mid-eye. Gut is straight and extends to just over half body length. No head spines present.

## Pigment description

Larva is unpigmented.

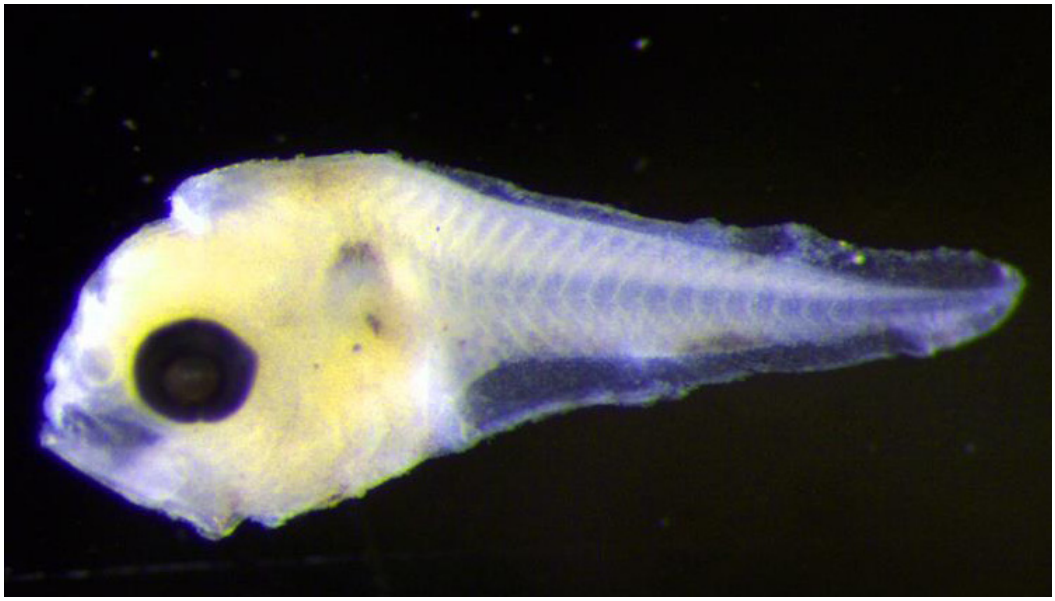
Meristic characters and morphometrics for *Schindleria praematura*.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 38 | BL | 9.4 |
| Dorsal fin | 18 | PAL | 5.7 |
| Anal fin | 15 | HL | 1.6 |
| Caudal fin | 13 | ED | 0.3 |
| Pectoral fin | 18 | BD | 1.0 |
| Pelvic fin | 0 | | |

# FAMILY: SCIAENIDAE (Croakers)

Sciaenids are carnivorous small to medium-sized bottom dwelling fishes that live primarily in warm temperate to tropical estuaries, bays, coastal oceans and muddy river banks around the world (Leis and Trnski 1989). Many species are of considerable commercial importance and common genera in Kenya waters are *Johnius, Otothiles*, and *Umbrina*.

Sciaenid sp.



Sciaenid sp. (3.1 mm), Malindi.

## Larval morphology

Moderately deep bodied and compressed. Gut is coiled with inconspicuous gas bladder located above the anterior portion of gut. Head is large, with short, rounded snout. Eye is round. Head spination (supraoccular and preopercular spines) present, but very reduced in 3.1 mm size larvae.

## Pigment description

Lightly pigmented larva. Pigmentation present on the nape, gas bladder and on the ventral midline of the anal fin base. Pigmentation also present near the clethral symphysis and on the angular.

Meristic characters and morphometrics for Sciaenid sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 25 | BL | 3.1 |
| Dorsal fin | IX-XII,22-34 | PAL | 1.0 |
| Anal fin | II,6-9 | HL | 0.6 |
| Caudal fin | 9+8 | ED | 0.2 |
| Pectoral fin | 16-19 | BD | 0.8 |
| Pelvic fin | I,5 | | |

# FAMILY: SCOMBERESOCIDAE (Sauries)

These are highly migratory pelagic schooling fish that are found near the surface of the water. Adults are generally offshore. Juveniles associate with drifting seaweed. Eggs are attached to one another and to floating objects such as seaweed via filaments on the egg surface. The saury feeds on zooplankton, such as copepods, krill, amphipods, and the eggs and larvae of common fish, such as anchovies (Froese and Pauly 2013).

*Scomberesox simulans*

*Scomberesox simulans* (4.6 mm), Ungwana Bay.

## Larval morphology

Elongate and rotund in shape. Gut is long and straight, extending to three-quarters body length. Head is small and round. Eye large and elongate. Snout is short initially, but becomes rather acute with larval growth. No spines on the head.

## Pigment description

Heavily pigmented over entire body and on the dorsal margin from the snout to the caudal peduncle. Ventral and mid-lateral parts of the trunk, tail and the gut with pigmented spots.

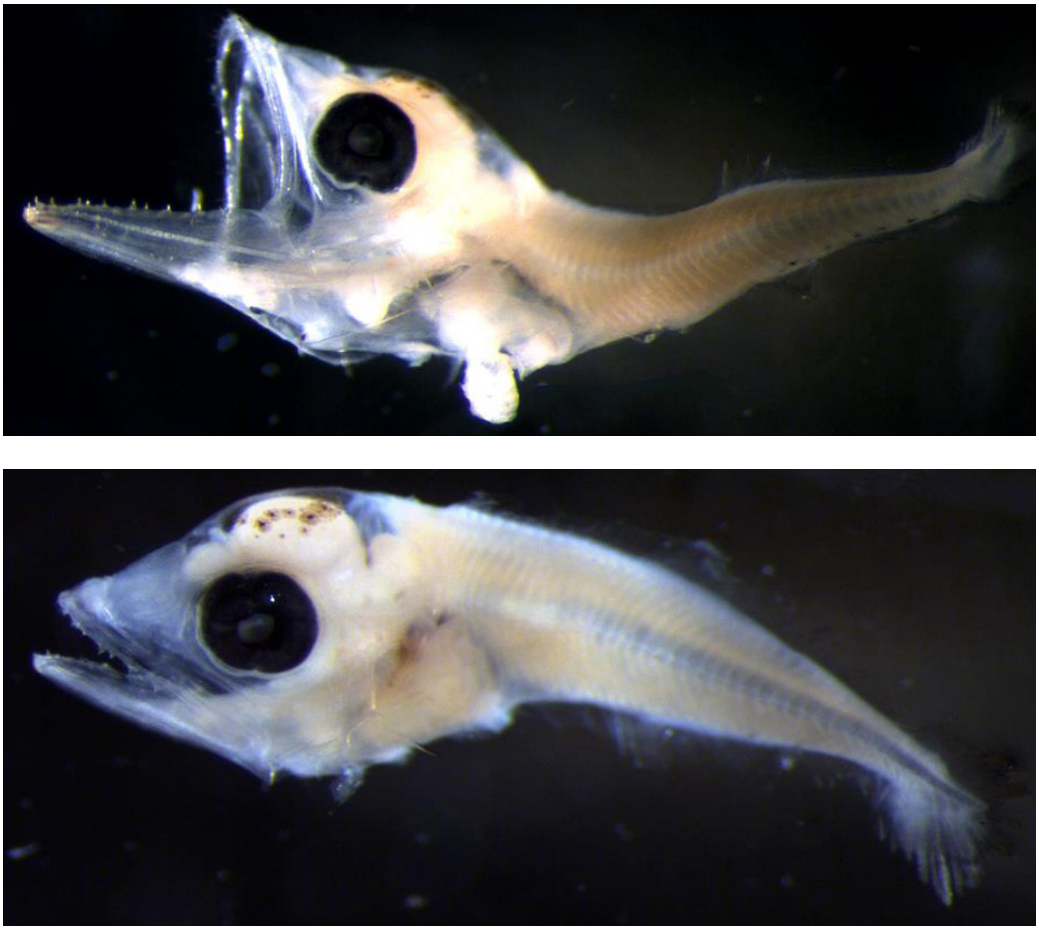
Meristic characters and morphometrics for *Scomberesox simulans*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 62 | BL | 4.6 |
| Dorsal fin | 15 | PAL | 3.6 |
| Anal fin | 15 | HL | 1.4 |
| Caudal fin | 7+8 | ED | 0.4 |
| Pectoral fin | 15 | BD | 0.8 |
| Pelvic fin | 6 | | |

# FAMILY: SCOMBRIDAE (mackerels, tunas, and bonitos)

Scombridae is the family of the mackerels, tunas, and bonitos, and thus includes many of the most important and familiar food fishes of the Kenya coast. Scombrids are generally predators of the open ocean, and are found worldwide in tropical and temperate waters. They are capable of considerable speed, due to a highly streamlined body and retractable fins. Common genera include *Auxis, Thunnus, Euthynnus, Scomberomorus* and *Rastrelliger*.

*Euthynnus* sp.



*Euthynnus* sp. (5.0 mm), Ungwana Bay.

## Larval morphology

Body is moderately deep and laterally compressed, deeper in the head and gut than tail. Gut is coiled and relatively short (PAL ~ 50%BL). Mouth is large, snout is elongate, large and pointed. Upper jaw projects beyond lower jaw. Teeth prominent and visible on both jaws. Prominent preopercular spines. No supraoccipital crest present.

## Pigment description

Larva is lightly pigmented. Melanophore row present midventrally along anal fin base, while stellate melanophores are present on the head. Pigment dorsally and anteriorly on upper portion of gut.

Meristic characters and morphometrics for *Euthynnus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 39 | BL | 5.0 |
| Dorsal fin | IX-XIV,12-16,7-10 | PAL | 2.5 |
| Anal fin | 11-16, 6-10 | HL | 1.9 |
| Caudal fin | 9+8 | ED | 0.6 |
| Pectoral fin | 30-36 | BD | 1.6 |
| Pelvic fin | I,5 | | |

# FAMILY: SCOMBROLABRACIDAE (Longfin escolars)

The longfin escolar identified in this family, *Scombrolabrax heterolepis*, also known as the black mackerel, is a widespread but uncommon deep sea fish that presents some difficulties for taxonomy. It is placed in its own family Scombrolabracidae, but the family's placement in the suborders of Perciformes has included Scombroidei, Percoidei, and Trichiuiroidei, while some authors place it in its own suborder Scombrolabracoidei. Its color varies from black to dark brown. This fish is known to grow to 30 cm in length. The longfin escolar is unique among fishes for having several of its vertebrae hollowed out and filled by evaginations of the gas bladder. It is most often encountered as a bycatch species in pelagic longline fisheries (Froese and Pauly 2013).

*Scombrolabrax heterolepis*

*Scombrolabrax heterolepis* (8.6 mm), Ungwana Bay.

## Larval morphology

Body is moderately deep and laterally compressed, deeper in the head and gut than tail. Gut is compressed and coiled, extending up to 65% body length. Mouth is large, snout is elongate, large and pointed. Upper jaw projects beyond lower jaw. Teeth prominent and visible on both jaws at 8.6 mm size. Head spination absent.

## Pigment description

Moderately pigmented larva. *Stellate melanophores* present on head, lower jaw and snout. Pigmentation present dorsally on gut and dorsally, dorsolaterally, and ventrolaterally on anterior part of trunk. Pectoral-fin base is pigmented. Tail devoid of pigmentation.

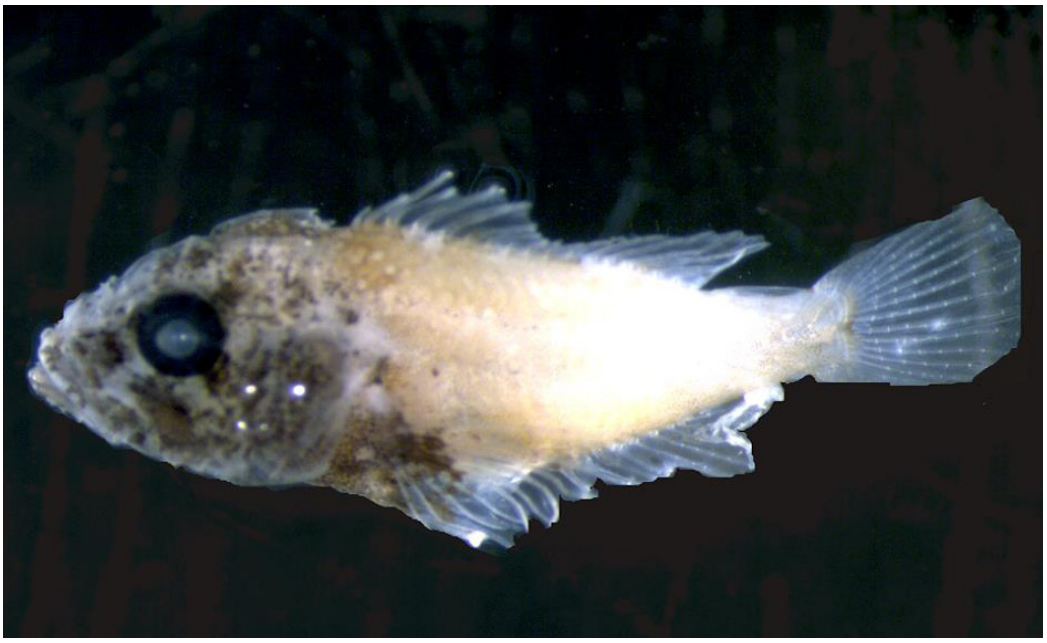
Meristic characters and morphometrics for *Scombrolabrax heterolepis*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 30 | BL | 8.6 |
| Dorsal fin | XII, 12 | PAL | 5.9 |
| Anal fin | 16 | HL | 3.7 |
| Caudal fin | 9+8 | ED | 1.7 |
| Pectoral fin | 19 | BD | 2.9 |
| Pelvic fin | I,5 | | |

# FAMILY: SCORPAENIDAE (Scorpionfishes)

The scorpionfishes are a family of mostly marine fish that includes many of the world's most venomous species. As the name suggests, scorpionfish have sharp fin spines coated with venomous mucus. The family is a large one, with hundreds of members (Eschmeyer 1998). They are widespread in tropical and temperate seas, but mostly found in the Indo-Pacific. Common genera include *Dendrochirus, Scorpaenopsis, Scorpaena*, and *Pterois*.

*Scorpaenodes* sp.



*Scorpaenodes* sp. (9.3 mm), Ungwana Bay.

## Larval morphology

Body moderately deep, and ovoid in cross section. Head spination present, but not prominent. Parietal spines, preopercular spines present, but reduced. Pectoral fins are large.

## Pigment description

Heavily pigmented on the head; pectoral fins with brownish melanophores. Pigmentation also on the gut, dorsally and dorsolaterally on the anterior part of the trunk, to about the level of the third dorsal-fin spine. Trunk and tail devoid of pigmentation.

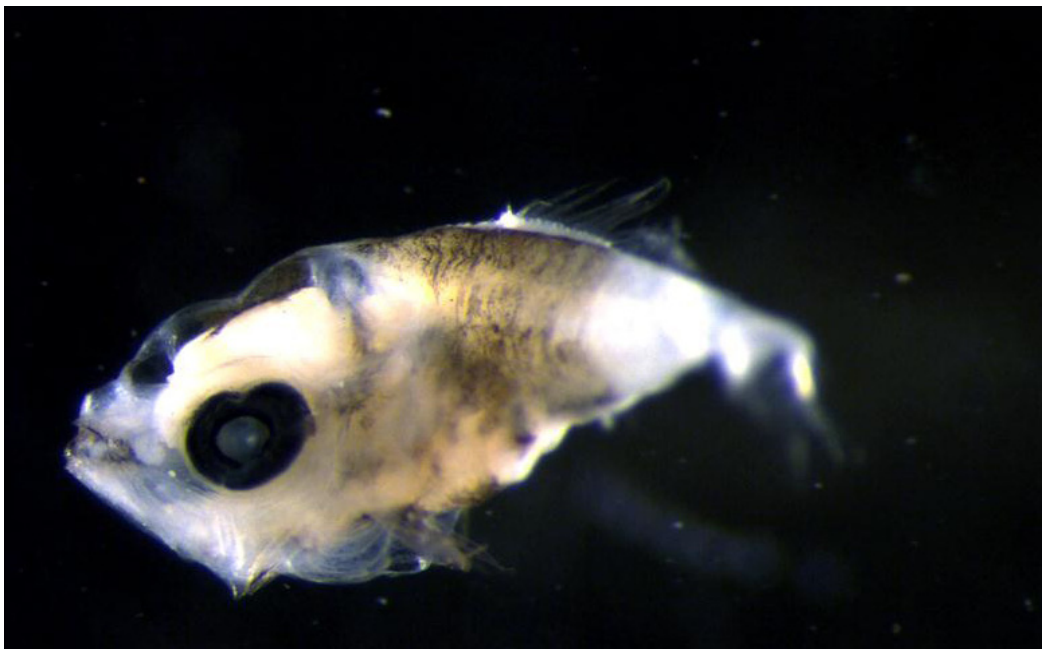
Meristic characters and morphometrics for *Scorpaenodes* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 9.3 |
| Dorsal fin | XII, 6 | PAL | 5.0 |
| Anal fin | III, 6 | HL | 4.0 |
| Caudal fin | 15 (8+7) | ED | 0.8 |
| Pectoral fin | 13 | BD | 3.2 |
| Pelvic fin | I,5 | | |

# FAMILY: SERRANIDAE
# (Basses and groupers)

Serranidae is a large family of fishes containing about 450 species in 64 genera including the sea basses and groupers. Many are caught for food and are usually found over reefs in tropical and subtropical waters. All serranids are carnivorous (Froese and Pauly 2013), with some planktivorous, such as the anthiids. Common genera include *Pseudanthias, Variola, Epinephelus, Cephalopholis* and *Plectropomus*.

Serranid sp. (Anthiinae)



Serranid sp. (3.8 mm), Nyali.

## Larval morphology

Body deep and ovoid with a narrow caudal peduncle. Larva has a hunched back appearance. Gut is coiled and extends beyond mid-body. The head is large, with small villiform teeth visible in both jaws. Head spination is extensive. Preopercular spines, supraocular ridge and serrate post-temporal spines present.

## Pigment description

Larva moderately pigmented. Pigment patch extending from the dorsal to the ventral surface of the trunk, and ventrally on the gut. Caudal peduncle unpigmented. Melanophores also present on the brain and jaws.

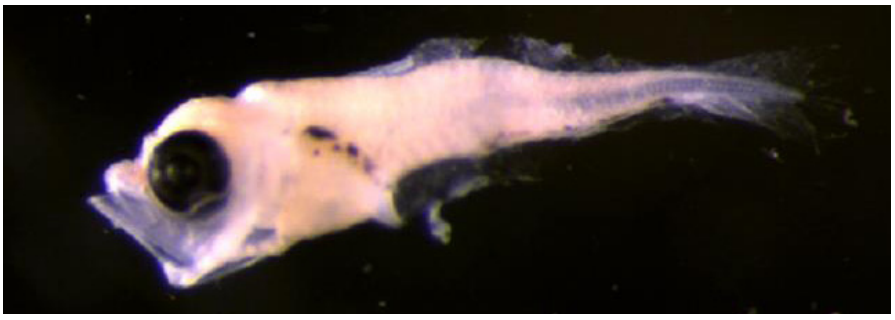
Meristic characters and morphometrics for Serranid sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 26 | BL | 3.8 |
| Dorsal fin | IX-XI,15-18 | PAL | 2.4 |
| Anal fin | III, 8 | HL | 1.5 |
| Caudal fin | 13 | ED | 0.7 |
| Pectoral fin | 15-21 | BD | 2.0 |
| Pelvic fin | I,5 | | |

# FAMILY: SIGANIDAE (Rabbitfishes)

Rabbitfishes are perciform fishes found in shallow lagoons in the Indo-Pacific and eastern Mediterranean. Some live in schools, while others live more solitary lives among the corals. In the Western Indian Ocean they comprise the bulk of the artisanal exploitable fishery resources. Juveniles are common among seagrass beds in the coastal lagoons (Froese and Pauly 2013). The most common genus is *Signaus*.

*Siganus* sp.



*Siganus* sp. (3.0 mm), Shimoni.

*Siganus* sp. (4.3 mm), Ungwana Bay.

## Larval morphology

Larvae are deep bodied and laterally compressed. Inconspicuous gas bladder in preflexion larvae. Small spines present on the operculum (3.0 mm). Head small and round with a blunt snout. Mouth small and terminal, eyes are rounded. Serrate ridges present on the head and laterally on the snout (4.3 mm).Supraoccular, supracleithral and lachrymal spines present (4.3 mm). Dorsal- and pelvic-fin spines fully formed.

## Pigment description

Larva is lightly pigmented. Internal pigmentation present on the dorsal surface of the gut and along the ventral midline of the tail.

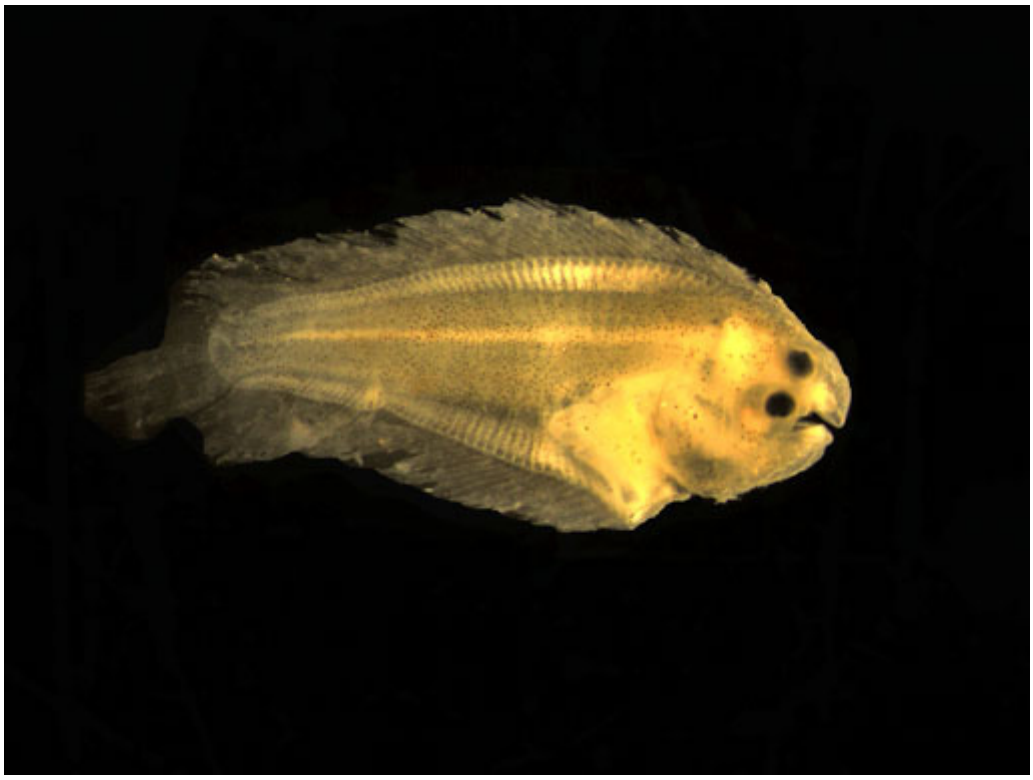
Meristic characters and morphometrics for *Siganus* sp.(larger specimen)

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 4.3 |
| Dorsal fin | VII-XIV.8-11 | PAL | 2.0 |
| Anal fin | VII, 9-10 | HL | 1.2 |
| Caudal fin | 8+7 | ED | 0.5 |
| Pectoral fin | 14-21 | BD | 23 |
| Pelvic fin | 1,3,1 | | |

# FAMILY: SOLEIDAE
# (Soles)

Soles are benthic carnivores inhabiting sandy and muddy bottoms of coastal waters (Leis and Trnski 1989). Some species are of commercial value. Common genera include *Pardachirus, Cynoglossus, Aesopia* and *Paraplagusia*.

*Pardachirus* sp.



*Pardachirus* sp. (8.3 mm), Ungwana Bay.

## Larval morphology

Moderately deep-bodied, extremely laterally compressed larvae with thick coiled gut. Head is moderate in size and rounded. Mouth is oblique, eye small and rounded.

## Pigment description

Lightly pigmented. Entire body covered with evenly distributed melanophores, except on the head and gut where markings are sparser.

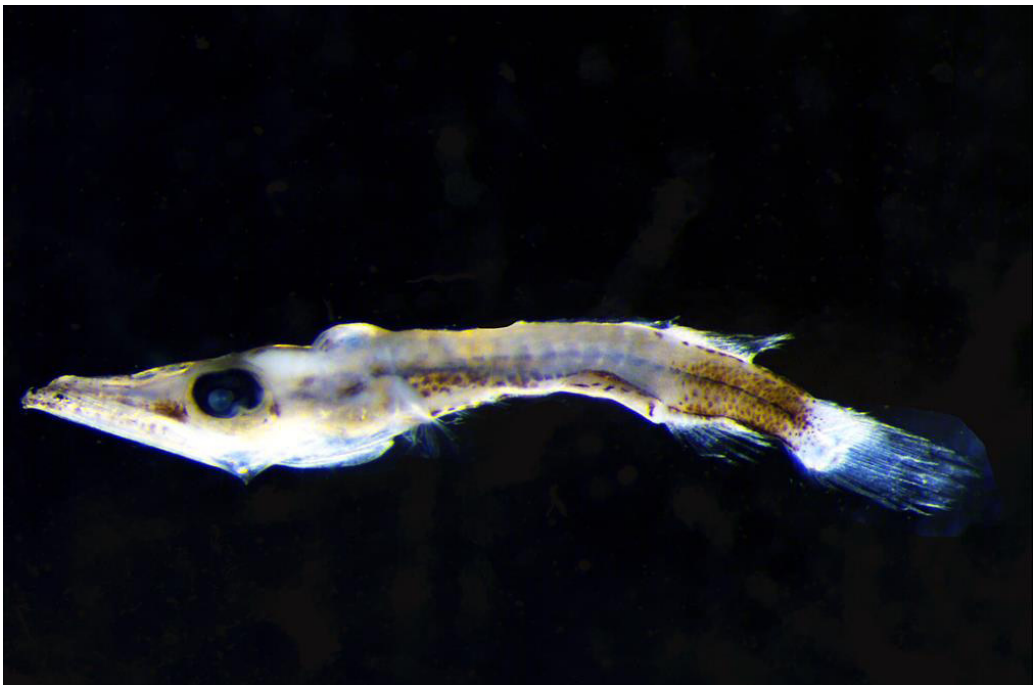
Meristic characters and morphometrics for *Pardachirus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 41 | BL | 8.3 |
| Dorsal fin | 62 | PAL | 2.0 |
| Anal fin | 54 | HL | 1.2 |
| Caudal fin | 18 | ED | 0.5 |
| Pectoral fin | 0 | BD | 2.3 |
| Pelvic fin | 5 | | |

# FAMILY: SPHYRAENIDAE (Barracudas)

Barracudas are elongate, moderate to large fishes found in tropical and subtropical oceans worldwide (Leis and Rennis 1983). They are fairly compressed, and covered with small, smooth scales. Some species can reach up to 1.8 m in length, and 30 cm in width. The barracuda is a salt water fish of the genus Sphyraena, the only genus in the family (Froese and Pauly 2013). *Sphyraena* is the most common genus.

*Sphyraena* sp.



*Sphyraena* sp. (17.0 mm), Nyali.

## Larval morphology

Larva is very elongate, and laterally compressed. Gut is straight, long and extending to about 70% of total length. The head is elongate, with a pointed snout that is dorso-ventrally flattened. Mouth is large, with small teeth visible on the jaws. Lower jaw protrudes slightly beyond the upper one. Eye large and round.

## Pigmentation

Heavily pigmented larva with series of melanophores mid-laterally along the horizontal septum giving an impression of a line. Pigment over the gut appears to be continuous with pigment under the brain and in the roof of the mouth, which also gives the impression of an internal stripe through the eye.

Meristic characters and morphometrics for *Sphyraena* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 24 | BL | 17.0 |
| Dorsal fin | V+I, 10 | PAL | 15.0 |
| Anal fin | II, 9 | HL | 7.0 |
| Caudal fin | 9 + 8 | ED | 1.1 |
| Pectoral fin | 14 | BD | 1.5 |
| Pelvic fin | 1,5 | | |

# FAMILY: SYNGNATHIDAE (Pipefishes)

The Syngnathidae are a family of fish which includes the seahorses, the pipefishes, and the weedy and leafy sea dragons (Sara *et al* 1999).Syngnathids are found in temperate and tropical seas across the world. Most species inhabit shallow, coastal waters, but a few are known from the open ocean. They are characterised by their elongated snouts, fused jaws, absence of pelvic fins and by thick plates of bony armour covering their bodies (Orr and Pietsch1998). Common genera include *Sygnathus* and *Hippocampus*.

*Syngnathus* sp.

*Syngnathus* sp. (5.6 mm), Ungwana Bay.

## Larval morphology

Very elongate, laterally compressed body with elongated snout and small mouth. Projecting lower jaw; straight gut reaching about 55% of body length. Relatively large spines over head and body. Lack of pelvic fins and spinous dorsal fin. Elongate gas bladder located anteriorly over gut. Supraocular crest present. Small spines on the dorsal midline of trunk anteriorly.

## Pigment description

Heavy pigmentation (brownish) in form of spots and light brownish bands along the lateral surface of the body.

Meristic characters and morphometrics for *Syngnathus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 43 | BL | 5.6 |
| Dorsal fin | 48 | PAL | 4.0 |
| Anal fin | 3 | HL | 1.4 |
| Caudal fin | not developed | ED | 0.2 |
| Pectoral fin | not developed | BD | 0.4 |
| Pelvic fin | - | | |

# FAMILY: TERAPONTIDAE (Grunters)

Terapontids are found in shallow coastal waters in the Indian Ocean and western Pacific, where they live in saltwater, brackish and freshwater habitats. They grow up to 80 cm in length and feed on fishes, insects and other invertebrates. They are important food fishes (Froese and Pauly 2013). Common genera include *Terapon* and *Pelates*.

*Terapon jarbua*

*Terapon jarbua* (4.0 mm), Ungwana Bay.

## Larval morphology

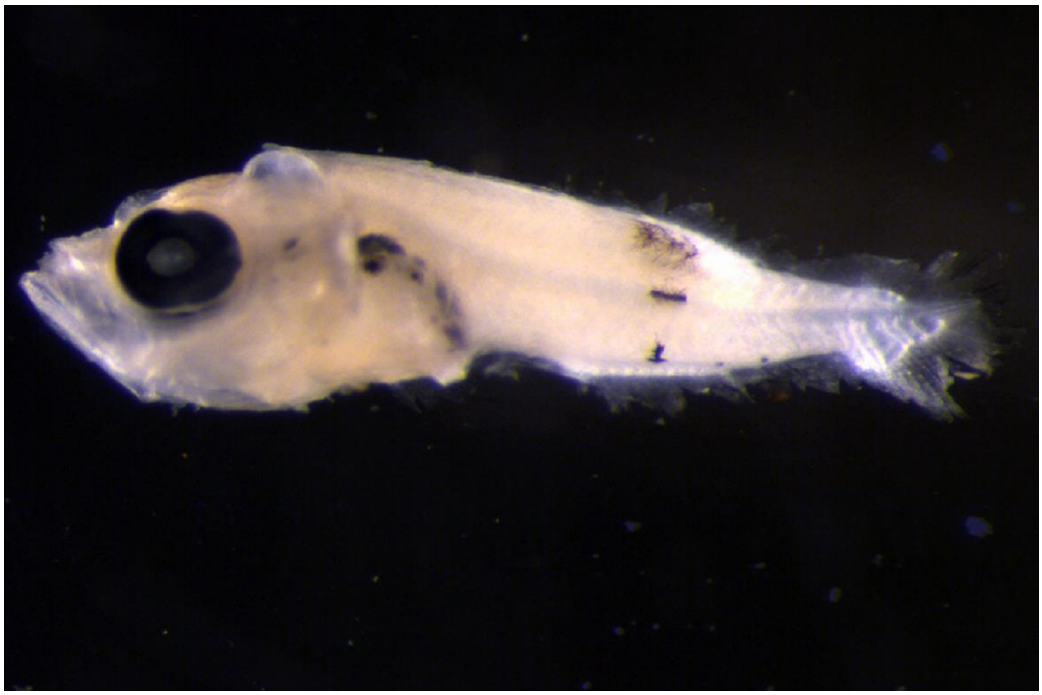
Body moderately elongate and laterally compressed. Eye slightly elongate; gut triangular and compact, reaching 42% body length. Head is large, compressed and slightly elongate. Snout is short and concave. Mouth reaches anterior portion of the eye. Small unserrated preopercular and cleithral spines visible.

## Pigmentation:

Lightly pigmented with small rows of melanophores along the dorsal, lateral and few on the ventral midline of the tail. Pigment also present on the snout, head lips, hindgut and the anterior margin of the gut.

Meristic characters and morphometrics for *Terapon jarbua*

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 25 | BL | 4.0 |
| Dorsal fin | XI-XII,9-11 | PAL | 1.8 |
| Anal fin | III,7-10 | HL | 1.1 |
| Caudal fin | 9+8 | ED | 0.4 |
| Pectoral fin | 13-15 | BD | 0.9 |
| Pelvic fin | I,5 | | |



*Terapon theraps* (3.5 mm), Shimoni

## Larval morphology

Body moderately deep and laterally compressed. Eye elongate; gut triangular and compact reaching 43% body length. Head large, compressed and slightly elongate. Snout short and concave. Mouth reaches anterior portion of the eye. Small preopercular spines present.

## Pigmentation

Lightly pigmented except patches of melanophores on the dorsal, lateral, and ventral parts of the tail. Heavy dorsal pigmentation on the gut, and pigment under the hindbrain.

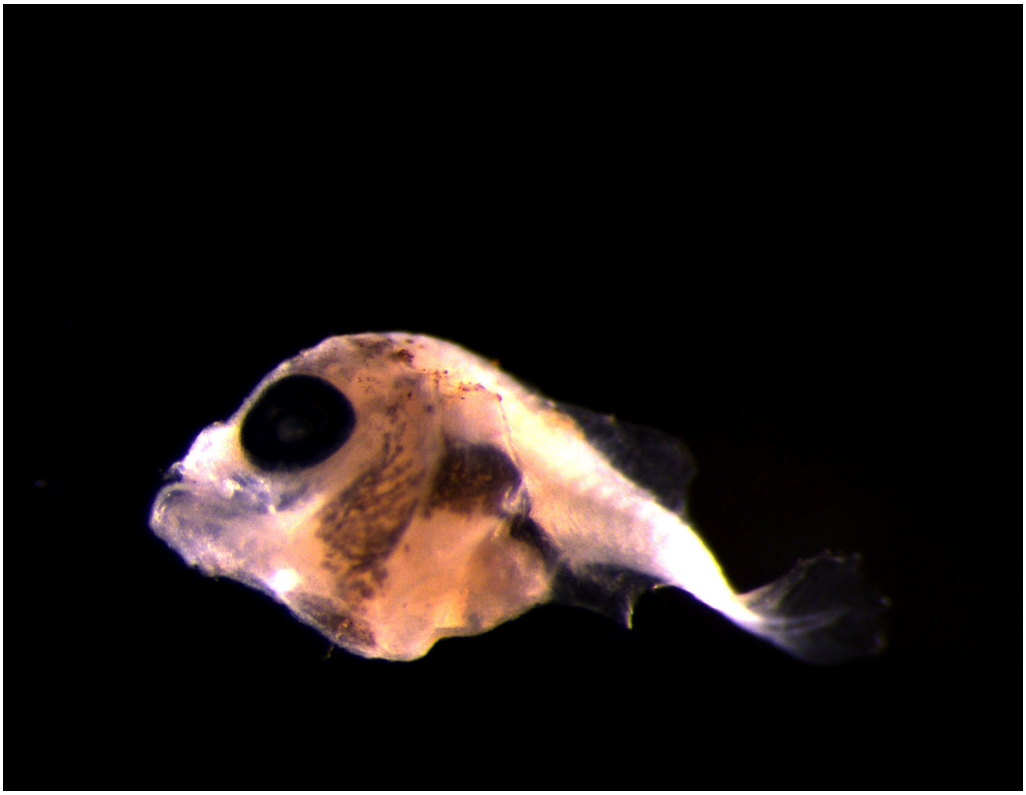
Meristic characters and morphometrics for *Terapon theraps*.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 25 | BL | 3.5 |
| Dorsal fin | XI-XII,9-11 | PAL | 1.6 |
| Anal fin | III,8 | HL | 1.2 |
| Caudal fin | 9+8 | ED | 0.5 |
| Pectoral fin | 13-15 | BD | 1.1 |
| Pelvic fin | I,5 | | |

# FAMILY: TETRAODONTIDAE (Puffer fish)

Tetraodontids are carnivorous fish, with strong jaws, usually found in a variety of habitats from open ocean to coral reefs (Leis and Rennis 1983). Most of the species are inflatable and poisonous and common genera include *Arothron* and *Canthigaster*.

Tetraodontid sp.



Tetraodontid sp. (2.6 mm), Vipingo

## Larval morphology

Body deep and rounded in the trunk, with a slender, compressed tail. The gut is coiled, and the gas bladder inconspicuous. Head is large, round and lacks spines.

## Pigment description

Larva is moderately pigmented. Heavy pigmentation on head, nape, operculum and anterior parts of the gut. Light pigmentation on the trunk and tail.

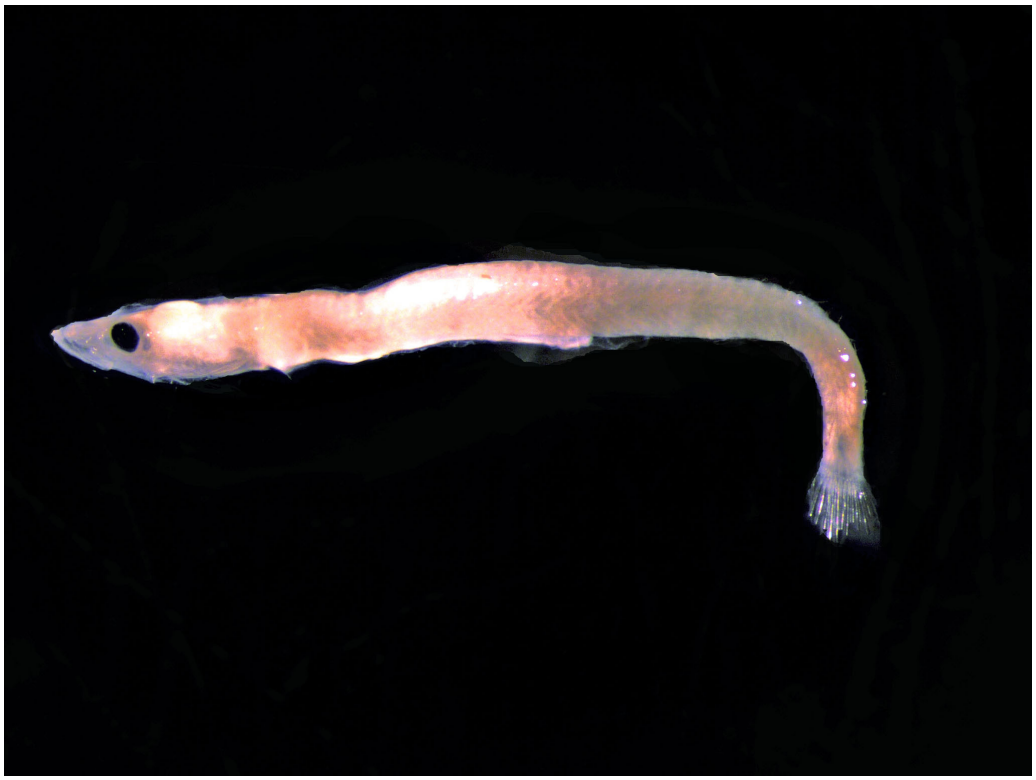
Meristic characters and morphometrics for Tetraodontid sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 19 | BL | 2.6 |
| Dorsal fin | 8-12 | PAL | 1.5 |
| Anal fin | 8-11 | HL | 1.3 |
| Caudal fin | 5+6 | ED | 0.4 |
| Pectoral fin | 14-18 | BD | 1.3 |
| Pelvic fin | - | | |

# FAMILY: TRICHONOTIDAE (Sand divers)

Trichonotidae live in the tropical waters of the Indo-Pacific region; they can be found in small groups, hovering in shallow waters, on sandy bottoms into which they dive when disturbed. They are very elongate fishes, with cylindrical, thin bodies, characterized by a jutting lower jaw. They feed on zooplankton (Leis and Rennis 1983). No species known from Kenya waters (Anam and Mastarda (2012), hence studied specimen represents a new record for the family.

*Trichonotus* sp.



*Trichonotus* sp. (11.2 mm), Ungwana Bay

## Larval morphology

Slender, elongate and ovoid in cross section. The gut is long and straight, extending up to 58% body length. The head is small, elongate and flattened dorso-ventrally. Mouth is large relative to the eyes, and snout is pointed. Lower jaw projects beyond upper jaw. No head spines present.

## Pigmentation

Larva is largely unpigmented, except for scanty melanophores on the posterior portion of the tail.

Meristic characters and morphometrics for *Trichonotus* sp.

| Meristic counts | | Morphometrics (mm) | |
|---|---|---|---|
| Myomeres | 54 | BL | 11.2 |
| Dorsal fin | VI-VII,40-45 | PAL | 7.0 |
| Anal fin | 36-40 | HL | 3.0 |
| Caudal fin | 13 (7+6) | ED | 0.2 |
| Pectoral fin | 14 | BD | 1.0 |
| Pelvic fin | I,5 | | |

# BIBLIOGRAPHY


Ahlstrom, E.H. and Ball, O.P. (1954) Description of eggs and larvae of jack mackerel (*Trachurus symmetricus*) and distribution and abundance of larvae in 1950 and 1951. Fish. Bull. 56:209-245.

Anam, R. and Mastarda, E. (2012) FAO species Identification field guide for fishery purposes. The living marine resources of Kenya. Rome, FAO 345.

Baker, J.L. (2008) Bythitidae. Chapter in: Baker, J.L. (2012) Marine Species of Conservation Concern in South Australia: Volume 1 - Bony and Cartilaginous Fishes. Electronic book, web pages and CD prepared for the South Australian Working Group for Marine Species of Conservation Concern. Produced with support from: Janine L. Baker (marine consultant); the former S.A. Department for Environment and Heritage (DEH); the former Marine and Coastal Community Network of S.A. (MCCN); Threatened Species Network (TSN); Australian Biological Resources Study (ABRS), and Adelaide and Mt Lofty Ranges NRM Board. Electronic version published by Reef Watch, Conservation Council of SA.

Bock, K. (1972). Preliminary checklist of lagoonal fishes of Diani, Kenya .*Journal of the East African Natural History Society and National Museum*.No.137.

Bock, K. (1978) A Guide to common Reef Fishes of the Western Indian Ocean and Kenya Coast. Macmillan Press LTD, London, 118pp.

Breder, Jr., C.M. (1949) "On the behavior of young *Lobotes surinamensis*". *Copeia* (4): 237–242.

Buller, D. J. (1998) "Etiological theories of function: a geographical survey". *Biology and Philosophy* 13 (4): 505–527.

Eschmeyer, W.N. (1998) In Paxton, J.R. and Eschmeyer, W.N. (eds). Encyclopedia of Fishes. San Diego: Academic Press. p 177.

FAO (Food and Agriculture Organization of the United Nations) (2011) *Yearbook of fishery and aquaculture statistics 2009*. Capture production. Rome: FAO. p. 182.

Fish, F. E. (1990) Wing design and scaling of flying fish with regard to flight performance. Journal of Zoology221 (3): 391–403.

Froese, R. and Pauly, D. eds. (2013) Fishbase. World Wide Web electronic publication.www.fishbase.org. version (04/2013).

Johnson, G.D. and Gill, A.C. (1998) In Paxton, J.R. and Eschmeyer, W.N. (eds.) Encyclopedia of Fishes. San Diego: Academic Press. p. 183.

Kendall, Jr. A.W, Ahlstrom, E.H. and Moser, H.G. (1984) "Early life history stages of fishes and their characters"*American Society of Ichthyologists and Herpetologists*, Special publication 1: 11–22.

Larson, H. (1999) Order Perciformes. Suborder Percoidei. Centropomidae. Sea perches. p. 2429-2432. In K.E. Carpenter and V.H. Niem (eds.) FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 4.Bony fishes part 2 (Mugilidae to Carangidae). FAO, Rome.

Leis, J.M. and Rennis, D.S. (1983) The larvae of Indo-Pacific coral reef fishes. New South Wales University Press, Kensington, 269 pp.

Leis, J.M. and Trnski, T. (1989) The Larvae of Indo-Pacific Shore fishes. New South Wales University Press, Kensington, 371 pp.

Leis, J.M. and Carson-Ewart, B.M. (2000) The larvae of Indo-Pacific coastal fishes. An identification guide to marine fish larvae (Fauna Malesiana Handbooks 2) EJ Brill, Leiden, 870 pp.

Lieske, E. and Myers, R. (1994) Coral reef fishes: Indo-Pacific & Caribbean including the Red Sea.Haper Collins Publishers, 400 pp.

Neira, F.J. Miskiewicz, A. and Trnski, T. (1998) Larvae of temperate Australian fishes: Laboratory guide for larval fish identification. Ned lands, W.A. University of Western Australia Press, 474 pp.

Orr, J.W. and Pietsch, T.W. (1998) In: Paxton, J.R. and Eschmeyer, W.N. (eds). Encyclopedia of Fishes. San Diego: Academic Press. pp. 168–169.

Richmond, M.D. (2002) A Field guide to the Seashores of Eastern Africa and the Western Indian Ocean Islands. Sida/SAREC-UDSM. 461pp. [there is a more recent edition, 2011.]

Ross, P. (2007) Extraordinary Animals: *An Encyclopedia of Curious and Unusual Animals*, Greenwood Press.320 pp.

Sara, A.L, Amanda, C.J. and Heather, J. H. (1999) *Seahorses: An Identification Guide to the World's Species and their Conversation*. London: Project Seahorse.

Schmitt, P.D. (1983) Atherinidae p 37-39 In: Leis and Rennis (eds). The larvae of Indo-Pacific coral reef fishes. New South Wales University Press, Kensington.

Smith, J.L.B. and Heemstra, P.C. (1998) Smith's Sea Fishes, fourth edition. Valiant Publishing Santom, South Africa.578 pp.

# Annex 1: List of fish larvae collected from along the Kenyan coast and useful characteristics for their identification.

| Family | Genus | Body shape | Area | Dorsal fin (s) | Anal fin(s) | Myomere counts | Size (mm) | Pigmentation pattern | Head spination |
|---|---|---|---|---|---|---|---|---|---|
| Acanthuridae | *Naso* sp. | Deep, strongly compressed | Ungwana Bay | VII, 24 | II + 23 | 23 | 4.4 | Moderate | Present |
| Apogonidae | *Gymnapogon* sp. | Elongate | Nyali | VI+ I, 10 | II,8 | 24 | 9.7 | Heavy | None |
| | *Apogon* sp. | Elongate compressed | Vipingo | VII | II,7 | 24 | 5.0 | Moderate | Present |
| | *Archamia* sp. | Elongate, strongly compressed | Watamu | VI + I, 9 | II + 13 | 24 | 8.5 | Moderate | Present |
| | *Fowleria* sp. | Moderate, compressed | | VII + I,9 | II, 6-8 | 24 | 12.0 | Heavy | None |
| Atherinidae | *Atherinomorus* sp. | Elongate compressed | Ungwana Bay | *VI + 1,9-11 | *I, 11-14 | 35 | 4.7 | Heavy on the head only | None |
| Blenniidae | *Petroscirtes mitratus* | Moderate, compressed trunk | Watamu | XII + 15 | II, 15 | 31 | 9.7 | Heavy | None |
| | *Omobranchus* sp. | Elongate, compressed trunk | Ungwana Bay | X, 18 | II, 24 | 36 | 4.1 | Light | Present |
| | *Parablennius* sp. | Elongate, compressed trunk | Ungwana Bay | XII,17-19 | II, 17-19 | 40 | 2.1 | Light | None |
| Bythitidae | *Dinematichthys* sp. | Elongate compressed | Malindi | *73-103 | *59-69 | 40 | 4.0 | Light | None |
| Callionymidae | *Callionymus* sp. | Deep, rounded | Malindi | IV, 9 | 8 | 19 | 2.8 | Moderate | |
| Carangidae | *Alepes* sp. | Elongate, compressed | Ungwana Bay | VIII + 22 | II + I, 18 | 24 | 6.5 | Light | Present |
| | *Carangoides* sp. | Deep, compressed | Ungwana Bay | VIII + I, 20 | II + I, 18 | 24 | 2.8 | Moderate | Present |
| | | | | | | | 9.6 | Heavy | None |
| | *Decapterus* sp. | Moderately compressed | Ungwana Bay | VIII + I , 29 | II + I, 18 | 24 | 8.2 | Light | Present |
| | *Caranx* sp. | Deep, compressed | Ungwana Bay | VIII + I, 19 | II + I, 16 | 24 | 3.0 | Light | Present |
| | *Elagatis bipinnulata* | Moderate, compressed | Nyali | VI +1, 24 | II +1, 18 | 24 | 5.5 | Heavy | Present |
| | *Gnathandon speciosus* | Moderate, compressed | Nyali | VII + I, 19 | II + I, 16 | 24 | 12.8 | Heavy | Present- small |
| | *Scomberoides* sp. | Elongate, moderately compressed | Ungwana Bay | VI + I, 20 | II + I, 20 | 24 | 8.2 | Heavy | Present prominent |
| | *Seriolina* sp. | Moderate and moderately compressed | Vipingo | VII +1, 30 | 1+I, 18 | 24 | 5.9 | Heavy | Present |
| | | | | | | | 6.5 | Heavy | Present |
| Cynoglossidae | *Cynoglossus* sp. | Moderate, strongly compressed | Malindi | 78 | 85 | 55 | 6.5 | Light | None |
| Dactylopteridae | *Dactyloptena* sp. | Moderate, ovoid | Vipingo | *0-1+1+V-VI +I, 6-8 | *5-7 | 22 | 4.0 | Heavy | Present |
| Exocoetidae | *Exocoetus* sp. | Elongate slightly compressed | Ungwana Bay | 13-14 | 12 | 43-46 | 7.7 | Heavy | None |
| Gerreidae | *Gerres* sp. | Moderate, compressed | Nyali | IX, 10 | II, 8 | 24 | 9.0 | Light | Present- small |
| Gobiesocidae | *Lepadichthys* sp. | Elongate, compressed | Vipingo | 11 | 8 | 36-37 | 4.4 | Heavy | None |
| Gobiidae | *Ctenogobius* sp. 1 | Elongate, compressed | Nyali | VI + 11 | 12 | 26 | 10.7 | Light | None |
| | *Ctenogobius* sp. 2 | Elongate, compressed | Kilifi | VI + 12 | 13 | 26 | 7.7 | Light | None |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Coryphoterus* sp. | Elongate, compressed | Nyali | VI + 11 | 10 | 26 | 7.5 | Light | None |
| | Gobiid sp. | Elongate, compressed | Vipingo | *VI-VII +I, 9-11 | *I,9-11 | 26 | 2.9 | Light | None |
| | *Fusigobius neophytus* | Elongate, ovoid | Watamu | VII + 9 | 9 | 26 | 6.8 | Heavy | None |
| | *Gnatholepis cauerensis* | Elongate, rounded | Ungwana Bay | VI +12 | 12 | 26 | 6.2 | Heavy | None |
| Hemiramphidae | *Hemiramphus far* | Very elongate, squarish | Ungwana Bay | 15 | 11 | 56 | 31.0 | Heavy | None |
| Labridae | *Cheilinus oxycephalus* | Elongate, compressed | Watamu | IX,10 | III, 9 | 25 | 8.6 | Light | None |
| | | | Watamu | IX,10 | III, 9 | 25 | 11.6 | Heavy | None |
| | *Cheilio inermis* | Elongate, compressed | Watamu | IX, 12 | III, 10 | 28 | 13.0 | Light | None |
| Latidae | *Lates calcarifer* | Moderate, compressed | Vipingo | *VII-VIII + I, 10-13 | *III, 7-9 | 24 | 2.8 | Moderate | Present-small |
| Lobotidae | *Lobotes surinamensis* | Deep, compressed | Ungwana Bay | XI, 14 | II, 11 | 27 | 6.8 | Heavy | Present |
| Lutjanidae | *Lutjanus* sp. | Deep, compressed | Nyali | X, 16 | III + 9 | 24 | 9.0 | Light | Present |
| Monacanthidae | Monacanthid sp. | Deep, strongly compressed | Shimoni | II+24-34 | 27-34 | 19 | 2.7 | Light | Present |
| Monodactylidae | *Monodactylus* sp. | Deep, compressed | Ungwana Bay | VII, 31 | III, 28 | 24 | 4.0 | Light | Present |
| Nomeidae | *Cubiceps* sp. | Deep, compressed | Ungwana Bay | *X-XIII+15-17 | II-III, 14-21 | 31 | 4.7 | Light | None |
| Platycephalidae | *Thysanophrys* sp. | Deep, ovoid | Ungwana Bay | VIII + 11 | 12 | 27 | 5.1 | Moderate | Present |
| Scaridae | *Leptoscarus vaigiensis* | Elongate, compressed | Ungwana Bay | IX, 10 | III, 9 | 28 | 10.5 | Light | None |
| | | | Watamu | IX, 10 | III, 9 | 28 | 15.5 | Moderate | None |
| Schindleriidae | *Schindleria praematura* | Very elongate, compressed | Vipingo | 18 | 15 | 38 | 9.4 | Absent | None |
| Sciaenidae | Sciaenid sp. | Elongate, compressed | Malindi | IX-XII,22-34 | II,6-9 | 25 | 3.2 | Light | Present |
| Scomberesocidae | *Scomberesox simulans* | Elongate, rounded | Ungwana Bay | 15 | 15 | 62 | 4.6 | Heavy | None |
| Scombridae | *Euthynnus* sp. | Moderate, compressed | Ungwana Bay | IX-XIV,12-16,7-10 | 11-16, 6-10 | 39 | 5.0 | Light | Present |
| Scombrolabracidae | *Scombrolabrax heterolepis* | Moderate, compressed | Ungwana Bay | 12 | 16 | 30 | 8.6 | Moderate | None |
| Scorpaenidae | *Scorpaenodes* sp. | Moderate, ovoid | Ungwana Bay | XII, 6 | III, 6 | 24-27 | 9.3 | Heavy | Present |
| Serranidae | *Anthiine* sp. | Deep, ovoid | Nyali | IX-XI,15-18 | 11 | 26 | 3.8 | Moderate | Present |
| Siganidae | *Siganus* sp. | Deep, compressed | Ungwana Bay | *XII-XIV, 9-11 | *VII,9-10 | 24 | 4.3 | Light | Present |
| Soleidae | *Pardachirus* sp. | Moderate, strongly compressed | Ungwana Bay | 62 | 54 | 41 | 8.3 | Light | None |
| Sphyraenidae | *Sphyraena* sp. | Very elongate, compressed | Nyali | V + I, 10 | II, 9 | 24 | 17.0 | Heavy | Present |
| Syngnathidae | *Syngnathus* sp. | Very elongate, compressed | Ungwana Bay | 48 | 3 | 43 | 5.6 | Moderate | Present |
| Terapontidae | *Terapon jarbua* | Moderate, compressed | Ungwana Bay | *XI-XII, 9-11 | *III, 9 | 25 | 4.0 | Light | Present |
| | *Terapon theraps* | Moderate, compressed | Shimoni | *XI-XII, 9-11 | *III, 9 | 25 | 3.5 | Light | Present |
| Tetraodontidae | *Tetraodontid* sp. | Deep, rounded | Vipingo | | | 19 | 2.6 | Moderate | None |
| Trichonotidae | *Trichonotonus* sp. | Very elongate, ovoid | Vipingo | *VI-VII, 40-45 | *36-40 | 54 | 11.2 | Light | None |

(For specimens which dorsal and anal fins were developing (not counted), data were obtained from Leis and Trnski (1989) or Anam and Mostarda (2012), and are marked with asterix *)

# Annex 2: Checklist of genera and species recorded for Kenya of the families included in this guide

| Family | Species | Dorsal spine | Dorsal soft rays | Anal spines | Anal soft rays | Vertebral counts | Geographical range |
|---|---|---|---|---|---|---|---|
| Acanthuridae | *Naso annulatus* | 5 | 28-29 | 2 | 27-28 | 22-23 | Indo-Pacific: East Africa |
| | *Naso brevirostris* | 6 | 27-29 | 2 | 27-30 | 22-23 | Indo-Pacific: East Africa |
| | *Naso brachycentron* | 4-5 | 28-30 | 2 | 27-28 | 22-23 | Indo-Pacific: East Africa |
| | *Naso hexacanthus* | 6 | 27-29 | 2 | 27-30 | 22-23 | Indo-Pacific: East Africa |
| | *Naso lituratus* | 6 | 28-31 | 2 | 29-31 | 22-23 | Indo-Pacific: East Africa |
| | *Naso thynonoides* | 4 | 28-30 | 2 | 27-29 | 22-23 | Indo-Pacific: East Africa |
| | *Naso vlamingii* | 6 | 27-29 | 3 | 27-29 | 22-23 | Indo-Pacific: East Africa |
| | *Naso unicornis* | 6 | 27-29 | 2 | 27-30 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus blochii* | 9 | 25-27 | 3 | 24-25 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus dussumieri* | 9 | 25-27 | 3 | 24-26 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus leucosternon* | 9 | 28-30 | 3 | 23-26 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus lineatus* | 9 | 27-30 | 3 | 25-27 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus mata* | 9 | 24-26 | 3 | 23-24 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus nigricauda* | 9 | 25-27 | 3 | 23-26 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus nigrofuscus* | 9 | 24-27 | 3 | 22-24 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus thompsonii* | 9 | 23-26 | 3 | 23-26 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus tennentii* | 9 | 23-24 | 3 | 22-23 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus triostegus* | 9 | 22-26 | 3 | 19-22 | 22-23 | Indo-Pacific: East Africa |
| | *Acanthurus xanthopterus* | 8-9 | 25-27 | 3 | 23-25 | 22-23 | Indo-Pacific: East Africa |
| | *Ctenochaetus binotatus* | 8 | 24-27 | 3 | 22-27 | 22 | Indo-Pacific: East Africa |
| | *Ctenochaetus striatus* | 8 | 27-31 | 3 | 24-28 | 22 | Indo-Pacific: East Africa |
| | *Ctenochaetus strigosus* | 8 | 25-28 | 3 | 22-25 | 22 | Indo-Pacific: East Africa |
| | *Paracanthurus hepatus* | 9 | 19-20 | 3 | 18-19 | 22 | Indo-Pacific: East Africa |
| | *Zebrasoma scopas* | 4-5 | 22-23 | 3 | 19-21 | 22 | Indo-Pacific: East Africa |
| | *Zebrasoma veliferum* | 4-5 | 29-33 | 3 | 23-26 | 22 | Indo-Pacific: East Africa |
| | *Zebrasoma xanthurum* | 4-5 | 22-33 | 3 | 19-26 | 22 | W.I.O. |
| Apogonidae | *Apogon aureus* | 8 | 9 | 2 | 8 | 24 | Indo-Pacific: East Africa |
| | *Apogon coccineus* | 7+1 | 9 | 2 | 8 | 24 | Indo-West Pacific, Red Sea to Durban |
| | *Apogon cookii* | 7 | 9 | 2 | 8 | 24 | Indo-West Pacific |
| | *Apogon fleurieu* | 8 | 9 | 2 | 8 | 24 | Indo-West Pacific: Red Sea, Gulf of Oman, East Africa |
| | *Apogon guamensis* | 8 | 9 | 2 | 8 | 24 | Indo-West Pacific: Red Sea, north to Ryukyu Islands |
| | *Apogon natalensis* | - | - | - | - | 24 | W.I.O.: Red Sea to Durban, South Africa. |
| | *Apogon thermalis* | 7 | 9 | 2 | 8 | 24 | Indo-Pacific: South Africa and east to western Pacific |
| | *Apogonichthyoides taeniatus* | 8 | 8-9 | 2 | 6-8 | 24 | W.I.O. |
| | *Archamia bleekeri* | 7 | 9 | 2 | 15-17 | 24 | Indo-West Pacific, East Africa, South Africa |
| | *Archamia flavofasciata* | 7 | 9 | 2 | 12-14 | 24 | W.I.O., South Africa |
| | *Archamia fucata* | 7 | 9 | 2 | 15-18 | 24 | Indo-Pacific, Red sea, East Africa |
| | *Archamia mozambiquensis* | 7+1 | 9 | 2 | 13-15 | 24 | Indo-Pacific, Red sea, East Africa |
| | *Cheilodipterus macrodon* | 7 | 9 | 2 | 8 | 24 | Indo-Pacific, Red sea, East Africa |
| | *Fowleria variegata* | 8 | 9 | 2 | 8 | 24 | Indo-Pacific, Red sea, Samoa |
| | *Gymnapogon africanus* | 7 | 9 | 2 | 8 | 24 | W.I.O., Mozambique |
| | *Pseudamia gelatinosa* | 7 | 8 | 2 | 8 | 24 | Indo-Pacific, Red sea, East Africa |
| | *Pseudamiops pellucidus* | 7 | 8 | 2 | 9 | 24 | W.I.O., East Africa, South Africa |
| | *Siphamia mossambica* | 8 | 9 | 2 | 8 | 24 | W.I.O., East Africa, South Africa |
| Atherinidae | *Atherinomorus duodecimalis* | 5-7 | 9-10 | 1 | 12-13 | 35-44 | Indo-West Pacific, Aldabra |
| | *Atherinomorus lacunosus* | 5-8 | 8-11 | 1 | 12-17 | 35-44 | Indo- Pacific, Red sea, East Africa |
| | *Hypoantherina barnesi* | 5-7 | 8-11 | 1 | 12-17 | 38-47 | W.I.O. |
| | *Hypoantherina temminckii* | 5-7 | 8-10 | 1 | 11-14 | 38-47 | W.I.O. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Aulostomidae | *Aulostomus* sp. | 8-12 | 24-27 | 0 | 26-29 | 62-64 | Indo-Pacific, E.A, Hawaii |
| Blenniidae | *Istiblennius dussumieri* | 12-14 | 19-24 | 2 | 21-25 | 39 | Indo-West Pacific, East Africa |
| | *Parablennius pilicornis* | 11-12 | 18-24 | 2 | 20-25 | 36 | E. Atlantic, W.I.O. |
| | *Aspidontus taeniatus* | 10-12 | 26-28 | 2 | 25-28 | 35 | East Indian Ocean , Pacific Ocean, |
| | *Atrosalarias fuscus* | 11 | 18-20 | 0 | 18-20 | 33-35 | Indian Ocean. Red sea |
| | *Petroscirtes breviceps* | 10-11 | 17-21 | 2 | 17-21 | 34-36 | Indo-West Pacific, East Africa |
| | *Pertoscirtes mitratus* | 10-11 | 14-17 | 2 | 14 | 34-36 | Indo- Pacific, East Africa, Red sea |
| | *Pertoscirtes lupus* | 10-11 | 19-21 | 2 | 18-20 | 35-36 | Western Pacific |
| | *Ecsenius midas* | 13-14 | 19-21 | 2 | 20-23 | 30 | Indo- Pacific |
| | *Exallias brevis* | 12 | 12-13 | 2 | 14-15 | 30 | Indo-Pacific: Red Sea, South Africa |
| | *Meiacanthus mossambicus* | 4-5 | 24-27 | 2 | 15-17 | 34-36 | W.I.O.: East Africa |
| | *Omobranchus elongatus*. | 12-14 | 17-20 | 2 | 21-23 | 36 | W.I.O: East Africa |
| | *Omobranchus mekranensis* | 12 | 20-21 | 2 | 22-23 | 36 | Kilifi, Kenya |
| Bythitidae | *Dinematichthys iluocoeteoides* | | | | | | Eastern Indian Ocean, Western Indian Ocean, Seychelles Islands |
| Callionymidae | *Callionymus marleyi* | 4 | 9 | 0 | 8 | | W.I.O., Red sea, South Africa |
| Carangidae | *Alectis indica* | 6+1 | 18-20 | 2+1 | 15-17 | 24 | Indo-Pacific: Red Sea, East Africa, French Polynesia |
| | *Alectis ciliaris* | 7+1 | 18-20 | 2+1 | 15-17 | 24 | Worldwide in tropical seas |
| | *Alepes djedaba* | 8+1 | 23-25 | 2+1 | 18-20 | 24 | Indo-Pacific: Red Sea and East Africa |
| | *Atule mate* | 8+1 | 22-25 | 2+1 | 18-21 | 24 | Indo-Pacific: Red Sea, East Africa |
| | *Caranx heberi* | 8+1 | 19-21 | 2+1 | 15-17 | 24 | Indo-West Pacific: E.Africa, Madagascar |
| | *Caranx ignobilis* | 8+1 | 18-21 | 2+1 | 15-17 | 24 | Indo-Pacific: Red Sea and East Africa |
| | *Caranx lugubris* | 8+1 | 20-22 | 2+1 | 16-19 | 24 | W.I.O., South Africa |
| | *Caranx melampygus* | 8+1 | 21-24 | 2+1 | 17-21 | 24 | Indo-Pacific: Red Sea and East Africa |
| | *Caranx papuensis* | 8+1 | 21-23 | 2+1 | 16-19 | 24 | Indo-Pacific: Red Sea and East Africa |
| | *Caranx tille* | 8+1 | 20-22 | 2+1 | 16-18 | 24 | Indo-Pacific: Red Sea and East Africa |
| | *Ulua mentalis* | 8+1 | 21-22 | 2+1 | 17-18 | 24 | Indo-West Pacific: E.Africa, Madagascar |
| | *Uraspis secunda* | 8+1 | 27-32 | 2+1 | 19-23 | 24 | Indo-West Pacific: E.Africa, Madagascar |
| | *Carangoides chrysophrys* | 8+1 | 18-20 | 2+1 | 14-17 | 24 | Indo-Pacific: East Africa to Fiji |
| | *Carangoides coeruleopinnatus* | 8+1 | 20-23 | 2+1 | 16-20 | 24 | Indo-West Pacific: East Africa to Samoa |
| | *Carangoides equula* | 8+1 | 23-25 | 2+1 | 21-24 | 24 | Indo-Pacific: Gulf of Oman, East Africa, Japan |
| | *Carangoides malabaricus* | 8+1 | 20-23 | 2+1 | 17-19 | 24 | Indo-West Pacific: East Africa, Sri Lanka |
| | *Carangoides armatus* | 8+1 | 19-22 | 2+1 | 16-18 | 24 | Indo-Pacific: Red Sea and East Africa |
| | *Carangoides ferdau* | 8+1 | 26-34 | 2+1 | 21-26 | 24 | Indo-Pacific: Red Sea and East Africa, South Africa |
| | *Carangoides oblongus* | 8+1 | 20-22 | 2+1 | 18-19 | 24 | Indo-Pacific: Gulf of Aden, E.A, Fiji, Tonga |
| | *Carangoides orthogrammus* | 8+1 | 28-31 | 2+1 | 24-26 | 24 | Indo-Pacific: W.I.O, Austral Islands, Japan |
| | *Carangoides plagiotaenia* | 8+1 | 22-24 | 2+1 | 18-20 | 24 | Indo-Pacific: Red Sea, Gulf of Aden, Sri Lanka, South Africa |
| | *Carangoides fulvoguttatus* | 8+1 | 25-30 | 2+1 | 21-26 | 24 | Indo-West Pacific: Red Sea, East Africa to Palau |
| | *Carangoides gymnostethus* | 8+1 | 28-32 | 2+1 | 24-26 | 24 | Indo-Pacific: W.I.O, Austral Islands, Japan |
| | *Megalaspis cordyla* | 8+1 | 18-20 | 2+1 | 16-17 | 24 | Indo-West Pacific: E.A, Japan and Australia |
| | *Naucrates ductor* | 5-6 | 25-29 | 2+1 | 15-17 | 25 | Circumtropical in tropical seas, West Atlantic |
| | *Decapterus tabl* | 8+1 | 30-31 | 2+1 | 24-25 | 24 | Pacific Ocean: Japan, Indonesia, Australia |
| | *Decapterus macrosoma* | 8+1 | 33 | 2+1 | 27-30 | 24 | Indo-West Pacific: East Africa, Malaysia |
| | *Decapterus kurroides* | 8+1 | 28-29 | 2+1 | 22-25 | 24 | Indo-West Pacific: E.A, Philippines, Japan |

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|---|---|---|---|---|---|---|---|
| | *Decapterus macarellus* | 8+1 | 31-36 | 2+1 | 27-30 | 24 | Circumglobal: Canada, Bermuda, Brazil |
| | *Decapterus ruselli* | 8+1 | 28-31 | 2+1 | 25-28 | 24 | Indo-West Pacific: East Africa to Japan |
| | *Elagatis bipinnulata* | 6+1 | 25-28 | 1+1 | 18-20 | 24 | Western Atlantic: USA, Brazil, Italy |
| | *Gnathadon speciosus* | 7+1 | 18-20 | 2+1 | 15-17 | 24 | Indo-Pacific. Eastern Pacific: Mexico, California |
| | *Pseudocaranx dentex* | 8+1 | 25-26 | 2+1 | 21-22 | 25 | Western Atlantic: USA ,Bermuda, southern Brazil |
| | *Scomberoides lysan* | 6-7+1 | 19-21 | 2+1 | 17-19 | 26 | Indo-Pacific: Red Sea and East Africa to Hawaii |
| | *Scomberoides commersonnianus* | 6-7+1 | 19-21 | 2+1 | 16-19 | 26 | Indo-West Pacific: in tropical waters |
| | *Scomberoides tol* | 6-7+1 | 19-21 | 2+1 | 18-20 | 26 | Indo-West Pacific: S.A to Japan |
| | *Seriola rivoliana* | 7+1 | 27-33 | 2+1 | 18-22 | | Indo-West Pacific: Kenya south to South Africa |
| | *Seriolina nigrofasciata* | 7-8 +1 | 30-37 | 1+1 | 15-18 | 24 | Indo-West Pacific: Red Sea and East Africa, Japan |
| | *Trachinotus bailloni* | 6+1 | 20-24 | 2+1 | 20-24 | 24 | Indo-Pacific: Red Sea, Japan |
| | *Trachinotus blochii* | 6+1 | 18-20 | 2 | 16-18 | 24 | Indo-Pacific: Red Sea, E.A, Japan, Australia |
| | *Trachinotus bolta* | 6+1 | 22-24 | 2+1 | 19-22 | 24 | Indian Ocean: Somalia, Kenya, S.A, Madagascar |
| | *Trachurusindicus* | 8+1 | 28-35 | 2+1 | 24-30 | 24 | W.I.O.: Pakistan, Somalia |
| | *Selar crumenophthalmus* | 8+1 | 24-27 | 2+1 | 21-23 | 24 | Indo-Pacific: East Africa, S. Japan, Hawaii |
| Cynoglossidae | *Cynoglossus acaudatus* | 0 | 108-110 | 0 | 86-87 | 52-53 | W.I.O.: Somalia , S.A, Seychelles |
| | *Cynoglossus lachneri* | 0 | 113-121 | 0 | 92-98 | 55-58 | Red Sea, Gulf of Oman, and E.A, Mozambique,S.A |
| | *Cynoglossus durbanensis* | 0 | 98-105 | 0 | 78-84 | 43-66 | Kenya, South Africa, Zanzibar and Madagascar |
| | *Cynoglossus zanzibariensis* | 0 | 116-124 | 0 | 92-103 | 43-66 | Kenya, South Africa, Namibia |
| | *Paraplagusia bilineata* | 0 | 99-115 | 0 | 72 - 89 | 50 | Indo-Pacific: Red Sea, East Africa, Philippines |
| Dactylopteridae | *Dactyloptena orientalis* | 7 | 9 | 0 | 6-7 | 22 | Indo-Pacific: Red Sea, East Africa, Hawaii |
| Exocoetidae | *Cheilopogon atrisignis* | 0 | 14-16 | 0 | 9-11 | 42-46 | Indo-West Pacific: East Africa |
| | *Cheilopogon cyanopterus* | 0 | 12-14 | 0 | 9-11 | 42-46 | Indo-West Pacific: East Africa |
| | *Cheilopogon furcatus* | 0 | 12-14 | 0 | 9-11 | 44-46 | Indo-West Pacific: East Africa |
| | *Cheilopogon nigricans* | 0 | 13-15 | 0 | 8-11 | 42-44 | Indo-West Pacific: East Africa |
| | *Cypselurus narseli* | 0 | 10-12 | 0 | 7-9 | | Indo-West Pacific: East Africa |
| | *Cypselurus poecilopterus* | 0 | 11-13 | 0 | 7-9 | 44-46 | Indo-West Pacific: East Africa |
| | *Cypselurus oligolepis* | 0 | 10-12 | 0 | 7-9 | 44 | |
| | *Exocoetus monocirrhus* | 0 | 12-14 | 0 | 12-14 | 40-43 | Indo-Pacific, from East Africa to Central America. |
| | *Parexocoetus branchypterus* | 0 | 12-14 | 0 | 12-14 | 39-40 | Indo-Pacific: East Africa, Red Sea southern Japan, Hawai |
| | *Parexocoetus mento* | 0 | 9-12 | 0 | 10-12 | 35-37 | |
| | *Prognichthys brevipinnis* | 0 | 10-11 | 0 | 8-10 | 41-45 | Indo-Pacific: East Africa to Okinawa, Palau, and Fiji. |
| Gerreidae | *Gerres filamentosus* | 9 | 10-11 | 2-3 | 7-8 | 24 | Indo-Pacific: East Africa and Madagascar to Japan |
| | *Gerres oyena* | 9 | 10 | 3 | 7 | 24 | Indo-Pacific: Red Sea, Persian Gulf and East Africa |
| | *Gerres oblongatus* | 9 | 10 | 3 | 7 | 24 | Indo-Pacific: Red Sea and East Africa, Samoa |
| Gobiesocidae | *Lepadichthys coccinotaenia* | 0 | 11-13 | 0 | 9-11 | 25-54 | W.I.O.: Tanzania, S. Africa, Pakistan |
| *Lepadichthys ctenion* | | 0 | 14 | 0 | 11-12 | 25-54 | W.I.O.: Pakistan |
| | *Lepadichthys erythraeus* | 0 | 17 | 0 | 13 | | W.I.O.: Egypt |
| | *Lepadichthys frenatus* | 0 | 15-17 | 0 | 12-15 | | Western Pacific: southern Japan to Australia |
| | *Lepadichthys lineatus* | 0 | 9-11 | 0 | 8-9 | | Indo-West Pacific: widespread in tropical waters |
| | *Lepadichthys minor* | 0 | 9-10 | 0 | 8 | | W.I.O: Reunion. Pacific Ocean: Indonesia, Tonga |

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| Gobiidae | *Acentrogobius audax* | 5 | 9 | 1 | 9 | 26 | W.I.O.: Mozambique, South Africa |
| | *Amblygobius albimaculatus* | 7 | 13-15 | 1 | 12-14 | 26 | Indo-West Pacific: Red Sea and East Africa, South Africa |
| | *Amoya signatus* | 7 | 8-9 | 1 | 9 | 26 | W.I.O, Mozambique and Reunion |
| | *Asterropteryx semipunctatus* | 7 | 9-11 | 1 | 8-9 | 26 | Indo-Pacific: Red Sea to the Hawaiian |
| | *Istigobius spence* | 7 | 10-11 | 1 | 9-10 | 26 | Indo-Pacific: Mozambique, Kenya, Sri Lanka |
| | *Coryogalops sordida* | 7 | 11-12 | 1 | 9 | | W.I.O: Malindi, Kenya to Inhaca, Mozambique |
| | *Caffrogobius nudiceps* | 7 | 11-12 | 1 | 10-11 | 27 | South-east Atlantic, Namibia, South Africa |
| | *Caffrogobius maculipinnis* | 6+1 | 9 | 1 | 7 | 27 | Red Sea to Mozambique, Seychelles |
| | *Drombus key* | 7 | 9 | 1 | 8 | 27 | W.I.O: Seychelles to Delagoa Bay, Mozambique |
| | *Favonigobius melanobranchus* | 7 | 8-9 | 1 | 8-9 | 26 | Indo-West Pacific, Mediterranean sea |
| | *Favonigobius reichei* | 7 | 8 | 1 | 7-8 | 26 | Indo-West Pacific: East Africa to the Philippines |
| | *Gnatholepis cauerensis* | 7 | 11 | 1 | 10-12 | 26 | Indo-Pacific: South Africa, Indian Ocean islands |
| | *Oligolepis acutipennis* | 7 | 10-11 | 1 | 10-11 | 26 | Indo-West Pacific: Natal, South Africa, Indonesia |
| | *Oligolepis keinensis* | 7 | 11-12 | 1 | 12 | 26 | W.I.O: Mozambique, South Africa, Seychelles |
| | *Oplopomus oplopomus* | 7 | 10 | 1 | 10 | 26 | Indo-Pacific: East Africa, Ryukus Islands |
| | *Oxyurichthys microlepis* | 7 | 12-13 | 1 | 13 | 26 | Indo-West Pacific: Kenya to Transkei, South Africa |
| | *Periopthalmus barbarus* | 11 | 9-12 | 1 | 8-11 | 26 | Africa, West Central Pacific |
| | *Priolepis inhaca* | 7 | 9-10 | 1 | 8 | 26 | Indo-Pacific: East Africa to Taiwan |
| Hemiramphidae | *Hemiramphus far* | 0 | 12-14 | 0 | 10-12 | 56 | Indo-West Pacific: Red Sea, East Africa to Samoa |
| | *Hemiramphus lutkei* | 0 | 12-15 | 0 | 10-13 | 52-57 | Pacific Ocean, Samoa , Japan |
| | *Hyporamphus affinis* | 0 | 14-17 | 0 | 15-19 | 54-59 | Indo-Pacific: Red Sea and East Africa, Australia |
| | *H. dussumieri* | 0 | 14-16 | 0 | 14-16 | 56-60 | Indo-Pacific: Seychelles. Philippines, Hong Kong |
| Labridae | *Anampses lineatus* | 9 | 12 | 3 | 12 | 25 | Indo-West Pacific: Red Sea, South Africa, Bali |
| | *Anampses meleagrides* | 9 | 11-13 | 3 | 11-13 | 25 | Indo-Pacific: Red Sea and East Africa to Samoa |
| | *Anampses caeruleopuncatus* | 9 | 11-13 | 3 | 11-13 | 25 | Indo-Pacific: Red Sea and South Africa, Japan |
| | *Anampses twisti* | 9 | 12 | 3 | 11-13 | 25 | Indo-Pacific: Red Sea to the Tuamoto Islands |
| | *Bodianus anthoides* | 12 | 9-10 | 3 | 10-12 | 28 | Indo-Pacific: Red Sea to South Africa |
| | *Bodianus axillaris* | 12 | 9-10 | 3 | 12-13 | 28 | Indo-Pacific: Red Sea to South Africa |
| | *Bodianus bilunulatus* | 12 | 10 | 3 | 12 | 28 | Indo-West Pacific: E.Africa to Japan, Philippines |
| | *Bodianus leucosticticus* | 12 | 10 | 3 | 12 | 28 | Indo-West Pacific: Somalia, Mozambique, Natal |
| | *Bodianus macrognathos* | 12 | 10 | 3 | 12 | 28 | W.I.O.: Somalia, Kenya, Oman |
| | *Bodianus diana* | 12 | 10 | 3 | 12 | 28 | Indian Ocean: East Africa |
| | *Bodianus opecularis* | 12 | 10 | 3 | 12 | 28 | Indian Ocean: Red Sea, Gulf of Aqaba, Madagascar |
| | *Bodianus trilineatus* | 12 | 10 | 3 | 12 | 28 | W.I.O.: Gulf of Aden, South Africa |
| | *Iniistius pavo* | 9 | 12-13 | 3 | 12-13 | 24 | Indo-Pacific: Red Sea and East Africa, Japan, Hawaii |
| | *Iniistius pentadactylus* | 9 | 12 | 3 | 12-13 | 24 | Indo-Pacific: Red Sea, East Africa. W. Pacific |
| | *Pseudodax moluccanus* | 11 | 12 | 3 | 14 | 28 | Indo-Pacific: Red Sea to South Africa |
| | *Pteragogus flagellifer* | 9 | 10-11 | 3 | 9 | 25 | Indo-West Pacific: Red Sea to South Africa |
| | *Pteragogus pelycus* | 11 | 8-9 | 3 | 8-9 | 25 | W.I.O.: Durban, South Africa |
| | *Cheilinus oxycephalus* | 9-10 | 9-10 | 3 | 8 | 23 | Indo-Pacific: East Africa, Taiwan, Australia |

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| *Cheilinus chlorourus* | 10 | 8-9 | 3 | 8 | 23 | Indo-Pacific: East Africa, Ryukus Islands |
| *Cheilinus. fasciatus* | 9 | 10 | 3 | 8 | 23 | Indo-Pacific: Red Sea and East Africa |
| *Cheilinus trilobatus* | 9 | 10 | 3 | 8 | 23 | Indo-Pacific: East Africa, Tuamoto islands |
| *Cheilinus undulatus* | 9 | 10 | 3 | 8 | 23 | Indo-Pacific: Red Sea to South Africa, Japan |
| *Cheilio inermis* | 9 | 12-14 | 3 | 11-12 | 25 | Indo-Pacific: Red Sea and East Africa |
| *Macropharyngodon bipartitus* | 9 | 11 | 3 | 11 | 25 | W.I.O.: to Natal, South Africa |
| *Labroides dimidiatus* | 9 | 10-11 | 3 | 10 | 25 | Indo-Pacific: Red Sea and East Africa |
| *Stethojulis albovittata* | 9 | 11 | 3 | 11 | 24-25 | W.I.O: Red Sea ,Natal, South Africa |
| *Stethojulis interrupta* | 9 | 11 | 3 | 11 | 24-25 | Indo-West Pacific: Red Sea, East Africa. |
| *Stethojulis strigiventer* | 9 | 11 | 3 | 11 | 24-25 | Indo-Pacific: Red Sea, East Africa, South Africa |
| *Choerodon robustus* | | | | | 27 | Indo-West Pacific: Red Sea, Mozambique |
| *Cirrhilabrus exquistus* | 11 | 8-9 | 3 | 9 | 25 | Indo-Pacific: East Africa to Sodwana Bay, S.A |
| *Coris agyula* | 9 | 12-13 | 3 | 12 | 25 | Indo-Pacific: Red Sea and East Africa |
| *Coris caudimacula* | 9 | 12 | 3 | 12 | 25 | Indian Ocean: Red sea, East London, South Africa |
| *Coris cuvieri* | | | | | 25 | Indian Ocean: Red Sea, Zanzibar and South Africa |
| *Coris formosa* | 9 | 12 | 3 | 12 | 25 | W.I.O.: Red Sea Natal, South Africa |
| *Epibulus insidiator* | 9-10 | 9-11 | 3 | 8-9 | 23 | Indo-Pacific: Red Sea to South Africa |
| *Gomphosus caeruleus* | 8 | 13 | 3 | 11 | 25 | Andaman Sea to East Africa |
| *Halichoeres costmetus* | 9 | 11 | 3 | 11 | 25 | W.I.O.: south to Natal, South Africa |
| *Novaculichthys macrolepidotus* | 9 | 12-14 | 3 | 12-14 | 25 | Indo-West Pacific: Red Sea and East Africa |
| *Novaculichthys taeniourus* | 9 | 12-13 | 3 | 12-13 | 25 | Indo-Pacific: Red Sea to South Africa |
| *Suezichthys russeli* | 9 | 11 | 3 | 10 | 25 | W.I.O.: Red Sea, Indian Ocean |
| *Thalossoma amblycephalum* | 8 | 13 | 3 | 11 | 25 | W.I.O.: Red Sea, Indian Ocean. |
| *Thalossoma hardwicke* | 8 | 12-14 | 3 | 11 | 25 | Indo-Pacific: East Africa, Tuamoto islands |
| *Thalossoma quinquevittatum* | 8 | 12-14 | 3 | 10-12 | 25 | Indo-Pacific: East Africa to the Hawaiian |
| *Thalassoma lunare* | 8 | 13 | 3 | 11 | 25 | Indo-Pacific: Red Sea and East Africa |
| *Thalassoma hebraicum* | 8 | 13 | 3 | 11 | 25 | W.I.O. to Algoa Bay, South Africa |
| *Thalassoma purpureum* | 8 | 12-14 | 3 | 10-12 | 25 | Indo-Pacific: Red sea, East Africa to Hawaii |
| *Thalassoma trilobatum* | 8 | 12-14 | 3 | 10-12 | 25 | Indo-Pacific: East Africa, to the Ryukyu Islands |
| *Halichoeres hortulanus* | 9 | 11 | 3 | 11 | 25 | Indo-Pacific: Red Sea to Sodwana Bay, South Africa |
| *Halichoeres marginatus* | 9 | 13-14 | 3 | 12-13 | 25 | Indo-Pacific: Red Sea to Inhaca Island, Mozambique |
| *Halichoeres nebulosus* | 9 | 11 | 3 | 11 | 25 | Indo-West Pacific: tropical and subtropical I. Ocean |
| *Halichoeres nigrescens* | 9 | 12 | 3 | 12 | 25 | Indo-West Pacific: Durban, India, Philippines |
| *Halichoeres scapularis* | 9 | 11 | 3 | 11 | 25 | Indo-West Pacific: Red Sea and East Africa |
| *Halichoeres fasciatus* | 9 | 10-11 | 3 | 11 | 25 | Indo-Pacific: Red Sea, Inhaca Island, Mozambique |
| *Halichoeres melapterus* | 9 | 10-11 | 3 | 11 | 25 | Indo-Pacific: Red Sea and East Africa to Micronesia |
| *Hologymnosus annulatus* | 9 | 12 | 3 | 12 | 25 | Indo-Pacific: Red Sea and South Africa |
| *Hologymnosus doliatus* | 9 | 12 | 3 | 12 | 25 | Indo-Pacific: East Africa, Natal, South Africa |
| *Oxycheilinus bimaculatus* | 9 | 10-11 | 3 | 8 | 25 | Indo-Pacific: East Africa, Hawaii, southern Japan |
| *Oxychelinus digramma* | 9 | 10 | 3 | 8-11 | 25 | Indo-Pacific: Red Sea, East Africa, Samoa |

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| Latidae | *Lates calcarifer* | 7-9 | 10-11 | 3 | 7-8 | 24 | Indo-West Pacific: |
| Lobotidae | *Lobotes surinamensis* | 11-12 | 15-16 | 3 | 11-12 | 27 | Tropical and subtropical waters of all oceans |
| Lutjanidae | *Aphareus furca* | 10 | 10-11 | 3 | 8 | 24 | Indo-Pacific: East Africa to the Hawaiian Islands |
| | *Aphareus rutilans* | 10 | 10-11 | 3 | 8 | 24 | Indo-Pacific: East Africa to the Hawaiian Islands |
| | *Aprion virescens* | 10 | 11 | 3 | 8 | 24 | Indo-Pacific: East Africa to the Hawaiian Islands |
| | *Etelis carbunculus* | 10 | 11 | 3 | 8 | 24 | Indo-Pacific: East Africa to the Hawaiian Islands |
| | *Etelis coruscans* | 10 | 11 | 3 | 8 | 24 | Indo-Pacific: East Africa up to the Hawaii |
| | *Lutjanus argentimaculatus* | 10 | 13-14 | 3 | 7-8 | 24 | Indo-West Pacific: East Africa to Samoa |
| | *Lutjanus bengalensis* | 11-12 | 12-14 | 3 | 8 | 24 | Indian Ocean: Red Sea and East Africa to Sumatra. |
| | *Lutjanus bohar* | 10 | 13-14 | 3 | 8 | 24 | Indo-Pacific: East Africa, Ryukyu Islands |
| | *Lutjanus ehrenbergii* | 10 | 13-14 | 3 | 7-9 | 24 | Indo-West Pacific: Red Sea and East Africa |
| | *Lutjanus fulviflamma* | 10 | 12-14 | 3 | 8 | 24 | Indo-Pacific: Red Sea , East Africa to Samoa |
| | *Lutjanus fulvus* | 10 | 13-14 | 3 | 8 | 24 | Indo-Pacific: East Africa, Japan to Australia |
| | *Lutjanus gibbus* | 10 | 13-14 | 3 | 8 | 24 | Indo-Pacific: Red Sea , East Africa, Japan, Australia |
| | *Lutjanus johnii* | 10 | 13-14 | 3 | 8 | 24 | Indo-West Pacific: East Africa, Fiji, Ryukyus Island |
| | *Lutjanus kasmira* | 10 | 14-15 | 3 | 7-8 | 24 | Indo-Pacific: Red Sea and East Africa, Japan |
| | *Lutjanus lutjanus* | 10-12 | 12 | 3 | 8 | 24 | Indo-West Pacific: East Africa, Solomon Islands |
| | *Lutjanus monostigma* | 10 | 13-14 | 3 | 8-9 | 24 | Indo-Pacific: East Africa to the Marquesas |
| | *Lutjanus rivulatus* | 10 | 15-16 | 3 | 8 | 24 | Indo-Pacific: East Africa to Tahiti, Japan |
| | *Lutjanus russellii* | 10 | 14 | 3 | 8 | 24 | Indo-West Pacific: East Africa, Fiji, Japan, Australia |
| | *Lutjanus sanguineus* | 10 | 13-14 | 3 | 8-9 | 24 | W.I.O.: Red Sea, Arabian Sea, South Africa |
| | *Lutjanus sebae* | 11 | 15-16 | 3 | 10 | 24 | Indo-West Pacific: Red Sea, East Africa, New Caledonia |
| | *Macolor niger* | 9-10 | 13-15 | 3 | 10-11 | 24 | Indo-Pacific: East Africa, Samoa, Japan, to Australia. |
| | *Paracaesio xanthura* | 10 | 10-11 | 3 | 8-9 | 24 | Indo-Pacific: East Africa to the Austral Islands |
| | *Pinjalo pinjalo* | 11 | 13-15 | 3 | 8-10 | 24 | Indo-West Pacific: Persian Gulf to the Gulf of Papua |
| | *Pristipomoides filamentosus* | 10 | 12 | 3 | 8 | 24 | Indo-Pacific: East Africa, Hawaii, Tahiti, southern Japan |
| | *Pristipomoides sieboldii* | 10 | 12 | 3 | 8 | 24 | Indo-Pacific: East Africa, Hawaii, Tahiti, southern Japan |
| | *Pristipomoides zonatus* | 10 | 10-11 | 3 | 8 | 24 | Indo-Pacific: East Africa, Hawaii, Tahiti, southern Japan |
| Monacanthidae | *Paramonacanthus frenatus* | 0 | 24-26 | 0 | 25-28 | 19 | W.I.O.: Kenya, S.A, Seychelles |
| Monodactylidae | *Monodactylus argenteus* | 7-8 | 27-31 | 3 | 27-32 | 24 | Indo-West Pacific: Red Sea and East Africa, Samoa |
| | *Monodactylus falciformis* | 8 | 25-30 | 3 | 25-29 | 24 | W.I.O, Red Sea, S.A, Madagascar, and Reunion |
| Nomeidae | *Cubiceps paucciradiatus* | 10-13 | 15-17 | 2 | 14-16 | 31-32 | W.I.O, Kenya |
| | *Cubiceps whiteleggi* | 11-13 | 18-21 | 2-3 | 17-20 | 31-32 | W.I.O, Kenya |

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| Platycephalidae | *Papilloculiceps longiceps* | 9 | 11 | 0 | 11 | 27 | W.I.O, Red Sea, South Africa and Madagascar |
| | *Platycephalus indicus* | 9-10 | 13 | 0 | 13 | 27 | Indo-West Pacific: Red Sea, East Africa, Philippines |
| | *Sorsogona prionota* | 9 | 12 | 0 | 12-13 | 27 | W.I.O, Delagoa Bay, Karachi and Red Sea |
| | *Cociella crocodila* | 9 | 11 | 0 | 11 | 27 | W.I.O, Kenya |
| | *Rogadius pristriger* | 9 | 10 | 0 | 12 | 27 | W.I.O, Kenya |
| | *Thysanophrys chiltonae* | 9 | 11-13 | 0 | 11 | 27 | W.I.O, Kenya |
| Scaridae | *Calotomus carolinus* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific , Eastern Pacific, East Africa |
| | *Calotomus spinidens* | 9 | 10 | 3 | 9 | 25 | Indo-West Pacific: Kenya, Delagoa Bay, Mozambique |
| | *Chlorurus atrilunula* | | | | | 25 | W.I.O, Kenya, South Africa |
| | *Chlorurus sordidus* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: Red Sea south to Natal, South Africa |
| | *Leptoscarus vaigiensis* | 9-10 | 10 | 3 | 9 | 25 | Indo-Pacific: Red Sea, South Africa, Japan |
| | *Scarus niger* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: Red Sea, South Africa, Japan, W. Australia |
| | *Scarus caudofasciatus* | 9 | 10 | 3 | 9 | 25 | W.I.O.: Red Sea to South Africa |
| | *Scarus globiceps* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: East Africa, Australia |
| | *Scarus psittacus* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: Red Sea, South Africa Hawaii |
| | *Scarus russelii* | 9 | 10 | 3 | 9 | 25 | W.I.O: East Africa, Madagascar, Seychelles, Mauritius |
| | *Scarus scaber* | 9 | 10 | 3 | 9 | 25 | W.I.O: East Africa, south to Natal, South Africa |
| | *Scarus tricolor* | 9 | 10 | 3 | 9 | 25 | W.I.O: East Africa, Madagascar, Seychelles, Mauritius |
| | *Scarus falcipinnis* | 9 | 10 | 3 | 9 | 25 | W.I.O: Oman, Mozambique, Seychelles, and Mauritius |
| | *Scarus ghobban* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: Red Sea, S. Africa, Japan, Australia |
| | *Scarus viridifucatus* | 9 | 10 | 3 | 9 | 25 | W.I.O: East Africa, Madagascar, Seychelles, Maldives |
| | *Bolbometon muricatum* | 9 | 10 | 3 | 9 | 25 | W.I.O: Kenya |
| | *Cetoscarus bicolor* | 9 | 10 | 3 | 9 | 25 | W.I.O: Kenya |
| | *Hipposcarus harid* | 9 | 10 | 3 | 9 | 25 | W.I.O: Kenya |
| | *Scarus festivus* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: East Africa, north to the Ryukyu Islands |
| | *Scarus frenatus* | 9 | 10 | 3 | 9 | 25 | Indo-Pacific: Red Sea, southern Japan, western Australia |
| Schindleriidae | *Schindleria praematura* | - | 15-22 | - | 11-18 | 44 | W. Pacific: Japan, South China Sea, Papua New Guinea |
| Sciaenidae | *Johnius amblycephalus* | 11 | 23-26 | 2 | 7 | 24-25 | Indo-West Pacific: Pakistan, Indian Ocean, Australia |
| | *Johnius dussumieri* | 11 | 23-26 | 2 | 7 | 24-25 | Indian Ocean: Pakistan to the Andaman Islands |
| | *Otolithes ruber* | 10-11 | 27-30 | 2 | 7-8 | 25 | Indo-West Pacific: East Africa, Madagascar,Australia |
| | *Umbrina canariensis* | 11 | 25-29 | 2 | 7 | 25 | Eastern Atlantic: South Africa, W.I.O |
| | *Umbrina ronchus* | 11 | 23-26 | 2 | 7 | 25 | Eastern Atlantic, W.I.O, western Mediterranean |
| Scomberesocidae | *Scomberesox simulans* | 0 | 14-16 | 0 | 17-20 | 62 | S. Atlantic, N. Atlantic to eastern Indian Ocean |
| Scombridae | *Auxis rochei rochei* | 9-12 | 10-13 | 0 | 12-14 | 39 | Atlantic, Indian and Pacific, the Mediterranean Sea |
| | *Auxis thazard thazard* | 10-12 | 10-13 | 0 | 10-14 | 39 | Atlantic, Indian and Pacific, the Mediterranean Sea |
| | *Euthynnus affinis* | 11-14 | - | 0 | 13-14 | 39 | Indo-West Pacific: oceanic islands and archipelagos |

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|---|---|---|---|---|---|---|---|
| | *Katsuwonus pelamis* | 14-16 | 14-15 | 0 | 14-15 | 41 | Tropical and warm-temperate waters |
| | *Rastrelliger kanagurta* | 8-11 | 12 | 0 | 12 | 41 | Indo-West Pacific: Red Sea and East Africa to Indonesia |
| | *Sarda orientalis* | 17-19 | - | 0 | 14-16 | 44-45 | Indo-Pacific:Eastern Pacific, Hawaiian Islands |
| | *Scomberomorus commerson* | 15-18 | 15-20 | 0 | 16-21 | 42-46 | Indo-West Pacific: Red Sea, S. Africa, S.E Asia, China |
| | *Scomberomorus plurilineatus* | 15-17 | 19-21 | 0 | 19-22 | 45-46 | W.I.O.: Seychelles, Kenya, Zanzibar. South Africa |
| | *Thunnus alalunga* | 11-14 | 12-16 | 0 | 11-16 | 39 | Tropical and temperate waters of all oceans |
| | *Thunnus obesus* | 13-14 | 14-15 | 0 | 14 | 39 | Atlantic, Indian, Pacific: tropical and subtropical waters |
| Scombrolabracidae | *Scombrolabrax heterolepis* | 12 | 14-16 | 2-3 | 16-18 | 30 | Atlantic, Indian and Pacific: widespread in tropical and subtropical areas |
| Scorpaenidae | *Dendrochirus brachypterus* | 13 | 9-10 | 3 | 5-6 | 24 | Indo-West Pacific: Red Sea, East Africa, Samoa ,Tonga |
| | *Dendrochirus zebra* | 13 | 10-11 | 3 | 6-7 | 24 | Indo-West Pacific: Red Sea, East Africa, Samoa, Japan |
| | *Parascorpaena mossambica* | 12 | 9 | 3 | 5 | - | Indo-Pacific: East Africa, south to Australia |
| | *Pterois antennata* | 13 | 11-12 | 3 | 6 | 24 | Indo-Pacific: East Africa, Japan , Australia |
| | *Pterois miles* | 13 | 9-10 | 3 | 6-7 | 24 | Indian Ocean: Red Sea, South Africa, Indonesia |
| | *Pterois mombasae* | 13 | 10 | 3 | 6-7 | 24 | Indo-West Pacific: S. Africa, Sri Lanka, India |
| | *Pterois radiata* | 12-13 | 11 | 3 | 5-6 | 24 | Indo-Pacific: Red Sea, S. Africa, Japan |
| | *Pterois russelii* | 13 | | 3 | | 24 | Indo-Pacific: Persian Gulf, E. Africa, New Guinea |
| | *Scorpaena scrofa* | 12 | 9 | 3 | 5 | 24-25 | E. Atlantic: British Isles, Senegal, Madeira, Canary Is. |
| | *Scorpaenodes corallinus* | 13 | 8 | 3 | 5 | 24 | Indo-Pacific: East Africa to French Polynesia |
| | *Scorpaenodes guamensis* | 13-14 | 7-9 | 3 | 4-5 | 24 | Indo-Pacific: Red Sea, East Africa, Australia |
| | *Scorpaenodes tribulosus* | 13 | 8 | 3 | 5 | 24 | W.I.O.: Somalia and Kenya |
| | *Scorpaenopsis diabolus* | 12 | 8-10 | 3 | 5-6 | 24 | Indo-Pacific: Red Sea, East Africa, Hawaiian Islands |
| | *Scorpaenopsis gibbosa* | 12 | 9 | 3 | 5 | 24 | W.I.O.: Kenya and Mozambique |
| | *Sebastapistes strongia* | 12 | 8-9 | 3 | 5 | - | Indo-Pacific: Red Sea and East Africa, S. Australia |
| Serranidae | *Aporops bilinearis* | 7 | 23-25 | 3 | 19-21 | 24-26 | Indo-Pacific and Western Central Pacific |
| | *Cephalopholis argus* | 9 | 15-17 | 3 | 9 | 24 | Indo-Pacific: Red Sea, South Africa, to French Polynesia |
| | *Cephalopholis boenak* | 9 | 15-17 | 3 | 8 | 24 | Indo-West Pacific: Kenya, Mozambique, western Pacific |
| | *Cephalopholis leopardus* | 9 | 13-14 | 3 | 9-10 | 24 | Indo-Pacific: East Africa, Ryukyu Islands, S. Australia |
| | *Cephalopholis miniata* | 9 | 14-15 | 3 | 8-9 | 24 | Indo-Pacific: Red Sea to Durban, South Africa |
| | *Cephalopholis sexmaculata* | 9 | 14-16 | 3 | 9 | 24 | Indo-Pacific: Red Sea , South Africa, French Polynesia |
| | *Cephalopholis sonnerati* | 9 | 14-16 | 3 | 9 | 24 | Indo-Pacific: E. Africa, S. Japan, S. Australia |
| | *Cephalopholis urodeta* | 9 | 14-16 | 3 | 8-9 | 24 | Indo-Pacific: Kenya, South Africa, to French Polynesia |
| | *Cromileptes altivelis* | 0 | 17-19 | 3 | 9-10 | 24 | Western Pacific: Japan, Palau, Australia, E. Indian Ocean |
| | *Dermatolepis striolata* | 11 | 18-19 | 3 | 9-10 | 24-26 | W.I.O, Oman, Madagascar, Kenya, South Africa |

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|---|---|---|---|---|---|---|
| *Epinephelus areolatus* | 11 | 15-17 | 3 | 8 | 24 | Indo-Pacific: Red Sea, Persian Gulf, S.Africa, Fiji |
| *Epinephelus chabaudi* | 11 | 13-14 | 3 | 8-9 | 24 | W.I.O: Kenya,, South Africa and the Kerala coast of India |
| *Epinephelus chlorostigma* | 11 | 16-18 | 3 | 8 | 24 | Indo-Pacific: Red Sea, S. Africa, western Pacific |
| *Epinephelus coeruleopunctatus* | 11 | 15-17 | 3 | 8 | 24 | Indo-Pacific: East Africa, S.Africa and east to Fiji |
| *Epinephelus coioides* | 11 | 13-16 | 3 | 8 | 24 | Indo-West Pacific: Red Sea, S. Africa, Palau and Fiji |
| *Epinephelus epistictus* | 11 | 14-15 | 3 | 8 | 24 | Indo-West Pacific: Red Sea, Kenya, S. Africa; Oman, India |
| *Epinephelus fasciatus* | 11 | 15-17 | 3 | 8 | 24 | Indo-Pacific: Red Sea , South Africa, S. Australia |
| *Epinephelus flavocaeruleus* | 11 | 16-17 | 3 | 8 | 24 | Indian Ocean: Gulf of Aden, South Africa, W.I.O. |
| *Epinephelus hexagonatus* | 11 | 15-17 | 3 | 8 | 24 | Indo-West Pacific: Kenyan coast north of Kilifi Creek |
| *Epinephelus lanceolatus* | 11 | 14-16 | 3 | 8 | 24 | Indo-Pacific: Red Sea, S. Africa to the Hawaiian Islands |
| *Epinephelus longispinis* | 11 | 16-17 | 3 | 8 | 24 | Indo-West Pacific: Kenya to South Africa |
| *Epinephelus macrospilos* | 11 | 15-17 | 3 | 8 | 24 | Indo-Pacific: Kenya, South Africa, central Pacific |
| *Epinephelus malabaricus* | 11 | 14-16 | 3 | 8 | 24 | Indo-Pacific: Red Sea, East Africa, Tonga, Japan, Australia |
| *Epinephelus merra* | 11 | 15=17 | 3 | 8 | 24 | Indo-Pacific: South Africa to French Polynesia |
| *Epinephelus morrhua* | 11 | 14-15 | 3 | 7-8 | 24 | Indo-Pacific: Red Sea and East Africa to the central Pacific |
| *Epinephelus multinotatus* | 11 | 15-17 | 3 | 8 | 24 | Indian Ocean: Persian Gulf, Mozambique, W. Australia |
| *Epinephelus ongus* | 11 | 14-16 | 3 | 8 | 24 | Indo-West Pacific: East Africa, Japan, Fiji, New Caledonia |
| *Epinephelus poecilonotus* | 11 | 14-15 | 3 | 8 | 24 | Indo-West Pacific: E. Africa, Japan, Korea, S. China, Fiji |
| *Epinephelus rivulatus* | 11 | 16-18 | 3 | 8 | 24 | Indo-West Pacific: East Africa to the western Pacific |
| *Epinephelus tukula* | 11 | 14-15 | 3 | 8 | 24 | Indo-West Pacific: Red Sea, E. Africa, Japan, Australia |
| *Mycteroperca acutirostris* | 11 | 15-17 | 3 | 8 | 24 | Western Atlantic: Bermuda, Gulf of Mexico to Brazil |
| *Grammistes sexlineatus* | 7 | 13-14 | 2 | 9 | 24 | Indo-Pacific: Red Sea,S.Japan, south to New Zealand |
| *Hyporthodus octofasciatus* | 11 | 14-15 | 3 | 9 | 24-26 | Indo-West Pacific: Somalia and S. Africa, Japan, Australia |
| *Liopropoma africanum* | - | - | - | - | 24 | Indian Ocean: Pemba Island, Tanzania to Djibouti |
| *Liopropoma susumi* | 8 | 11-12 | 3 | 8 | 24 | Indo-Pacific: Red Sea, Samoa, Japan, Reunion |
| *Odontanthias caudicinctus* | 10 | 14 | 3 | 7-8 | 24-26 | Southeast Atlantic and W.I.O, S. Africa, Kenya |
| *Plectranthias longimanus* | 10 | 13-14 | 3 | 6-7 | 26 | Indo-West Pacific: East Africa, Fiji, Japan, Australia |
| *Plectranthias morgansi* | 10 | 13-15 | 3 | 7 | 24-26 | W.I.O.: off Kenya and South Africa |
| *Pseudanthias cooperi* | 10 | 15-17 | 3 | 7-8 | 24-26 | Indo-Pacific: East Africa to Samoa, Australia |
| *Pseudanthias evansi* | 10-11 | 16-18 | 3 | 8 | 24-26 | Indian Ocean: East Africa, Cocos-Keeling, Christmas Is. |
| *Pseudanthias squamipinnis* | 10 | 15-17 | 3 | 6-7 | 24-26 | Indo-West Pacific: Red Sea, S. Africa, Japan, Australia |
| *Plectropomus laevis* | -8 | 10-12 | 3 | 8 | 24-26 | Indo-Pacific: Kenya to Delagoa Bay, Mozambique |
| *Plectropomus punctatus* | 7-8 | 10-12 | 3 | 8 | 24-26 | W.I.O: Kenya, S. A. Comoros, Madagascar, Seychelles |

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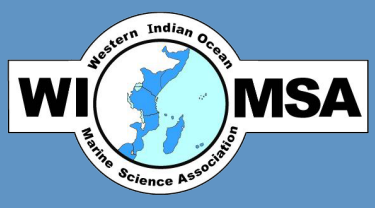
|---|---|---|---|---|---|---|---|
| | *Pseudogramma polyacantha* | 7-8 | 19-22 | 3 | 15-18 | 25-27 | Indo-Pacific: East Africa, S. Japan, Hawaiian Islands |
| | *Variola louti* | 9 | 13-14 | 3 | 8 | 24 | Indo-Pacific: Red Sea, S. Africa, Japan, Australia |
| Siganidae | *Siganus luridus* | 13-14 | 10 | 7 | 9 | 23 | W.I.O.: Red Sea and East Africa |
| | *Siganus stellatus* | 13 | 10 | 7 | 9 | 23 | Indian Ocean: Red Sea, East Africa to the Andaman Sea. |
| | *Siganus sutor* | 13-14 | 10 | 7 | 9-10 | 23 | W.I.O.: Kenya to Knysna, South Africa |
| Soleidae | *Pardachirus marmoratus* | 0 | 63-74 | 0 | 44-55 | 37-39 | W.I.O: Red Sea, Persian Gulf, South Africa and Sri Lanka |
| | *Pardachirus morrowi* | 0 | 73-81 | 0 | 53-62 | 41-42 | W.I.O.: Kenya, South Africa |
| Sphyraenidae | *Sphyraena barracuda* | 6 | 9 | 1 | 10 | 24 | Indo-Pacific: Red Sea and east coast of Africa to Hawaii |
| | *Sphyraena chrysotaenia* | 6 | 9-10 | 2 | 9 | 24 | Indo-Pacific. Mediterranean |
| | *Sphyraena flavicauda* | 6 | 9 | 2 | 9 | 24 | Indo-West Pacific: Red Sea, Samoa, Japan |
| | *Sphyraena jello* | 6 | 9 | 2 | 7-9 | 24 | Indo-West Pacific: Red Sea, S.Africa |
| Syngnathidae | *Syngnathus acus* | 0 | 48 | 0 | 3 | 43 | W.I.O.: Kenya |
| Terapontidae | *Terapon jarbua* | 11-12 | 9-11 | 3 | 7-10 | 25 | Indo-Pacific: Red Sea, East Africa, Samoa, southern Japan |
| | *Terapon puta* | 11-12 | 9-11 | 3 | 8-9 | 25 | Indo-West Pacific: N. Indian Ocean |
| | *Terapon theraps* | 11-12 | 9-11 | 3 | 7-9 | 25 | Indo-West Pacific: East Africa, Madagascar, Seychelles |
| | *Pelates quadrilineatus* | 12-13 | 8-11 | 3 | 9-11 | 25 | Indo-West Pacific: Red Sea, East Africa to southern Japan |
| Tetraodontidae | *Arothron immaculatus* | 0 | 9-11 | 0 | 9-17 | | Indo-West Pacific: Red Sea and East Africa |
| | *Canthigaster bennetti* | 0 | 9-11 | 0 | 8-10 | 44 | Indo-Pacific: East Africa south to Port Alfred, South Africa |
| | *Canthigaster cyanospilota* | 0 | 9-10 | 0 | 8-9 | 44 | W.I.O: Indian Ocean, Red Sea, Gulf of Aqaba |
| | *Canthigaster janthinoptera* | 0 | 9-10 | 0 | 9-10 | 44 | Indo-Pacific: East Africa south to Transkei, South Africa |
| | *Canthigaster margaritata* | 0 | 9-10 | 0 | 9-10 | 44 | Indo-West Pacific: Red Sea, Inhaca Island in Mozambique |
| | *Chelonodon patoca* | 0 | 9-10 | 0 | 8-10 | 44 | Indo-Pacific: East Africa, Trobiand Islands, north to China |
| | *Torquigener flavimaculosus* | 0 | 9 | 0 | 7-8 | 44 | W.I.O.: northern Red Sea and Kenya |
| | *Torquigener hypselogeneion* | 0 | 8-9 | 0 | 7-8 | 44 | Indo-Pacific: Knysna, South Africa, Samoa, Japan |
| Trichonotidae | *Trichonotonus* sp. | 6-7 | 40-45 | - | 36-40 | 55 | Indo-Pacific |

(Sources: Anam and Mostarda (2012), Richmond (2002), Smith and Heemstra (1998), Bock (1972), Bock, (1978), www,fishbase.org)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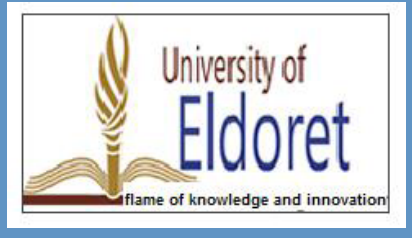
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