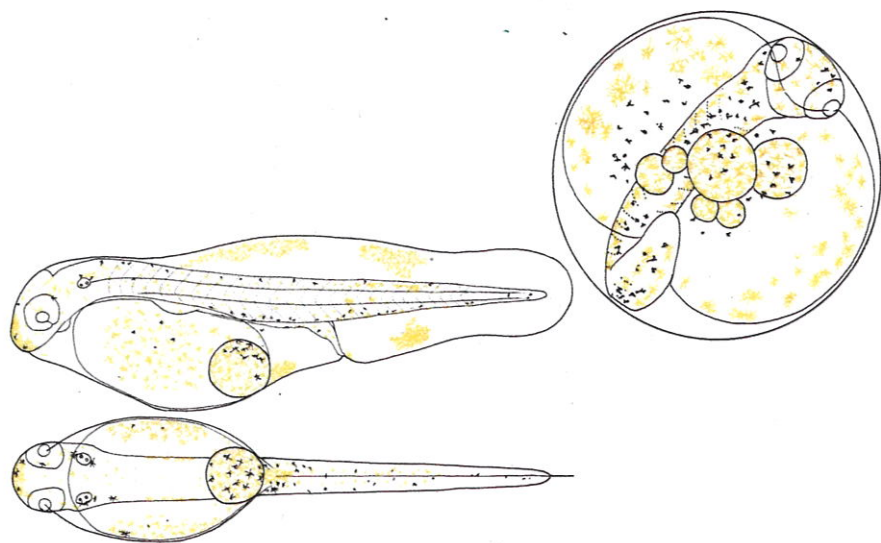
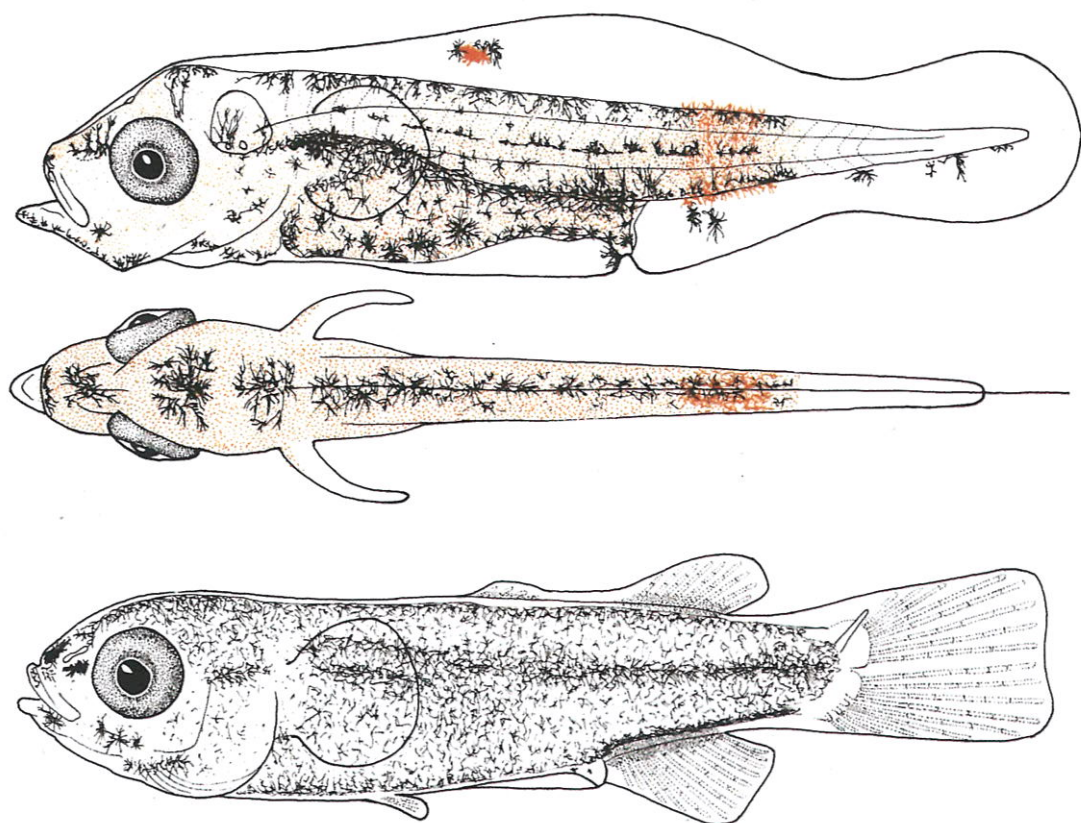




EARLY STAGES OF MARINE FISHES OCCURRING IN THE IBERIAN PENINSULA



Pedro Ré & Isabel Meneses

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INTRODUCTION

This guide is intended for the identification of the Early Life History (ELH) stages of fishes collected by plankton nets from the marine and estuarine waters of the Iberian Peninsula (Eastern North Atlantic Ocean). The coverage area extends from latitude 34°-45° north, to longitude 6°-14° west.

The basic characteristics of the eggs and larvae of 104 species belonging to 45 families are described. The emphasis has been placed on the most diagnostic or easily observed characters in order to facilitate comparisons between taxa.

The descriptive accounts of this guide follow the format of previous ELH guides: Fahay (1983), Moser (1996) and Richards (2005). Nomenclature follows Eschmeyer (1998) except for more recent changes. Within families, genera are listed in alphabetical order.

Species descriptions are given only for species for which some ELH stages are known. Each species account includes the same basic information (written information on the left hand page and figures on the facing right hand page). Written information includes meristic data (fin-ray counts in adults and myomere counts), life history information (range, habitat, spawning season, ELH pattern), main references and ELH descriptions (eggs and larvae). Measurements of larvae usually refer to standard lengths. Many published illustrations have been redrawn mainly to provide certain uniformity throughout the guide. Sources of illustrations are given for every Plate.

The contents of the present guide represent the current knowledge on the development of ELH stages of fishes occurring in coastal waters of the Iberian Peninsula. The authors have been involved, for more than 25 years, in ichthyoplankton research.

HISTORICAL BACKGROUND

In 1865 G.O. Sars (1837-1927) was asked by the Norwegian authorities to study the biology of *Gadus morhua* in order to understand the fluctuations of cod fisheries in the Lofoten area. Sars carefully studied, for the first time, the complete life history of cod, from pelagic eggs and pelagic larvae to juveniles and adults. The pioneer work of Sars stimulated interest in pelagic fish eggs and larvae. Soon it was realized that most species of commercial interest had planktonic eggs and larvae.

Systematic sampling of fish eggs was initiated by the German planktonologist Vitor Hensen (1835-1924). Hensen devised special plankton nets to capture pelagic fish eggs in a quantitative way. During the last two decades of the 19th century, fish eggs and early larvae were reared under controlled conditions to determine the main characters that would permit their identification in plankton samples. This early work was mainly pursued in England, Italy and Germany. Among these pioneers were J.T. Cunningham, E.W.L. Holt, W.C. McIntosh, W.C. Prince, A.T. Masterman in the United Kingdom, C. Emery, L. Facciola, F. Raffaele in Italy and E. Ehrenbaum, FR. Heincke in Germany.

Older stages of fish larvae were seldom obtained by rearing fish eggs. The improvement of plankton nets and research vessels was a major step forward in the early 20th century. German researchers (V. Hensen, C. Apstein) were responsible for most of the early work on performance and quantification of plankton nets. C.G.J. Petersen in Denmark designed a very effective young fish trawl.

E. Ehrenbaum (1861-1942) published a comprehensive account of these studies that became a standard reference for the identification of early life history stages of marine fish in the North-eastern Atlantic. This book was published in two volumes, one dated 1905 and the other 1909 (Ehrenbaum, 1905-1909).

A series of papers published by C.G.J. Petersen and J. Schmidt emerged from the cooperative research undertaken by the research steamer "Thor" off Iceland and the Faeroe Islands in 1903 and 1904. Petersen described the early life history stages of flatfishes (Petersen 1904, 1906, 1909). Schmidt dealt mainly with the genus *Gadus* (Schmidt, 1905, 1906, 1907). The later contributions are landmarks even by present standards. Schmidt (1905) gives an excellent description of his technique for describing the early life history stages:

"The order of procedure has been, to begin with such older stages as were so far developed, that they could be identified from characters similar to those which mark the adult fish. Then, earlier and still earlier stages were taken and compared with the older, and the determinations were in this manner, if the material was rich enough, successfully carried down to the youngest, post-larval stages, attention being directed to certain outstanding characters whose successive development could be followed through the development series. The method thus employed for the determination of the unknown, pelagic fish-young might be called the series-method and it stands in contrast to the hatching-method in that, instead of making certain starting-point with the egg and following its further development, it begins at the opposite end and follows the development backwards. The condition for being able to use the series-method is, that a large material has to be at disposal, but in such cases it will lead to certain results, especially if the material contains whole series of the species".

Schmidt used for the first time meristic counts especially of anal and dorsal fins to verify each series. The pigmentation pattern was also extensively used for discriminating among the described gadoid species. J. Schmidt is also well known for his work on the European eel, especially for establishing its breeding ground (Schmidt, 1923).

The Danish researcher A.V. Tåning described a great number of larval myctophids and sternoptychids (Tåning, 1918, Jespersen and Tåning, 1926). His larval studies of myctophids preceded his major contribution in adult taxonomy. V. Ege made very important contributions on larvae of meso- and bathypelagic species (Ege, 1918, 1930, 1953, 1957). Bertelsen (1951) was the first author to include larval characters in the clarification of the taxonomy of ceratioid fishes.

A few ichthyoplanktonologists are well known for their collective works. L. Sanzo published 65 contributions between 1905 and 1940 that lead to the publication of the monograph "Uova, larve e stadî giovanili di Teleostei" that appeared in the series "Fauna e Flora del Golfo di Napoli". This monograph was published over a 25-year period in four volumes. The monograph used extensively the material sampled by Lo Bianco, however his name does not appear as author of any section (Bertolini *et al.* 1931-1956).

The study of fish eggs and larvae can thus be roughly divided into two major periods: (i) rearing work for the description of early developmental stages, non quantitative sampling at sea mainly for studies of identification, life history and overall distribution of eggs and early larvae; (ii) quantitative surveys for estimations of abundance as a measure of parent stock size and subsequent recruitment, studies on the ecology of fish eggs and larvae at sea and experimental contributions to the physiology of the early life history stages.

There are perhaps three principal reasons why ichthyoplankton surveys are made: (i) Surveys are often directed towards a single target species (or a group of closely related species) in order to use the distribution and abundance of the pelagic eggs to obtain an estimate of the biomass of the adult spawning population; (ii) Larvae of the target species are studied in order to estimate the success of the year brood resulting from its spawn and hopefully to understand the factors underlying fluctuations e survival; (iii) Surveys are also used to evaluate fish resources in general. The plankton net collects the eggs and larvae of all kinds of fishes with pelagic eggs and/or larval stages. It provides important information on exploited as well as unexploited resources. With few exceptions, it provides information on the whole spectrum of fish in the area being surveyed (Ahlstrom and Moser, 1976).

As mentioned before, field investigations of fish eggs and larvae originated in the late 1800s. The motivations for investigations have changed little over this period, being mainly the assessment of adult spawning biomass and distribution, and the desire to understand how environmental variations and changes in the abundance of other species interact to regulate the abundance in particular fish populations. The factors affecting recruitment, in particular those that affect the survival of fish eggs and larvae are of key importance in this context.

The process of recruitment, in spite of about 100 years of research, is still not fully understood. Trophic relations are implicated as a major influence on early fish life dynamics and are embodied in the "critical period" (Hjort, 1914) and "match-mismatch" (Cushing, 1975) hypothesis. Spatial characteristics are also considered of importance in the alternative "member-vagrant" (Sinclair, 1988) and "ocean triad" (enrichment, concentration, transport/retention) (Bakun, 1996) hypotheses.

TABLE 1
Main early contributions dealing with early life history descriptions of marine teleost fishes (adapted from Ahlstrom and Moser, 1981).

Author	Date	no. of papers	Group	Field	Rearing	Egg	Larvae	Juveniles	Area
Petersen, C.G.J.	1904-1909	3	Flatfishes	+	-	-	all	some	E. North Atlantic
Schmidt, J.	1905-1907	6	Gadoid	+	-	-	all	some	E. North Atlantic
Schmidt, J.	1908-1932	44	Eels	+	-	-	all	some	North Atlantic-Worldwide
Ehrenbaum, E.	1905-1909	book	Teleosts	+	+	some	all	some	E. North Atlantic
Sanzo, L.	1905-1940	65	Teleosts	+	+	some	all	some	Mediterranean
Kyle, H.M.	1913	1	Flatfishes	+	-	-	all	some	Mediterranean-E. North Atlantic
Fage, L.	1918	1	Shorefishes	+	-	-	most	some	Mediterranean-E. North Atlantic
Tåning, A.V.	1918	1	Myctophids	+	-	-	all	all	Mediterranean-E. North Atlantic
Jespersen and Tåning	1919-1926	2	Sternopychids	+	-	some	all	some	Mediterranean-E. North Atlantic
Delsman, H.C.	1921-1938	24	Teleosts	+	+	some	most	some	Indo Pacific
Hildebrand and Cable	1930-1938	3	Shore-Bay Fishes	+	+	most	all	most	W. North Atlantic
Uchida <i>et al.</i>	1958	1	Teleosts	+	+	some	all	some	Japan
Mito, S.	1960-1963	12	Fish eggs	+	+	all	some	-	Japan
Castle, P.H.J.	1959-	several	Eels	+	+	some	all	some	New Zealand-Worldwide
Dekhnik, T.V.	1973	1	Teleosts	+	+	most	most	-	Black Sea
Russell, FS	1976	book	Teleosts	+	+	most	all	-	North Sea

TERMINOLOGY

Most marine fishes spawn pelagic eggs that are fertilized externally and float individually near the sea surface. These eggs range from 0.5 to 5.5 mm in diameter. The embryonic period can be divided into three stages: *early* (fertilization to blastopore closure); *middle* (from blastopore closure to the time the tail begins to curve laterally away from the embryonic axis) and; *late* (from the time the tail is curved away from the embryonic axis to hatching).

Within a single species there is little variation in egg characters (size, number and size of oil globules, chorion surface, yolk, pigmentation, and morphology of the developing embryo) (Figure 1). Development time is highly related to temperature and is species-specific. The majority of pelagic eggs are spherical with chorion diameters close to 1 mm. Species in some groups produce eggs with ellipsoidal chorions (*e.g.* Engraulidae). Demersal eggs tend to be spherical (*e.g.* Blenniidae), flattened (*e.g.* Blenniidae) or urn-shaped (*e.g.* Gobiidae). The chorion can be smooth or ornamented with spines and filaments (*e.g.* Belontiidae, Atherinidae), hexagonal or polygonal networks of different sizes (*e.g.* Callionymidae, Macrouridae) or a single protuberance or swelling (*e.g.* Centrarchidae). The space between the chorion and the yolk mass (perivitelline space) is usually small, but in some groups can be considerably large (*e.g.* Clupeidae, Anguilliforms). The yolk can be segmented or homogenous. In some groups the yolk is initially homogenous becoming segmented in late stages of embryonic development. Yolk segmentation can be a useful taxonomical character. The presence or absence of oil globules, size, number and position, are also important taxonomic characters. About 60 % of the species with described eggs have a single oil globule, 15 % have multiple oil globules and 25 % have none (Ahlstrom and Moser, 1980).

In the present Guide the terminology of Moser (1996) is adopted. Individuals with a yolk-sac or remnants of yolk are referred as *yolk-sac larvae* or *newly hatched larvae*. Those that have used all their yolk are referred as *larvae* and *early* or *late larvae*. Finally those that are in the process of changing from larvae to juveniles are referred as *transforming* or *transformation stage* specimens. The larval period subsequent to the yolk-sac stage falls into three stages related to flexion of the notochord during caudal fin development. These three stages are termed preflexion-, flexion- and postflexion-stage larvae (Figure 2).

The size and length at hatch varies among fish species, being generally related to egg or yolk diameter. Yolk size, in newly hatched larvae, is also related to egg size and to the amount of yolk used before hatching. Usually the body length at the time of hatching is about 2.5 to 3 times the diameter of the yolk. Newly hatched larvae frequently have an unformed mouth, unpigmented eyes and undeveloped pectoral fins. A prominent median finfold (primordial fin) is also present extending from the top of the head, around the caudal region and forward to the posterior margin of the yolk (Figure 3).

The shape of the yolk sac varies greatly from round to elongate in species with elongated guts (*e.g.* Clupeoids). When present, the oil globule can be located anteriorly or posteriorly in the yolk. Multiple oil globules can be aggregated or evenly distributed. Location of the oil or oil globules is an important taxonomic character. Overall pigmentation is also very important as far as identification is concerned. Melanophores are the main pigments used for the identification of yolk-sac larvae. Other pigments may be present but most will be lost in preserved (formalin or alcohol) specimens. At the end of the yolk-sac stage the mouth and gut are formed and the anus is open at or close to the margin of the primordial fin (*e.g.* Gadoids). The eyes become pigmented and the major organs and sensory systems, essential for capturing preys, become functional.

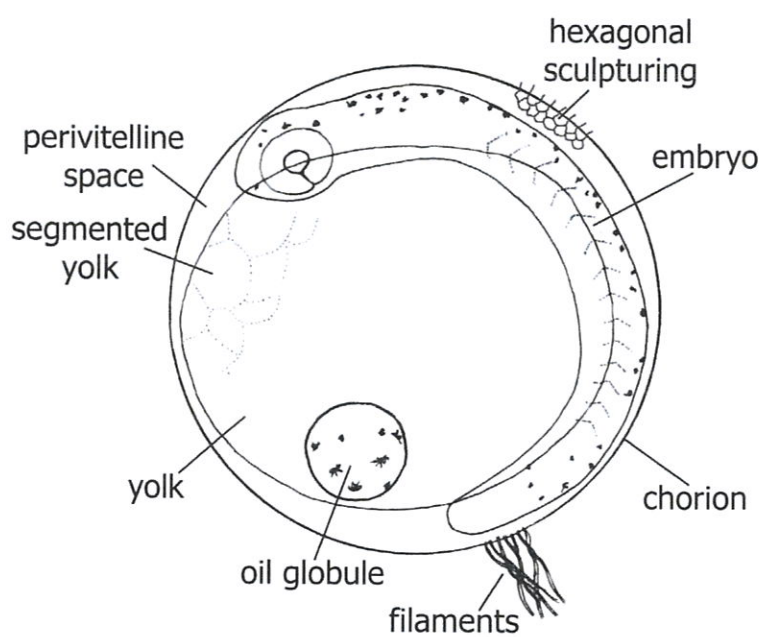


Figure 1- Anatomic features of early stages of fish eggs.

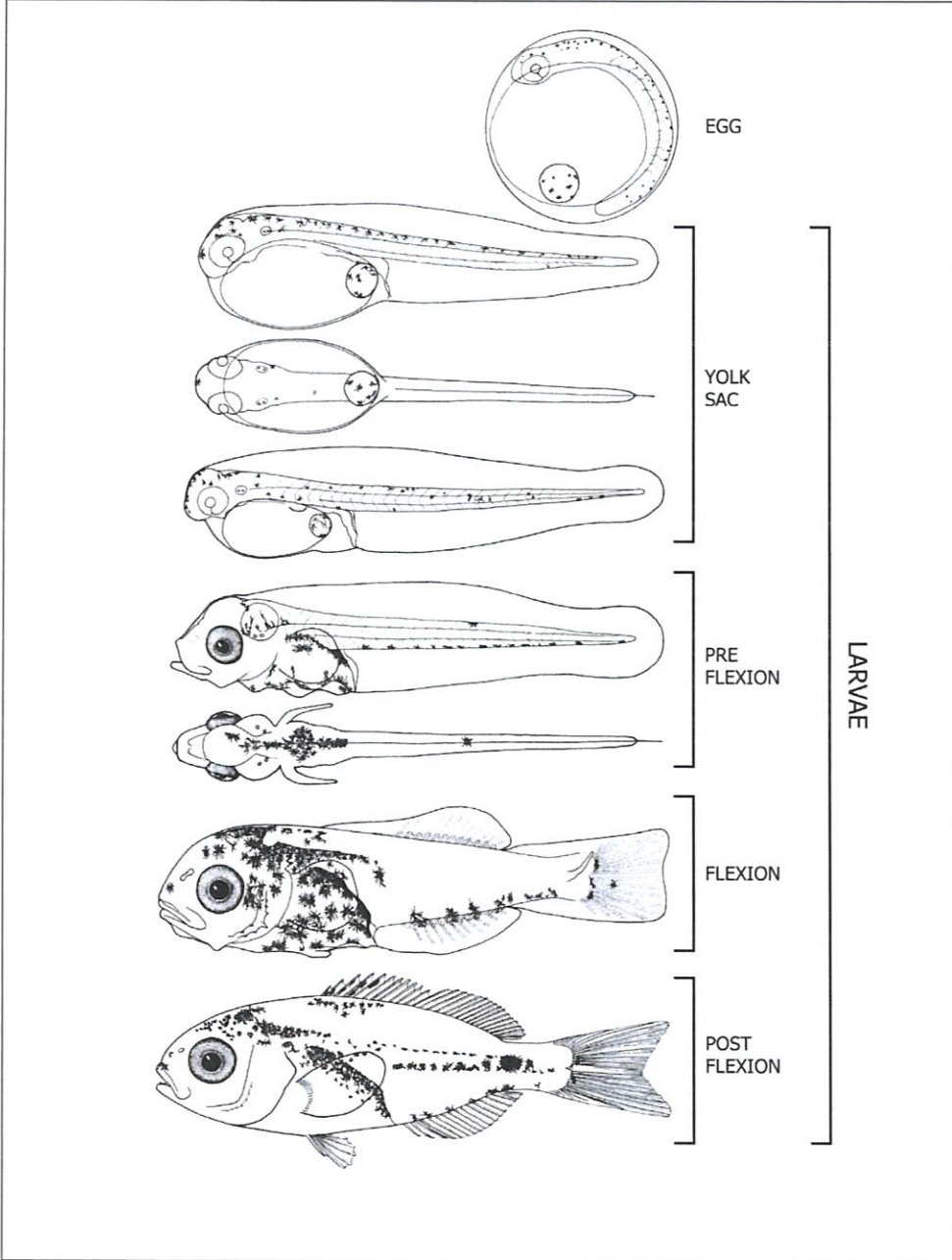


Figure 2- Early life history stages of *Diplodus sargus*. Images from Brownell (1979).

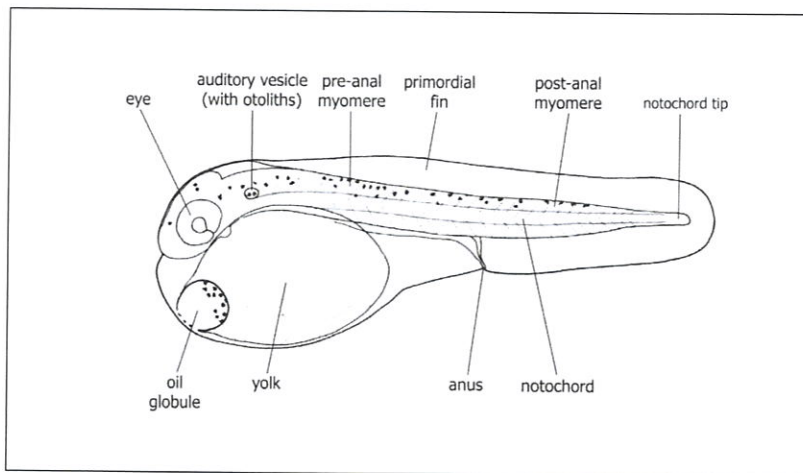


Figure 3- Anatomic features of yolk-sac larvae.

The larval stage, as mentioned before, can be divided into three different sub-stages, based on the degree of flexion of the terminal section of the notochord (Figure 2).

Marine teleost larvae are extremely diverse reflecting an array of specializations in form, pigment pattern and behaviour. Body length at the beginning of the larval stage is about 4 to 5 times the diameter of the egg (the majority of first-feeding larvae are 3 to 6 mm in length). Most species reach maximum larval size within the 10-30 mm range. The basic organ systems are developed during the larval period. One obvious feature is the myomeres that correspond roughly to the number of vertebrae in the adult. Gut shape and length are also important features. Gut is elongated in lower teleosts (clupeiforms, salmoniforms, stommiforms). On myctophids it varies from short to long. The gut is coiled in gadoids and higher teleosts. The relative size of the head, jaws and eyes are important taxonomic characters. The sequence of fin formation can be a useful character at specific or higher taxonomic levels. Larval teeth and head spines vary a lot in size, shape and pattern (Figure 4).

Pigmentation provides a wealth of information. Preserved specimens are usually limited to melanistic pigment. Melanophore location, size, shape, pattern and sequence of formation are very important taxonomic features. Many species have unique pigmentation patterns that typify higher taxa. Several pigmentation patterns have evolved independently, such as rows of melanophores above or below the gut, over the gas bladder, on the ventral margin of the tail, over the head, along the dorsal margin of the body or covering the entire larva (Figure 5).

The larval stage is followed by a transformation stage. This stage is characterized by changes in general shape and structural detail that can be gradual to abrupt. In the majority of fish species, larval shape and form is very different from that of the juvenile. Body measurements used in the present Guide are illustrated in Figure 6.

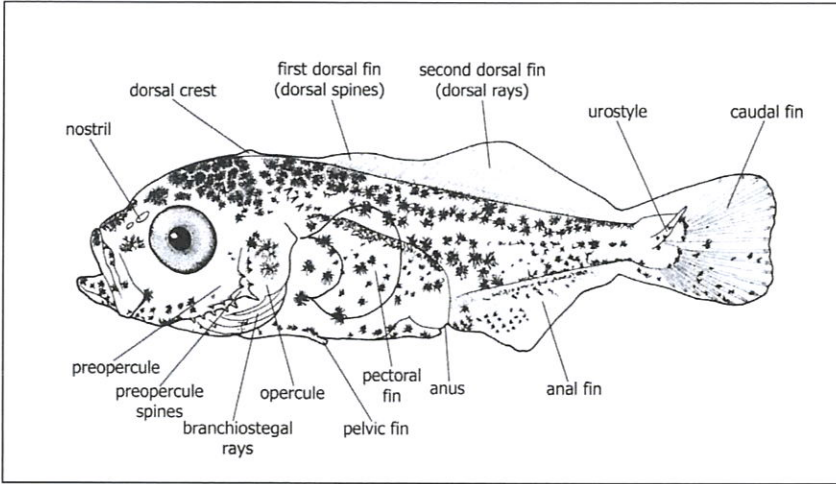


Figure 4- Anatomic features of fish larvae.

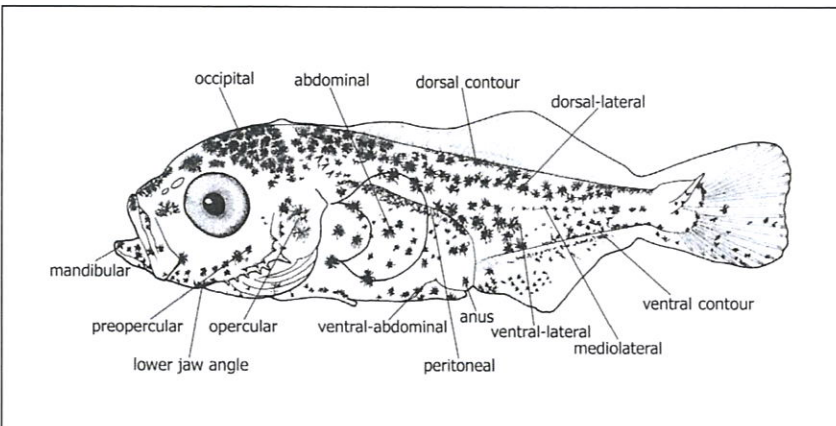


Figure 5- Melanophore pigmentation of fish larvae.

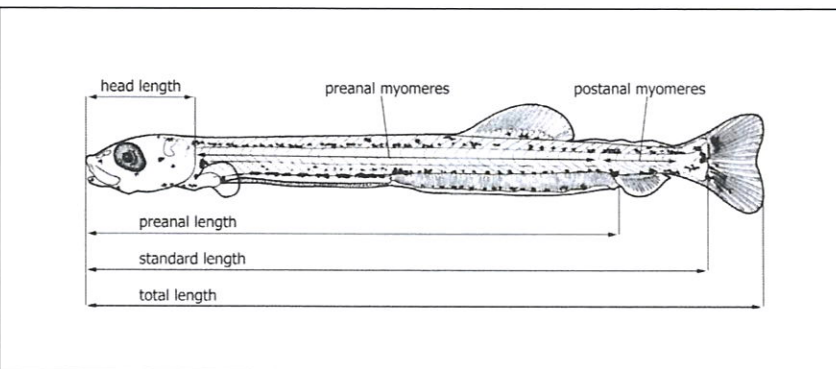


Figure 6- Body measurements.

IDENTIFICATION

Identification of early stages of fishes is not an easy task. Fish eggs and larvae are usually small requiring the use of a good stereoscopic microscope and adequate lighting. In a single ichthyoplankton sample there is usually a large variety of sizes, shapes and pigmentation patterns. Generally dichotomous keys can not be used since most of the important taxonomic characters change dramatically over the course of the development. Very few species have distinct features that can be recognized throughout the entire early life history. In a given area a large proportion of the fish eggs and larvae may be unknown or undescribed.

Identifying a fish larva is very different from identifying an adult specimen. Its shape, size, stage of development, pigmentation pattern and myomere count are very important features. New ways of manipulating data are needed to reach identification. This has been called the "look alike" system (Moser *et al.*, 1984). It consists of a simple procedure: one should be able to identify a fish larva to the family level by matching the characteristics of a specimen as far as general shape and striking features are concerned (Figures 7 to 9).

Meristic characters are also very important. Total myomere (vertebrae) count is presented in Table 2. The identification can be carried further by reading the information presented for each species.

TABLE 2
List of families in each interval of vertebral counts. Adapted from Aboussouan (1994).

15-23 vertebrae	31-40 vertebrae	51-68 vertebrae
Callionymidae	Blenniidae	Ammodytidae
Labridae	Bothidae	Argentinidae
Macroramphosidae	Gadidae	Atherinidae
	Gobiesocidae	Cepolidae
24-26 vertebrae	Gobiidae	Clupeidae
Carangidae	Gonostomatidae	Gadidae
Centracanthidae	Labridae	Liparidae
Gobiidae	Lophiidae	Merluccidae
Labridae	Myctophidae	Paralepididae
Lophiidae	Pleuronectidae	Scombridae
Macroramphosidae	Scombridae	Soleidae
Moronidae	Scophthalmidae	Syngnathidae
Mugilidae	Soleidae	
Mullidae	Sternoptychidae	69-100 vertebrae
Serranidae	Trachinidae	Belonidae
Sparidae	Triglidae	Carapidae
	Zeidae	Gadidae
27-30 vertebrae	41-50 vertebrae	Paralepididae
Blenniidae	Argentinidae	Syngnathidae
Cottidae	Atherinidae	>105 vertebrae
Gobiesocidae	Blenniidae	Anguillidae
Gobiidae	Bothidae	Carapidae
Labridae	Clupeidae	Congridae
Lophiidae	Engraulidae	Muraenidae
Serranidae	Gadidae	Syngnathidae
Triglidae	Gonostomatidae	
	Merluccidae	
	Myctophidae	
	Scombridae	
	Scophthalmidae	
	Soleidae	
	Syngnathidae	
	Trachinidae	

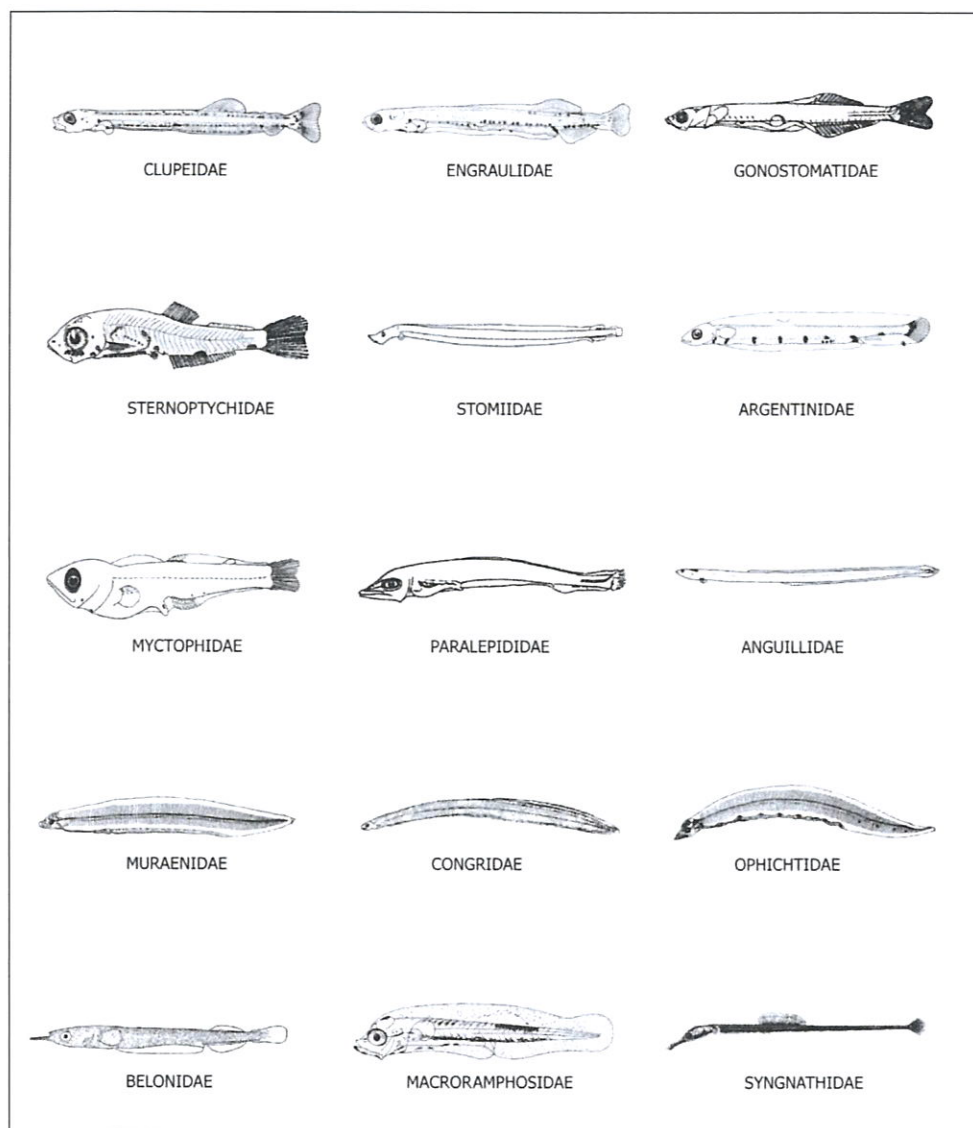


Figure 7- Illustrations of representative larvae of families of fishes occurring off the Iberian Peninsula.

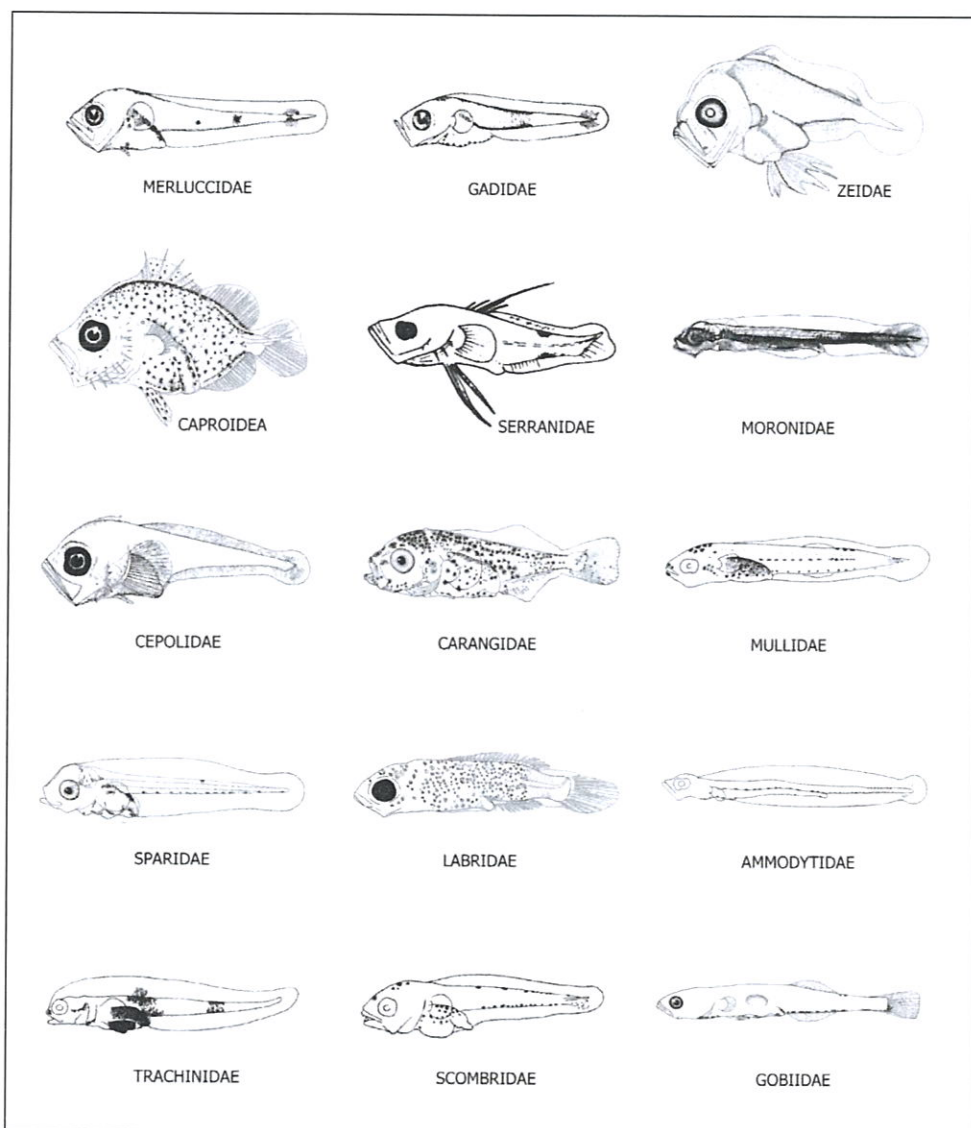


Figure 8- Illustrations of representative larvae of families of fishes occurring off the Iberian Peninsula.

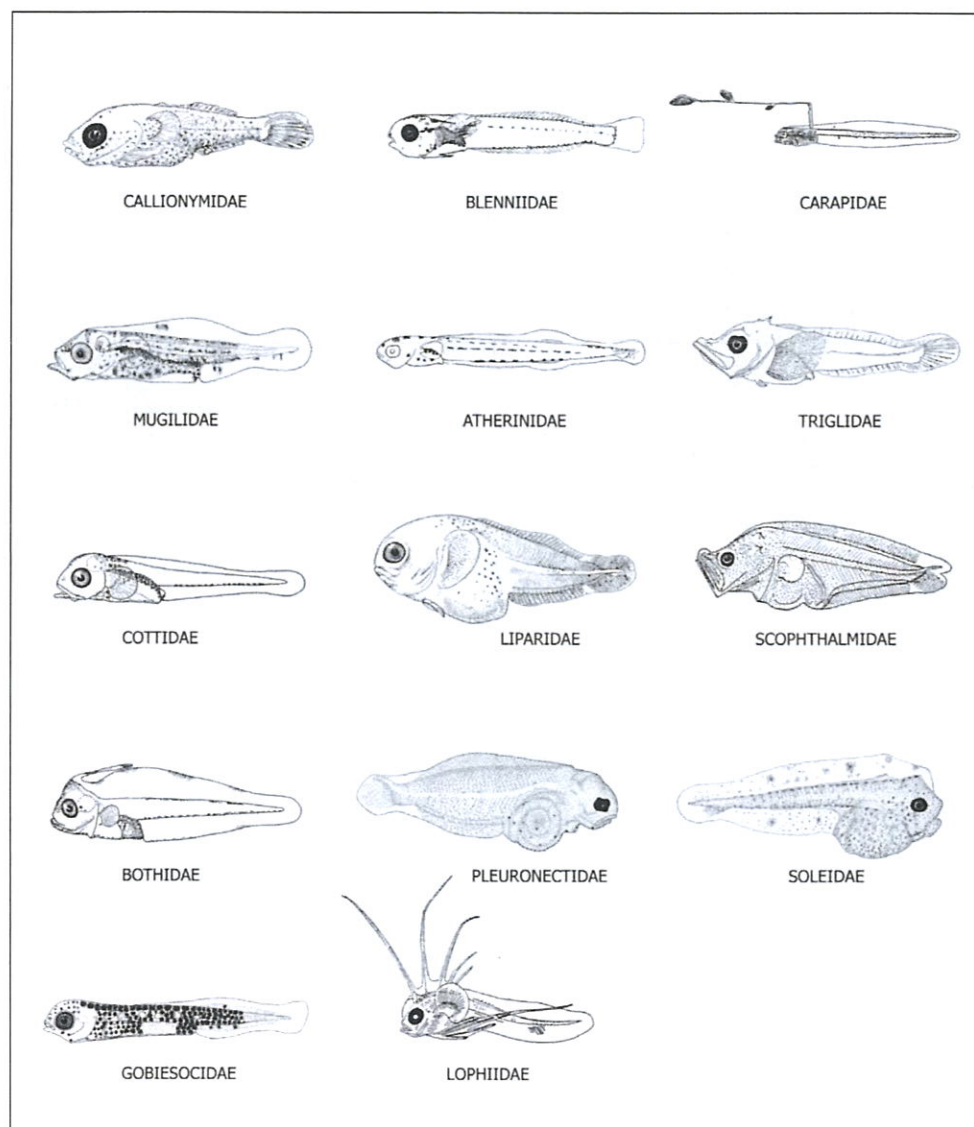


Figure 9- Illustrations of representative larvae of families of fishes occurring off the Iberian Peninsula.

EARLY LIFE HISTORY DESCRIPTIONS

This guide is intended for the identification of the early life history stages of fishes collected by plankton nets from the marine and estuarine waters of the Iberian Peninsula (Eastern North Atlantic Ocean). The coverage area extends from 34°-45° latitude north, to 6°-14° longitude west (Figure 10).

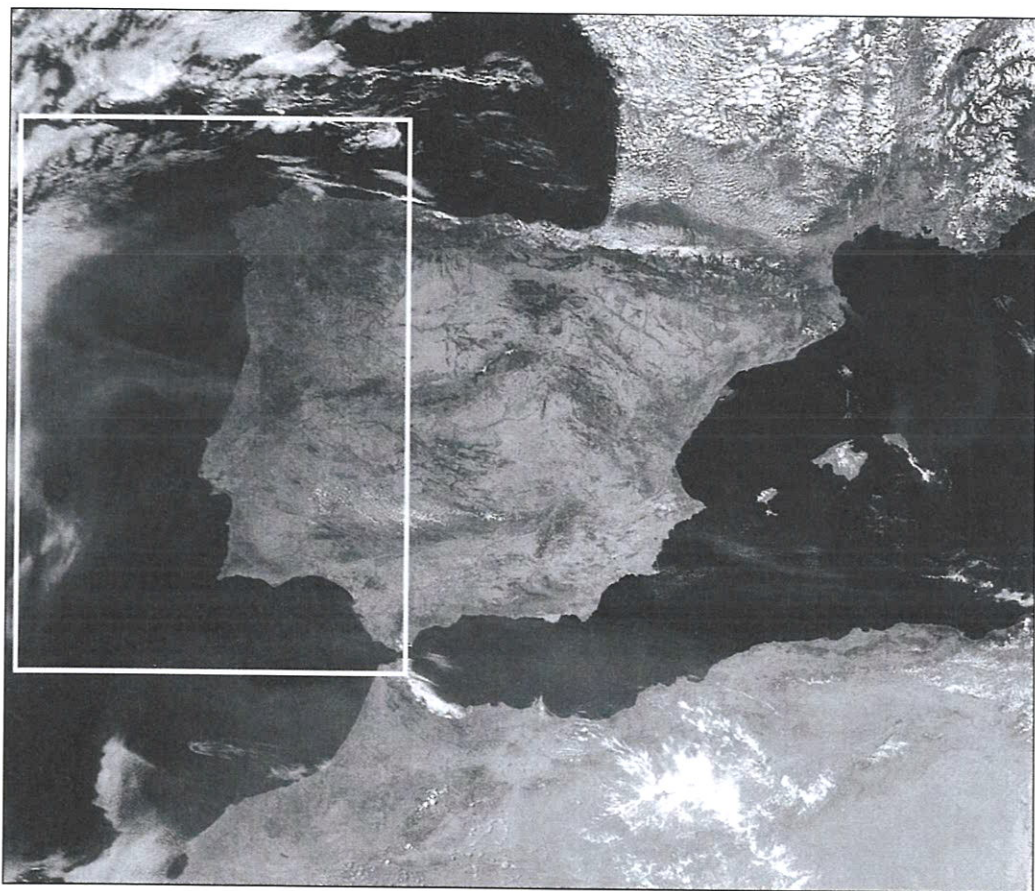


Figure 10- Satellite image of the Iberian Peninsula (coverage area). Nasa, Sensor OrbView-2/SeaWiFS (20000608).

In the following pages, the basic characteristics of the early life history of 104 species belonging to 45 families occurring in the Iberian Peninsula are described (Table 3).

Each species account includes the same basic information (written information on the left hand page and figures on the facing right hand page). Written information includes meristic data, life history information, main references and early life history descriptions.

TABLE 3

Early life history stages of fishes occurring in the Iberian Peninsula (marine and estuarine waters).
Seasonal occurrence is mentioned for the coverage area.

CLUPEIDAE	Spring	Summer	Autumn	Winter
<i>Sardina pilchardus</i> (Walbaum, 1972)	+	+	+	+
<i>Sprattus sprattus</i> (Linnaeus, 1758)	+	+		+
ENGRAULIDAE				
<i>Engraulis encrasicolus</i> (Linnaeus, 1758)	+	+	+	+
GONOSTOMATIDAE				
<i>Cyclothone braueri</i> Jespersen & Tåning, 1926		+		
STERNOPTYCHIDAE				
<i>Mauroliscus muelleri</i> (Gmelin, 1788)	+	+	+	+
STOMIIDAE				
<i>Stomias boa</i> (Risso, 1810)	+			
ARGENTINIDAE				
<i>Argentina sphyraena</i> Linnaeus, 1758	+	+		+
MYCTOPHIDAE				
<i>Benthoosema glaciale</i> (Reinhardt, 1837)	+	+	+	
<i>Ceratoscopelus maderensis</i> (Lowe, 1839)	+	+		
<i>Diogenichthys atlanticus</i> (Tåning, 1928)	+	+	+	+
<i>Electrona risso</i> (Cocco, 1829)	+			
<i>Myctophum punctatum</i> Rafinesque, 1810	+	+	+	+
<i>Notolychnus valdiviae</i> (Brauer, 1904)			+	
PARALEPIDIDAE				
<i>Magnisudis atlantica</i> Kroyer, 1868	+	+	+	+
<i>Paralepis coregonoides</i> Risso 1820	+	+		
ANGUILLIDAE				
<i>Anguilla anguilla</i> (Linnaeus, 1758)	+			+
MURAENIDAE				
<i>Muraena helena</i> Linnaeus, 1758			+	
CONGRIDAE				
<i>Conger conger</i> (Linnaeus, 1758)		+		
OPHICHTIDAE				
<i>Ophisurus serpens</i> (Linnaeus, 1758)			+	
BELONIDAE				
<i>Belone belone</i> (Linnaeus, 1761)	+	+		+
MACRORAMPHOSIDAE				
<i>Macroramphosus scolopax</i> Linnaeus, 1758	+			+
SYNGNATHIDAE				
<i>Entelurus aequoreus</i> (Linnaeus, 1758)	+			
<i>Hippocampus hippocampus</i> (Linnaeus, 1758)	+	+		
<i>Hippocampus guttulatus</i> Cuvier, 1829	+	+	+	
<i>Nerophis lumbriciformis</i> (Jenyns, 1835)	+	+		
<i>Nerophis ophidion</i> (Linnaeus, 1758)	+	+	+	
<i>Syngnathus abaster</i> Risso, 1826	+	+	+	+
<i>Syngnathus acus</i> Linnaeus, 1758	+	+	+	
<i>Syngnathus typhle</i> Linnaeus, 1758	+	+		
MERLUCCIDAE				
<i>Merluccius merluccius</i> Linnaeus, 1758	+			
GADIDAE				
<i>Ciliata mustela</i> (Linnaeus, 1758)				+

<i>Gadiculus argenteus</i> Guichenot, 1850	+	+	+	
<i>Micromesistius poutassou</i> (Risso, 1826)	+			+
<i>Pollachius pollachius</i> (Linnaeus, 1758)	+			+
<i>Trisopterus luscus</i> (Linnaeus, 1758)	+			+
<i>Trisopterus minutus</i> (Linnaeus, 1758)		+		
ZEIDAE				
<i>Zeus faber</i> Linnaeus, 1758		+	+	
CAPROIDAE				
<i>Capros aper</i> (Linnaeus, 1758)			+	
SERRANIDAE				
<i>Serranus cabrilla</i> (Linnaeus, 1758)		+	+	
MORONIDAE				
<i>Dicentrarchus labrax</i> (Linnaeus, 1758)	+			+
CEPOLIDAE				
<i>Cepola macrophthalma</i> Linnaeus, 1766	+	+	+	+
CARANGIDAE				
<i>Trachurus trachurus</i> (Linnaeus, 1758)	+	+	+	+
MULLIDAE				
<i>Mullus surmuletus</i> Linnaeus, 1758	+			
SPARIDAE				
<i>Boops boops</i> (Linnaeus, 1758)	+			
<i>Diplodus sargus</i> (Linnaeus, 1758)	+	+	+	+
<i>Pagellus bogaraveo</i> (Brünnich, 1768)	+			
<i>Pagrus pagrus</i> (Linnaeus, 1758)	+			
<i>Spondylusoma cantharus</i> (Linnaeus, 1758)	+			
CENTRACANTHIDAE				
<i>Centracanthus cirrus</i> Rafinesque, 1810				+
LABRIDAE				
<i>Centrolabrus exoletus</i> (Linnaeus, 1758)	+	+		
<i>Coris julis</i> (Linnaeus, 1758)	+	+		
<i>Ctenolabrus rupestris</i> (Linnaeus, 1758)	+	+		
<i>Labrus bergylta</i> Ascanius, 1767	+	+		
<i>Labrus mixtus</i> Linnaeus, 1758	+	+		
<i>Labrus merula</i> Linnaeus, 1758				
<i>Symphodus melops</i> (Linnaeus, 1758)	+	+	+	+
AMMODYTIDAE				
<i>Ammodytes tobianus</i> Linnaeus, 1758	+			+
<i>Gymnammodytes semisquamatus</i> (Jourdain, 1879)	+			+
<i>Hyperoplus lanceolatus</i> (Le Sauvage, 1824)	+			
TRACHINIDAE				
<i>Echiichthys vipera</i> (Cuvier, 1829)	+	+	+	+
<i>Trachinus draco</i> Linnaeus, 1758			+	
SCOMBRIDAE				
<i>Scomber scombrus</i> (Linnaeus, 1758)				+
<i>Scomber japonicus</i> Houttuyn, 1782	+		+	
GOBIIDAE				
<i>Aphia minuta</i> (Risso, 1810)				+
<i>Crystallogobius linearis</i> (von Döben, 1845)		+		
<i>Gobius xanthocephalus</i> Heymer & Zander, 1992	+	+		
<i>Gobius cobitis</i> Pallas, 1814	+	+		
<i>Gobius cruentatus</i> Gmelin, 1789		+		

<i>Gobius niger</i> Linnaeus, 1758	+	+		
<i>Gobius paganellus</i> Linnaeus, 1758	+			
<i>Gobiusculus flavescens</i> (Fabricius, 1779)	+	+		
<i>Lebetus guiletti</i> (Le Danois, 1913)	+	+	+	+
<i>Lebetus scorpioides</i> (Collet, 1874)			+	
<i>Pomatoschistus minutus</i> (Pallas, 1770)	+	+	+	+
<i>Pomatoschistus pictus</i> (Malm, 1865)	+	+	+	
<i>Pomatoschistus microps</i> (Kroyer, 1838)	+	+		
CALLIONYMIDAE				
<i>Callionymus lyra</i> Linnaeus, 1758	+	+		+
<i>Callionymus maculatus</i> Rafinesque-Schmaltz, 1810	+			
BLENNIIDAE				
<i>Blennius ocellaris</i> Linnaeus, 1758	+		+	+
<i>Coryphoblennius galerita</i> (Linnaeus, 1758)	+	+		+
<i>Lipophrys pholis</i> (Linnaeus, 1758)	+	+	+	+
<i>Lipophrys trigloides</i> (Valenciennes, 1836)	+	+		
<i>Parablennius gattorugine</i> (Brünnich, 1768)	+	+	+	+
<i>Parablennius pilicornis</i> (Cuvier, 1829)	+	+		
CARAPIDAE				
<i>Carapus acus</i> (Brünnich, 1768)		+	+	+
MUGILIDAE				
<i>Mugil cephalus</i> Linnaeus, 1758	+		+	+
ATHERINIDAE				
<i>Atherina presbyter</i> Cuvier, 1829	+	+		+
TRIGLIDAE				
<i>Trigla lucerna</i> Linnaeus, 1758	+	+	+	+
COTTIDAE				
<i>Taurulus bubalis</i> (Euphrasen, 1768)	+			
LIPARIDAE				
<i>Liparis montagui</i> (Donovan, 1804)	+	+		+
SCOPHTHALMIDAE				
<i>Psetta maxima</i> (Linnaeus, 1758)	+	+		
<i>Lepidorhombus boscii</i> (Risso, 1810)				+
<i>Zeugopterus regius</i> (Bonnaterre, 1788)		+		
<i>Zeugopterus punctatus</i> (Bloch, 1787)	+	+		+
BOTHIDAE				
<i>Arnoglossus laterna</i> (Walbaum, 1792)	+	+	+	+
PLEURONECTIDAE				
<i>Platichthys flesus</i> (Linnaeus, 1758)	+			+
SOLEIDAE				
<i>Buglossidium luteum</i> (Risso, 1810)	+	+	+	
<i>Microchirus variegatus</i> (Donovan, 1808)	+	+		+
<i>Pegusa lascaris</i> (Risso, 1810)	+	+		+
<i>Solea senegalensis</i> Kaup, 1858	+	+	+	+
<i>Solea solea</i> (Linnaeus, 1758)	+	+	+	+
GOBIESOCIDAE				
<i>Diplecogaster bimaculata</i> (Bonnaterre, 1788)	+	+		
<i>Lepadogaster lepadogaster</i> (Bonnaterre, 1788)		+		
LOPHIIDAE				
<i>Lophius piscatorius</i> Linnaeus, 1758	+			+

CLUPEIDAE

Sardina pilchardus (Walbaum, 1792)

MERISTICS

Fins:

Dorsal rays - 17-18
Anal rays - 17-18
Pelvic rays - 6-8
Pectoral rays - 16-17

Myomeres:

Total number - (preanal) 36-41

LIFE HISTORY

Range: Northeast Atlantic: from Iceland (rare) and North Sea, southward to Bay of Gorée, Sénégal. Mediterranean (common in the western part and in Adriatic Sea, rare in the eastern part), Sea of Marmara and Black Sea.

Habitat: Coastal pelagic, at 25-55 m by day and 15-35 m by night; shoaling, migratory.

Spawning season: Eggs and larvae found throughout the whole year; peak spawning periods, spring, autumn-winter.

ELH pattern: Oviparous, planktonic eggs and larvae.

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EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 1.4-1.8 mm
No. of oil globules - 1
Shell surface - smooth
Pigment - none
Yolk - segmented
Diameter of oil globules - 0.09-0.19 mm
Diagnostic features - spherical, 1.4-1.8 mm diameter, segmented yolk, 0.80-0.95 mm diameter, single oil globule 0.09-0.19 mm diameter, large perivitelline space

LARVAE

Hatching length - 3.2-4.0 mm
Yolk-sac absorption - 4.0-5.5 mm
Flexion length - 10-12.5 mm
Transformation length - 40-50 mm
Pigmentation - yolk-sac: many small scattered melanophores in the dorsal region extending from the head to the tail, with one ventral caudal melanophore. Late larvae: melanophores on head and trunk, tail with single melanophore.
Diagnostic features - newly hatched larva tube-like (typical clupeid form). Easily distinguishable from other clupeids by the presence of the oil globule. Yolk-sac absorption at 4.0-5.5 mm. Mouth and jaws undeveloped and unpigmented eyes at hatching. 7 to 8 larval sense organs along each side of the body. Typical larval pigmentation develops around 5-6 mm. Dorsal fin formation (31th myomere) 7.5 mm. Gas bladder formation at 10 mm. Notochord flexion occurs at 11-12.5 mm. Formation of pelvic fins (level with pylorus) at 20 mm. Complete dorsal fin formation at 26 mm. Complete anal fin formation at 28 mm. Number of preanal myomeres: 36-41.

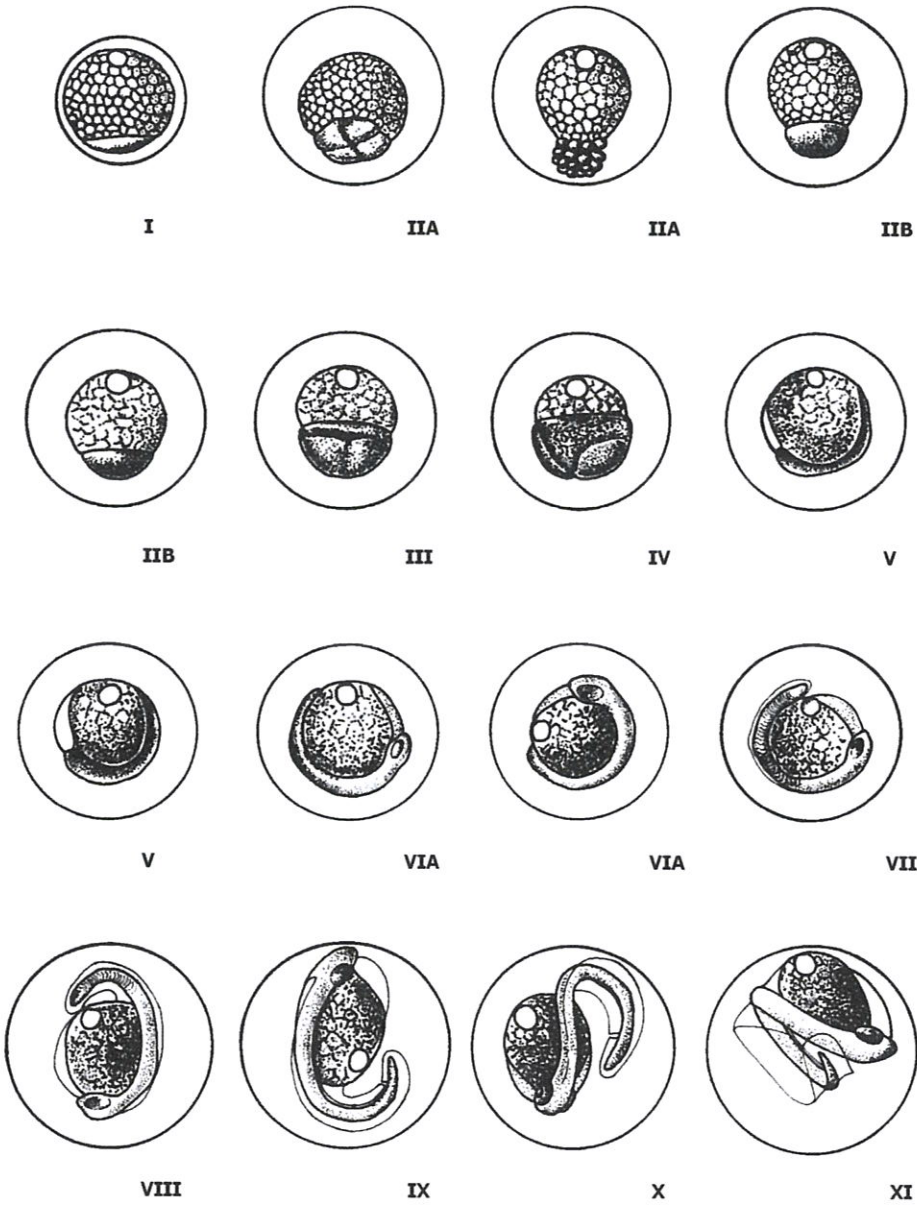


Plate 1- Stages of development of *Sardina pilchardus* eggs. Ré *et al.* (1988).

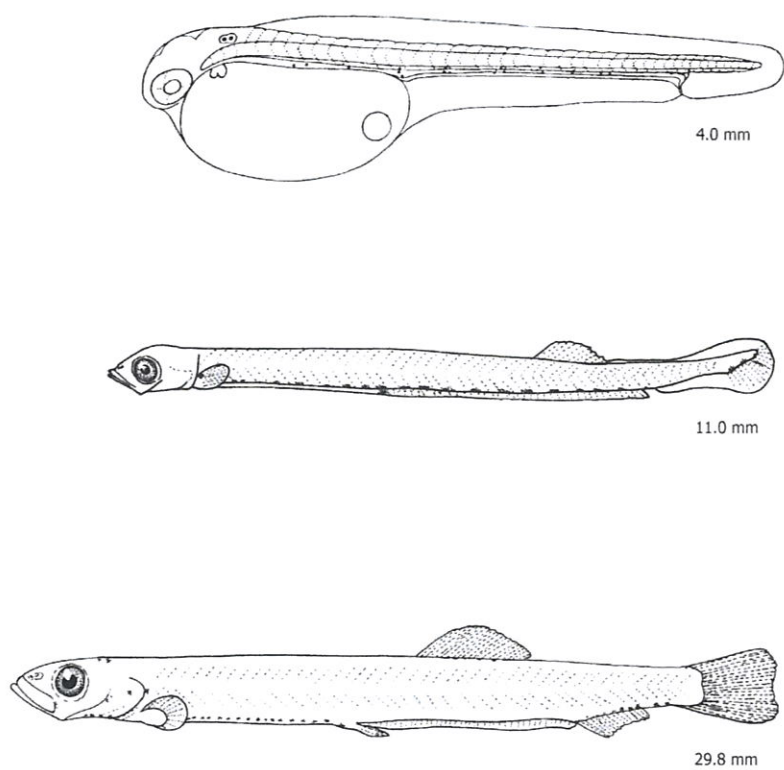


Plate 2- Early life history stages of *Sardina pilchardus*. Varagnolo (1964), Fage (1920).

CLUPEIDAE

Sprattus sprattus (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays – 15-19
- Anal rays – 17-21
- Pelvic rays – 7
- Pectoral rays – 16-17

Myomeres:

- Total number – (preanal) 35-37

LIFE HISTORY

Range: Northeast Atlantic; North Sea and Baltic south to Morocco, Mediterranean, Adriatic and Black seas.

Habitat: Coastal pelagic. Usually inshore schooling, sometimes entering estuaries (especially the juveniles) and tolerating low salinities. Strong migrations between winter feeding and summer spawning grounds.

Spawning season: eggs and larvae are most abundant from February to March. Spawning season extends from January to July.

ELH pattern: oviparous, planktonic eggs and larvae.

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EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter - 0.8-1.3 mm
- No. of oil globules - 0
- Shell surface - smooth
- Pigment - none
- Yolk - segmented
- Diameter of oil globules -
- Diagnostic features - spherical, segmented yolk, no oil globule, small perivitelline space.

LARVAE

- Hatching length - 3.0-3.6 mm
- Yolk-sac absorption - 5.0-6.0 mm
- Flexion length - 11 mm
- Transformation length - 32-41 mm
- Pigmentation - yolk-sac: small scattered melanophores in head and dorsal region (visible in the embryo).
- Diagnostic features - newly hatched larva tube-like (typical clupeid form). Prominent sense organs (6) on each side of the body. Pigmented eyes at the end of yolk-sac absorption. Dorsal fin formation (28th myomere) at 8 mm. Formation of pelvic fins 4 to 5 myomeres behind pylorus 17-20 mm. Number of preanal myomeres 35-37. Tail length less the six times into total length.

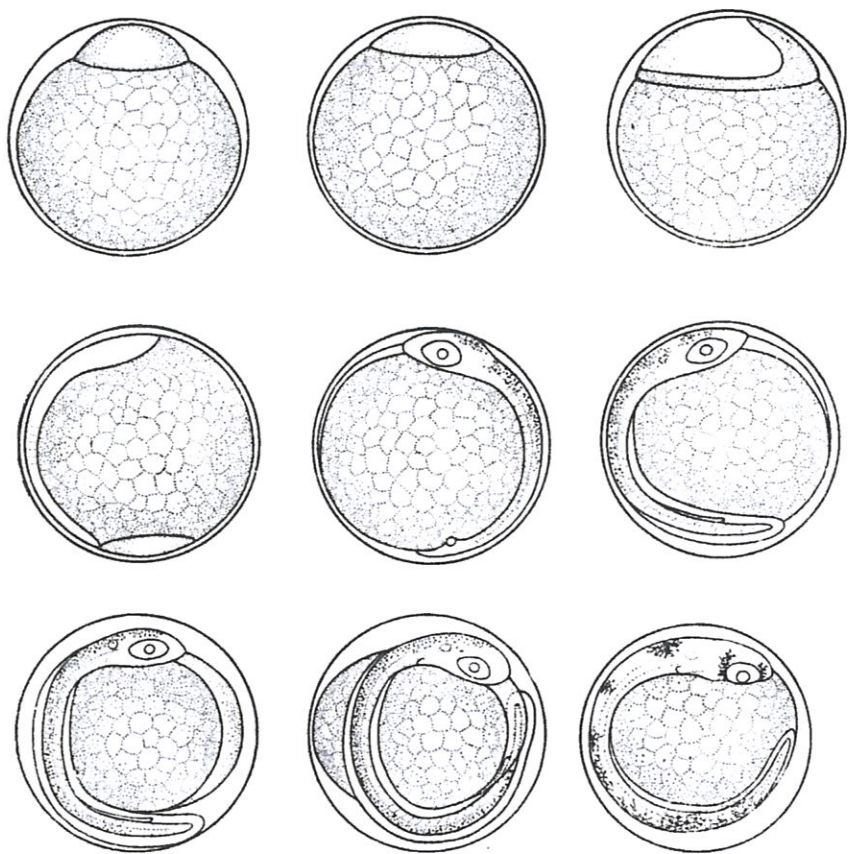


Plate 3- Stages of development of *Sprattus sprattus* eggs. Dekhnik (1973).

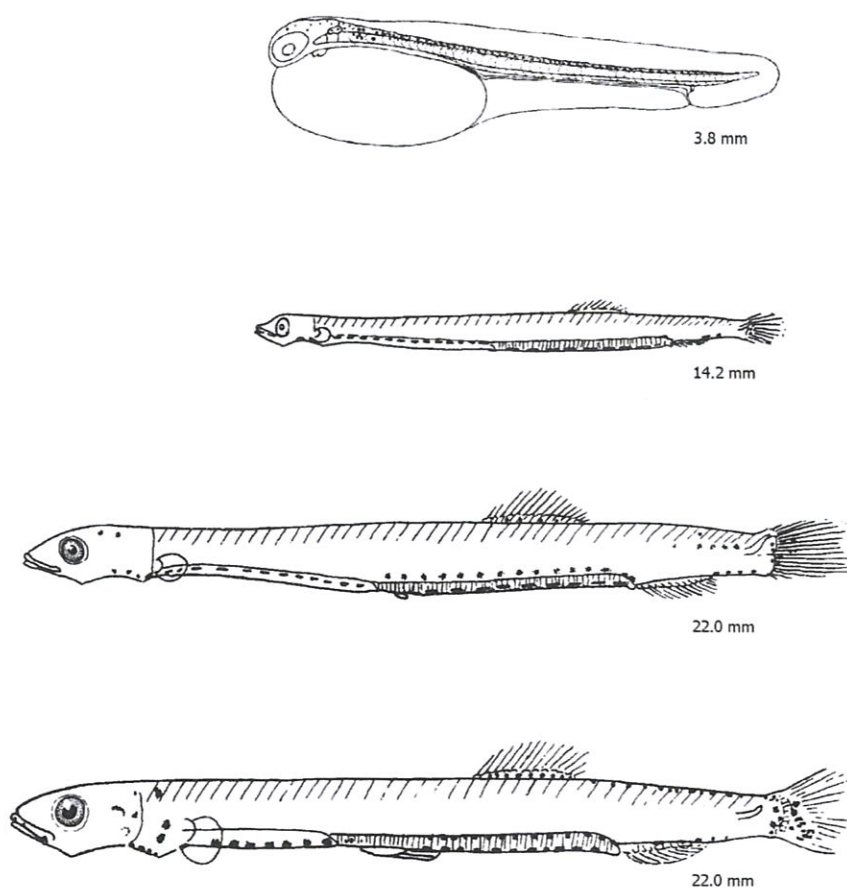


Plate 4- Early life history stages of *Sprattus sprattus*. Varagnolo (1964) and Russell (1976).

ENGRAULIDAE

Engraulis encrasicolus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays - 15-18
Anal rays - 16-18
Pelvic rays - 7
Pectoral rays - 15-17

Myomeres:

Total number - 44-47

LIFE HISTORY

Range: Eastern Atlantic; Bergen, Norway to South Africa. Mediterranean, Black and Azov Seas.

Habitat: Coastal marine species, forming large schools. Tolerates salinities of 5-41 ‰ and in some areas enters estuaries and lagoons, especially during spawning. Tends to move further north and into surface waters in summer, retreating and descending in winter.

Spawning season: Spawns from March to November with peaks usually in summer.

ELH pattern: oviparous, planktonic eggs and larvae.

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EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 1.2-1.9 mm x 0.5-1.2 mm
No. of oil globules - 0
Shell surface - smooth
Pigment - none
Yolk - segmented
Diameter of oil globules -
Diagnostic features - Ovoid in shape.
Segmented yolk, no oil globule, small perivitelline space.

LARVAE

Hatching length - 3.0-4.0 mm
Yolk-sac absorption - 5.0 mm
Flexion length - 9.0-10.0 mm
Transformation length - 25 mm
Pigmentation - Early larvae: two melanophores on abdominal wall behind pylorus, two on anal papilla, one or two in tail region. Late larvae: Row of melanophores on top of the gut.
Diagnostic features - Head more than five times into total length, dorsal fin opposite to anus. Pelvic fins on level with pylorus.
Late larvae: Head with characteristic adult shape. Dorsal and anal fins overlapping.

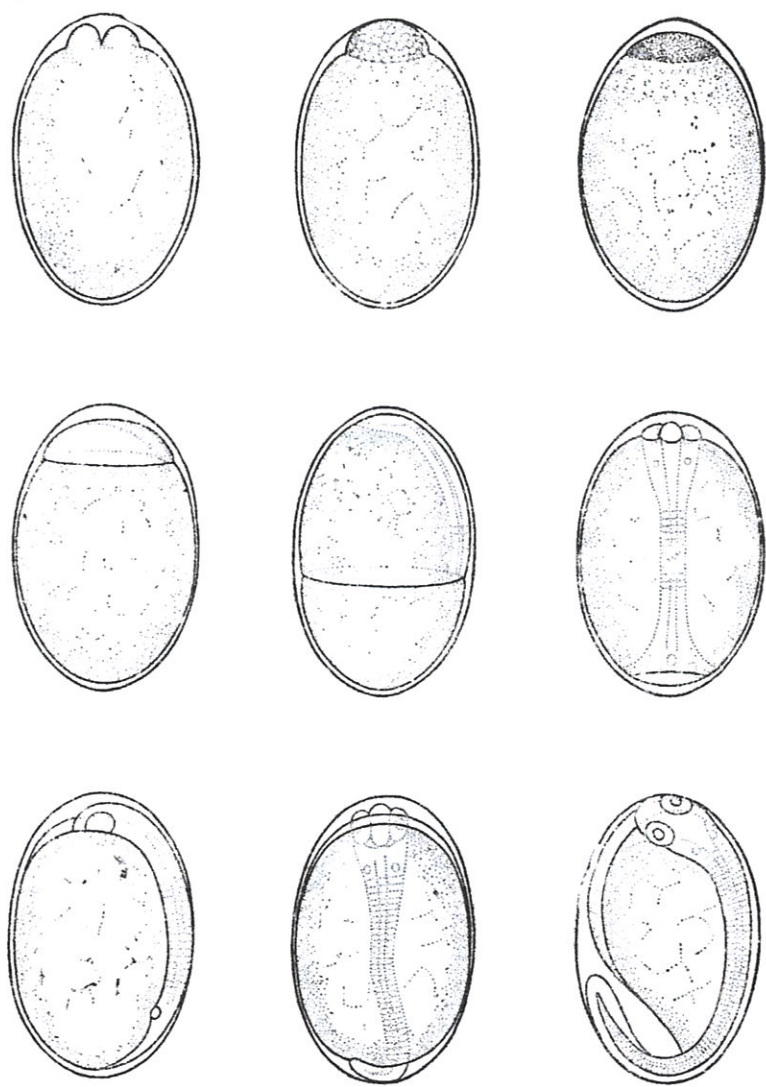


Plate 5- Stages of development of *Engraulis encrasicolus* eggs. Dekhnik (1973).

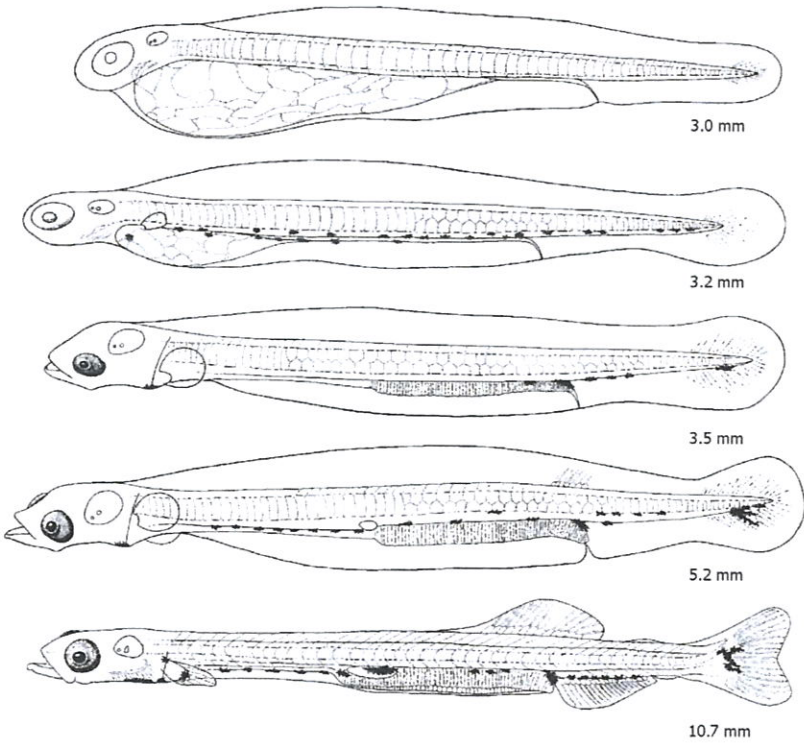


Plate 6- Early life history stages of *Engraulis encrasicolus*. Ré (unpublished data).

MERISTICS**Fins:**

Dorsal rays – 13-15

Anal rays – 18-20

Pelvic rays – 6-7

Pectoral rays – 9-10

Myomeres:

Total number – 29-33

LIFE HISTORY

Range: Atlantic, Indian and South Pacific: in tropical and subtropical waters, including the Mediterranean. Also known from the temperate North Atlantic as far as 66 °N and in the sub-Antarctic water south of Australia.

Habitat: Mesopelagic; depth range 10 – 2000 m. Deep-water; 67 °N – 40 °S, 180 °W – 180 °E.

Spawning season: Larvae found in spring and summer offshore.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Jespersen, P., A.V. Tåning (1926). Mediterranean Sternoptychidae. *Rep. Dan. Oceanogr. Exp. Mediterr.*, 2 (A.12): 1-59.
- Sanzo, L. (1931). Salmonoidei and Stomiatoidei. In *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38 (1): 21-92.

EARLY LIFE HISTORY DESCRIPTION**EGGS:** Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length – Unknown

Yolk-sac absorption - Unknown

Flexion length – 4.5-5.5 mm

Transformation length – 14 mm

Pigmentation – 2-3 melanophores along gut. 11-12 pairs of evenly-spaced melanophores over anal base. Lateral series of melanophores posterior to pectoral fin. 14-15 melanophores on pterygiophores, 1 melanophore over urostyle and 3 melanophores laterally before the urostyle.

Diagnostic features – Body slender, elongate, preanal length 50 % of standard length, round eyes, pigmented gas bladder. Photophores form at about 11-12 mm. Larvae similar to *Vinciguerria*.

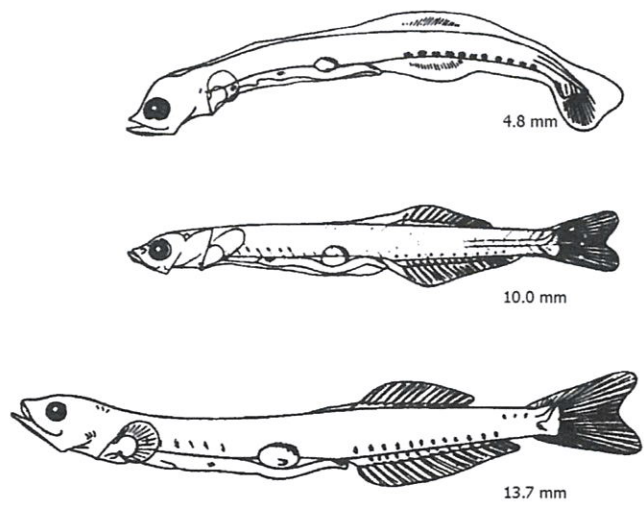


Plate 7- Early life history stages of *Cyclothone braueri*. Sanzo (1931).

STERNOPTYCHIDAE

Maurolicus muelleri (Gmelin, 1789)

MERISTICS

Fins:

Dorsal soft rays – 10-11
Anal soft rays – 19-22
Pelvic rays – 6-8
Pectoral rays – 17-20

Myomeres:

Total number – 33-35

LIFE HISTORY

Range: Eastern Atlantic: Iceland and Norway to Senegal, including the western Mediterranean. Western Atlantic: Gulf of Maine to the Gulf of Mexico, Caribbean Sea and the Straits of Magellan. Southeast Pacific: Chile. Western Pacific.

Habitat: Bathypelagic; marine; depth range 0 – 1524 m. Deep-water; 72 °N – 55 °S, 98 °W – 41 °E.

Spawning season: Eggs and larvae captured throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Olivar, P., J.-M. Fortuño (1991). *Guide to the ichthyoplankton of the Southeast Atlantic (Benguela current region)*. *Scientia Marina*, 55 (1): 1-383.
- Robertson, D.A. (1976). Planktonic stages of *Maurolicus muelleri* (Teleostei: Sternoptychidae) in New Zealand waters. *N.Z. J. Mar. Freshwater Res.*, 10: 331-328.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.60-1.84 mm
No. of oil globules – 1
Shell surface – Sculptured chorion. Network of hexagonal and pentagonal polygons
Pigment - None
Yolk - Segmented
Diameter of oil globules – 0.21-0.26 mm
Diagnostic features – Unique chorion ornamentation. Small perivitelline space.

LARVAE

Hatching length - Unknown
Yolk-sac absorption - Unknown
Flexion length – 5-7 mm
Transformation length – 11-12 mm
Pigmentation – Complete absence of melanophores up to a length of 7 mm.
Diagnostic features – Eyes vertically elliptical, rounded in late larvae. Early appearance of photophores. Gut < 50 % of standard length. Lack of pigment except over gas bladder. Development of photophores differs among Atlantic, Mediterranean and Pacific late larvae.

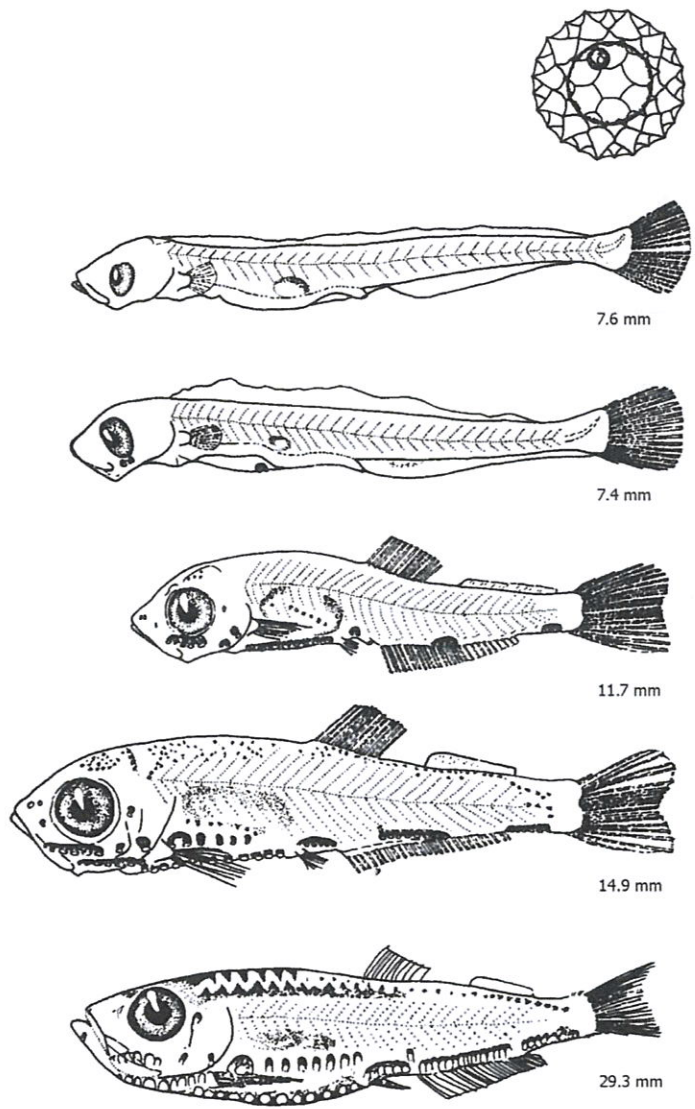


Plate 8- Early life history stages of *Maurolicus muelleri*. Robertson (1976).

STOMIIDAE

Stomias boa (Risso, 1810)

MERISTICS

Fins:

Dorsal rays – 17-21

Anal rays – 19-23

Pelvic rays - 5

Pectoral rays – 6-7

Myomeres:

Total number – 75-78

LIFE HISTORY

Range:

Eastern Atlantic: western Mediterranean south to Mauritania, and from Angola to South Africa. Southwest Atlantic: Brazil to Argentina. Southeast Pacific: Chile. Sub-Antarctic region of the Indian Ocean sector south to Heard Island.

Habitat: Found in deep oceanic waters to more than 1000 m depth, may migrate to near-surface waters at night.

Spawning season: Larvae found in spring. Rare.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Ege, V. (1918). Stomiatoidea. *Rep. Danish Oceanogr. Exp. Medit. 1908-1910*, Vol II (A4): 28pp.
- Olivar, P., J.-M. Fortuño (1991). *Guide to the ichthyoplankton of the Southeast Atlantic (Benguela current region)*. *Scientia Marina*, 55 (1): 1-383.
- Richards, W.J. (ed) (2005). *Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic*. CRC Press Inc., U.S. Two volumes: 2640pp.
- Sanzo, L. (1931). *Salmonoidi and Stomiatoidei. In Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr. 38 (1): 21-92.*

EARLY LIFE HISTORY DESCRIPTION

EGGS:

Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length – 3-4 mm ?

Yolk-sac absorption - Unknown

Flexion length - Unknown

Transformation length – 38–41.5 mm

Pigmentation – Distinct row of ventral pigment above the gut, intermittent pigment on dorsum, anal fin and lower caudal fin. Photophores appear around 30 mm.

Diagnostic features – Larvae elongate with long heads and prominent jaws. Elliptical eyes. Caudal fin fold in form of spatula. Pectorals very small and pedunculate. Slightly trailing gut (until transformation). At transformation when the barbell appears the juveniles are shorter than the late larvae.

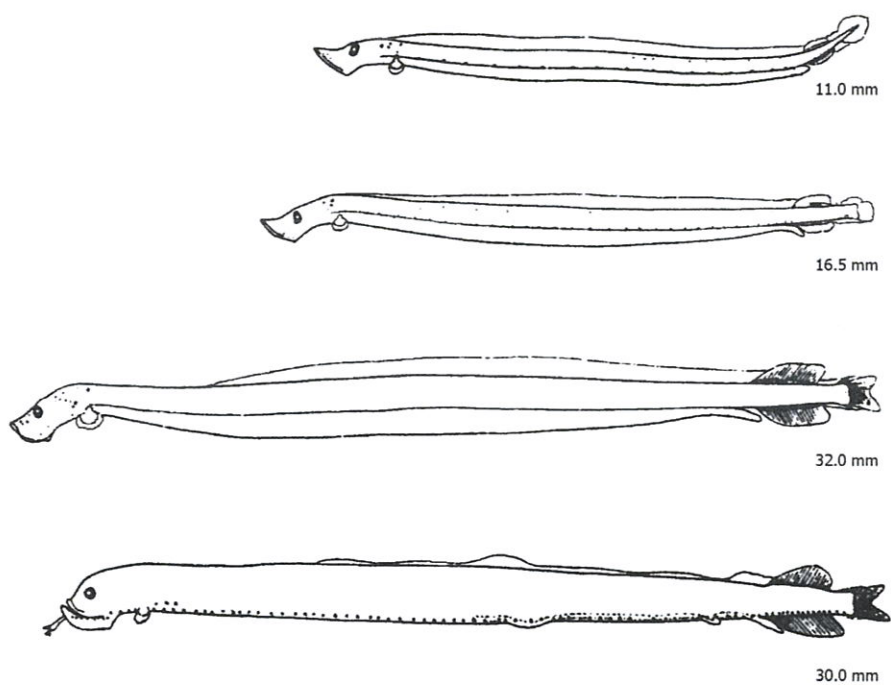


Plate 9- Early life history stages of *Stomias boa*. Ege (1918).

ARGENTINIDAE

Argentina sphyraena Linnaeus, 1758

MERISTICS

Fins:

- Dorsal rays – 10-12
- Anal rays – 11-15
- Pelvic rays – 10-12
- Pectoral rays – 12-15

Myomeres:

- Total number – 46-55: 36 (preanal) 17-19 (postanal)

LIFE HISTORY

Range: Eastern Atlantic: northern Norway to western Sahara including southern Iceland, Faroe Islands, Shetlands and western Mediterranean.

Habitat: Relatively common on the continental shelf and upper slope, probably schools near the bottom. Depth range 50-500 m.

Spawning season: Larvae found in spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1906). On the larval and post-larval development of the argentines *Argentina silus* (Ascan.) and *Argentina sphyraena* (Linné) with some notes on *Malloyus villosus* (O.F. Muller). *Medd. Komm. Havunders. Ser. Fiskeri* 2 (4): 20pp.
- Schmidt, J. (1918). Argentinidae, Microstomidae, Opisthoproctidae, Mediterranean Odontostomidae. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adiac. seas 2 Biology*, A5: 1-40.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 1.70-1.85 mm
- No. of oil globules - 1
- Shell surface - smooth
- Pigment - Small melanophores on the embryo, and numerous stellate melanophores on the yolk sac (which vary in position and number). Advanced embryo exhibits ventral melanophores and a caudal group on the dorsal and ventral sides.
- Yolk - segmented
- Diameter of oil globules – 0.37-0.47 mm
- Diagnostic features – Large oil globule. Segmented yolk, small perivitelline space.

LARVAE

- Hatching length – 7-8 mm
- Yolk-sac absorption – 9-10 mm
- Flexion length – 13-17 mm
- Transformation length – 50 mm?
- Pigmentation – Large stellate melanophores on yolk sac (anterior portion). 6 Groups of melanophores present along the dorsal side of the gut. Postanal dorsal and anal groups of melanophores. Pigmentation of late larvae identical.
- Diagnostic features – Typical pigmentation. Seven groups of equally spaced melanophores along the ventral contour. The primordial fin does not disappear until the larva is over 30 mm.

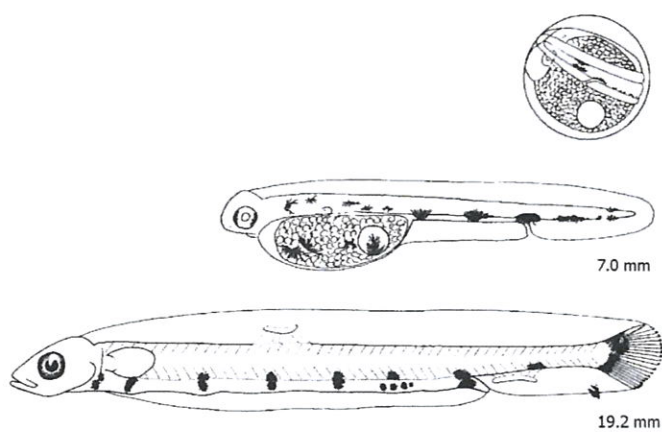


Plate 10- Early life history stages of *Argentina sphyraena*. Schmidt (1906), Russell (1976).

MYCTOPHIDAE

Benthoosema glaciale (Reinhardt, 1837)

MERISTICS

Fins:

Dorsal rays – 12-14
Anal rays – 17-19
Pelvic rays – 17-19
Pectoral rays – 11-13

Myomeres:

Total number – 34-36

LIFE HISTORY

Range: Eastern Atlantic: Norway and Greenland south to Morocco, and from Mauritania to Guinea (Mauritanian Upwelling Region). Seasonally present from Morocco to Mauritania along the edge of the continental shelf. Also known from the Mediterranean Sea. Western Atlantic: Baffin Bay to northern edge of Gulf Stream.

Habitat: Mesopelagic at depths between 375-800 m during daytime and 12-200 m during night.

Spawning season: Larvae present during spring and summer

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Moser, H.G., E.H. Ahlstrom (1974). Role of larval stages in systematic investigations of marine teleosts: the Myctophidae, a case study. *Fish. Bull. U.S.*, 72: 391-413.
- Shiganova, T.A. (1977). Larvae and juvenile of lantern-fishes (Myctophidae, Pisces) of the Atlantic Ocean. *Proceedings of the P.P Shirshov Institute of Oceanology*, 109: 42-112.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown
No. of oil globules - Unknown
Shell surface - Unknown
Pigment - Unknown
Yolk - Unknown
Diameter of oil globules - Unknown
Diagnostic features - Unknown

LARVAE

Hatching length - Unknown
Yolk-sac absorption - Unknown
Flexion length – 5-7 mm
Transformation length – 11 mm
Pigmentation – Pigmented pectoral fins.
Melanophore at posterior edge of opercula.
Pigment at tips of snout and lower jaw.
Three preanal melanophores. Faint spot over mid anal fin.
Diagnostic features – General form and pigmentation.

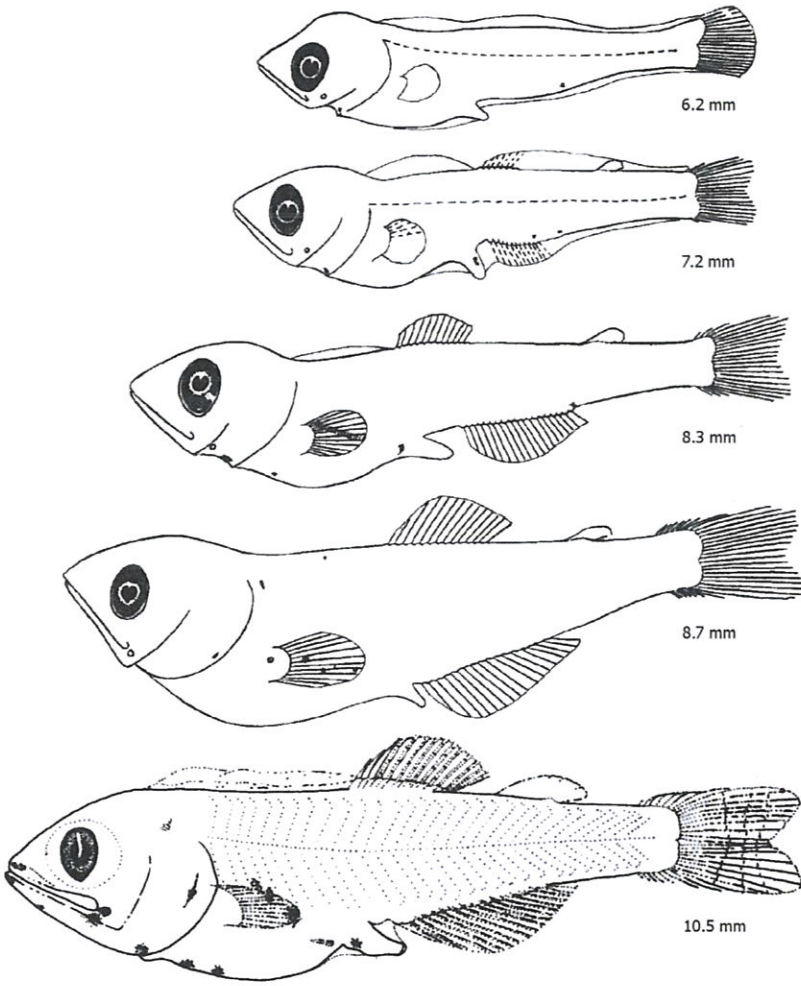


Plate 11- Early life history stages of *Benthosema glaciale*.
Shiganova (1977), Moser and Ahlstrom (1974).

MYCTOPHIDAE

Ceratoscopelus maderensis (Lowe, 1839)

MERISTICS

Fins:

Dorsal rays – 13-14
Anal rays – 13-15
Pelvic rays - 8
Pectoral rays – 13-14

Myomeres:

Total number – 35-38

LIFE HISTORY

Range: Eastern Atlantic: France to Mauritania, including the Mediterranean. Reported from Iceland. Western Atlantic: Slope Water and Gulf Streams regions from 50 °N to 30 °N.

Habitat: Bathypelagic, schooling, found between 650-700 m during the day and between 51-250 m at night with size stratification with depth.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Shiganova, T.A. (1977). Larvae and juvenile of lantern-fishes (Myctophidae, Pisces) of the Atlantic Ocean. *Proceedings of the P.P. Shirshov Institute of Oceanology*, 109: 42-112.
- Richards, W.J. (ed) (2005). Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic. CRC Press Inc., U.S. Two volumes: 2640pp.
- Tåning, Å. V. (1918). Mediterranean Scopelidae (*Saurus*, *Aulopus*, *Chlorophthalmus* and *Myctophum*). *Rep. Danish Oceanogr. Exped. Medit. 108-1910 Vol. II (A7)*: 154pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown
No. of oil globules - Unknown
Shell surface - Unknown
Pigment - Unknown
Yolk - Unknown
Diameter of oil globules - Unknown
Diagnostic features – Unknown

LARVAE

Hatching length - Unknown
Yolk-sac absorption - Unknown
Flexion length – 6 mm
Transformation length – 16 mm
Pigmentation – Few melanophores.
Preflexion larvae at around 5 mm exhibit a series of melanophores extending from anus to the ventral peduncle. Three to four melanophores on dorsal and ventral midlines of peduncle.
Diagnostic features – Body slender. Small head. Large round eyes. Gut extends to midbody. Few melanophores.

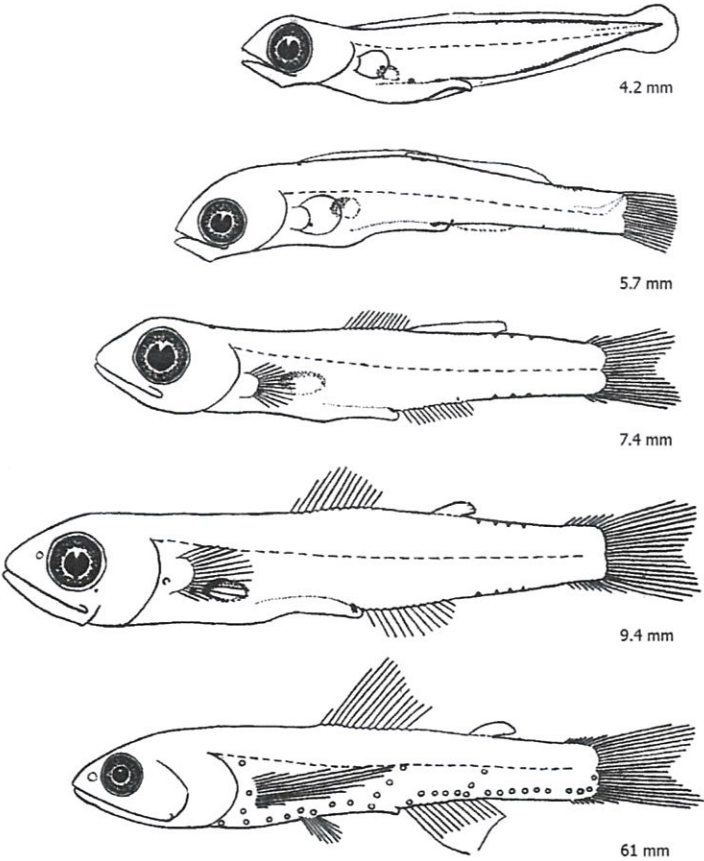


Plate 12- Early life history stages of *Ceratoscopelus maderensis*. Shiganova (1977).

MYCTOPHIDAE

Diogenichthys atlanticus (Tåning, 1928)

MERISTICS

Fins:

- Dorsal rays – 11-12
- Anal rays – 15-16
- Pelvic rays -
- Pectoral rays – 12-13

Myomeres:

- Total number – 32-35

LIFE HISTORY

Range: Atlantic Ocean: widely but unevenly distributed between 50 °N and 48 °S, less abundant or absent in regions of low productivity. Western Indian Ocean: between 22 °S and 45 °S. Pacific Ocean: widespread uneven distribution between 35 °N and 25 °S.

Habitat: Oceanic, epipelagic to mesopelagic, found between 400-930 m during the day and between 18-1050 m at night.

Spawning season: Spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Moser, H.G. (Ed.) (1996). *The early stages of fishes in the California Current region*. Calcofi Atlas no. 33: 1505pp.
- Moser, H.G., E.H. Ahlstrom (1970). Development of lanternfishes (Family Myctophidae) in the California Current. Part I. Species with narrow-eyed larvae. *Nat. Hist. Mus. Los Ang. Cty. Sci. Bull.*, 7 : 145pp.
- Richards, W.J. (ed) (2005). *Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic*. CRC Press Inc., U.S. Two volumes: 2640pp.
- Shiganova, T.A. (1977). Larvae and juvenile of lanternfishes (Myctophidae, Pisces) of the Atlantic Ocean. *Proceedings of the P.P. Shirshov Institute of Oceanology*, 109: 42-112.
- Tåning, Å. V. (1918). Mediterranean Scopelidae (*Saurus*, *Aulopus*, *Chlorophthalmus* and *Myctophum*). *Rep. Danish Oceanogr. Exped. Medit.* 108-1910 Vol. II (A7): 154pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

- Capsule diameter - Unknown
- No. of oil globules - Unknown
- Shell surface - Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features – Unknown

LARVAE

- Hatching length - Unknown
- Yolk-sac absorption - Unknown
- Flexion length – 6-7 mm
- Transformation length – 14-15 mm
- Pigmentation – Four pairs of melanophores on the lateral surfaces of the gut.
- Melanophores on anal rays, at base of pectoral rays and at base of caudal rays.
- Large melanophore over end of gut (side of trunk). Row of melanophores on ventral midline of tail and along anal fin base.
- Diagnostic features – Eye slightly oval. Body slender in small larvae. Barbel on lower jaw present from about 5 mm until transformation.

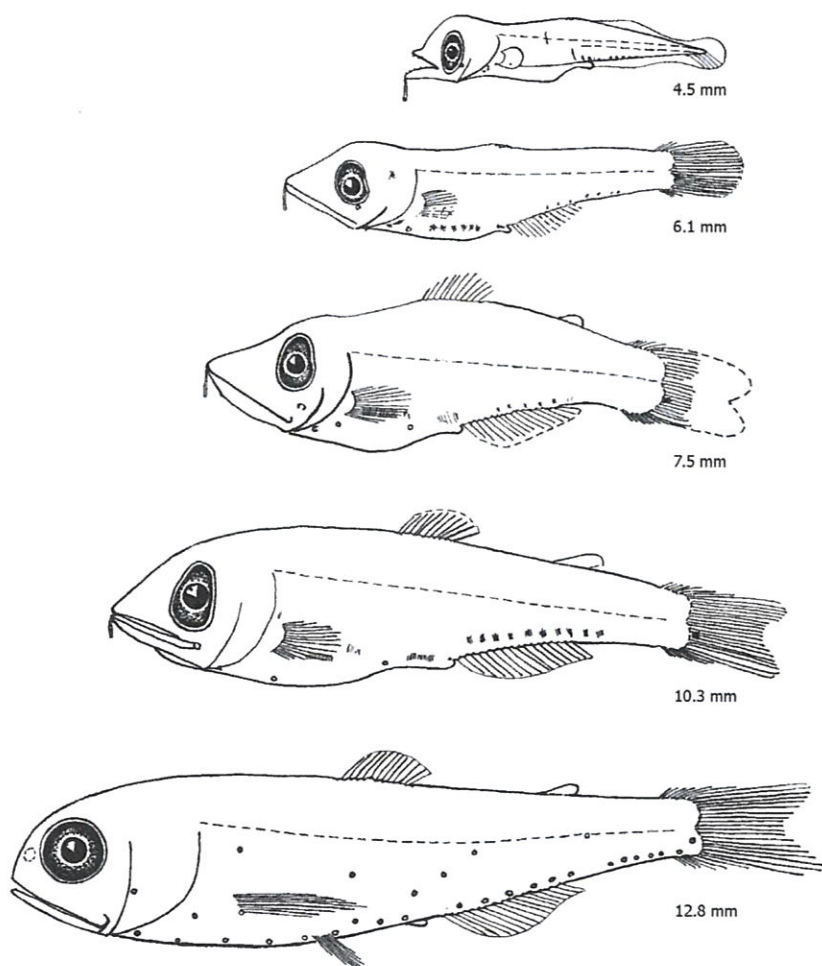


Plate 13- Early life history stages of *Diogenichthys atlanticus*. Shiganova (1977).

MYCTOPHIDAE

Electrona risso (Cocco, 1829)

MERISTICS

Fins:

- Dorsal rays – 13-14
- Anal rays – 18-19
- Pelvic rays - 8
- Pectoral rays – 13-16

Myomeres:

- Total number – 32-34

LIFE HISTORY

Range: Eastern Atlantic: British Isles to Namibia, also the Mediterranean (gap across region of cyclonic gyre between the South Equatorial Countercurrent and western branch of Benguela Current (5°S-13°S).

Habitat: Oceanic, found between 225-750 m during the day and between 90-375 m (juveniles) and 450-550 m (adults) at night. Epipelagic to mesopelagic. Widespread distribution in all oceans.

Spawning season: Spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Moser, H.G. (Ed.) (1996). *The early stages of fishes in the California Current region*. Calcofi Atlas no. 33: 1505pp.
- Moser, H.G., E.H. Ahlstrom (1970). Development of lanternfishes (Family Myctophidae) in the California Current. Part I. Species with narrow-eyed larvae. *Nat. Hist. Mus. Los Ang. Cty. Sci. Bull.*, 7 : 145pp.
- Richards, W.J. (ed) (2005). *Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic*. CRC Press Inc., U.S. Two volumes: 2640pp.
- Tåning, Å. V. (1918). Mediterranean Scopelidae (*Saurus*, *Aulopus*, *Chlorophthalmus* and *Myctophum*). *Rep. Danish Oceanogr. Exped. Medit.* 108-1910 Vol. II (A7): 154pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

- Capsule diameter - Unknown
- No. of oil globules - Unknown
- Shell surface - Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features – Unknown

LARVAE

- Hatching length - < 3.8 mm
- Yolk-sac absorption - Unknown
- Flexion length – 6-7 mm
- Transformation length – 10 mm
- Pigmentation – Preflexion larvae without pigmentation. Few pigments in flexion larvae: 6.0 mm, a pair at lower jaw tip and a patch on pectoral fin blade; 7.0 mm, above developing gas bladder.
- Diagnostic features – Unique gut shape (broad anteriorly, narrows in posterior third). Gut about 50 % of standard length.
- Large head. Eyes moderately narrow, with small choroids mass. Photophores appear in early larvae (6 mm)

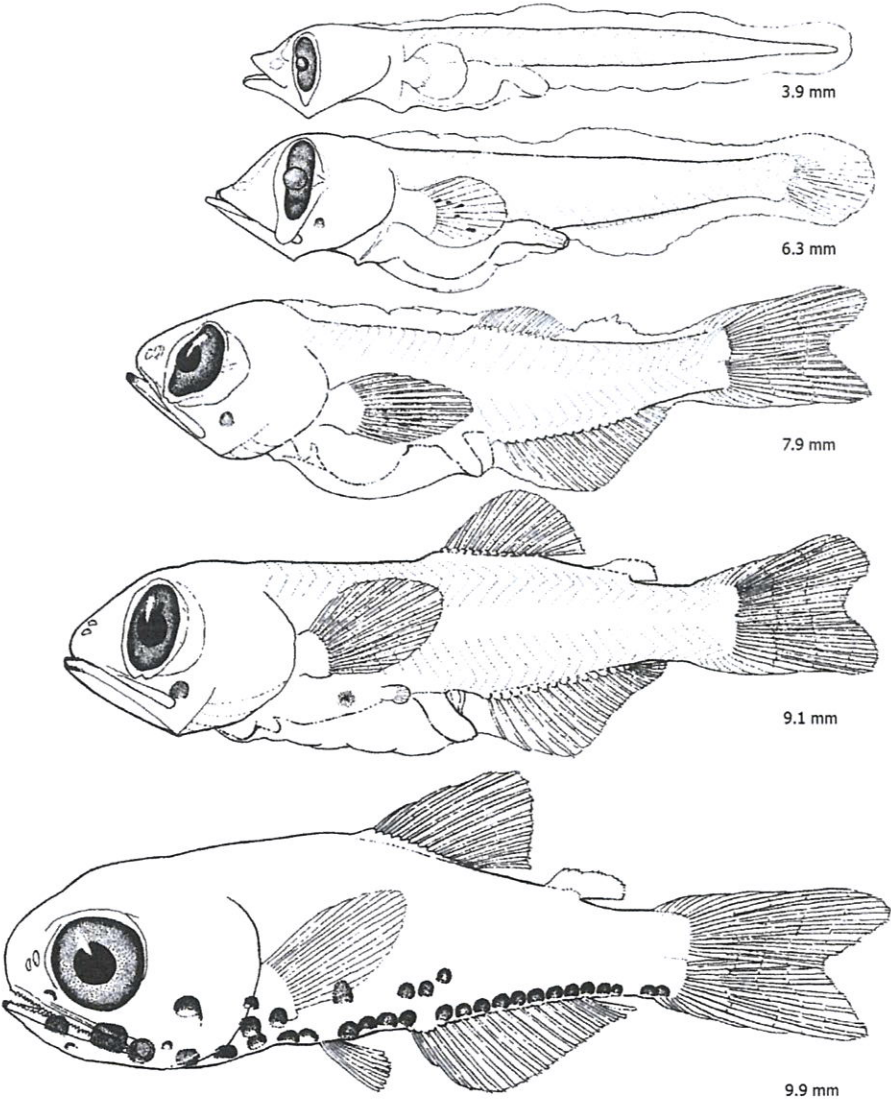


Plate 14- Early life history stages of *Electrona risso*. Moser and Ahlstrom (1970).

MYCTOPHIDAE

Myctophum punctatum Rafinesque, 1810

MERISTICS

Fins:

Dorsal rays – 13-14
Anal rays – 20-22
Pelvic rays - 8
Pectoral rays – 13-14

Myomeres:

Total number – 40-42

LIFE HISTORY

Range: Eastern Atlantic: Mauritanian Upwelling Region (15 °N-20 °N) as far as 30 °N. Mediterranean Sea. Western Atlantic: Greenland to USA.

Habitat: High-oceanic, mesopelagic. Nyctoepipelagic at the surface and down to 125 m, between 225-750 m during the day.

Spawning season: spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Moser, H.G., E.H. Ahlstrom (1974). Role of larval stages in systematic investigations of marine teleosts: the Myctophidae, a case study. *Fish. Bull. U.S.*, 72: 391-413.
- Shiganova, T.A. (1977). Larvae and juvenile of lantern-fishes (Myctophidae, Pisces) of the Atlantic Ocean. *Proceedings of the P.P Shirshov Institute of Oceanology*, 109: 42-112.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown
No. of oil globules - Unknown
Shell surface - Unknown
Pigment - Unknown
Yolk - Unknown
Diameter of oil globules - Unknown
Diagnostic features – Unknown

LARVAE

Hatching length - Unknown
Yolk-sac absorption - Unknown
Flexion length – 7 mm
Transformation length – 21-22 mm
Pigmentation – Characteristic pigmentation. Preanal series of melanophores from anus to head. Rows of melanophores on upper and lower jaws. Spots on upper edge of opercula.
Diagnostic features – Body elongate, snout prominent, flat and broad. Eyes narrow, stalked with choroids mass. Large pectoral fins (fan shaped base).

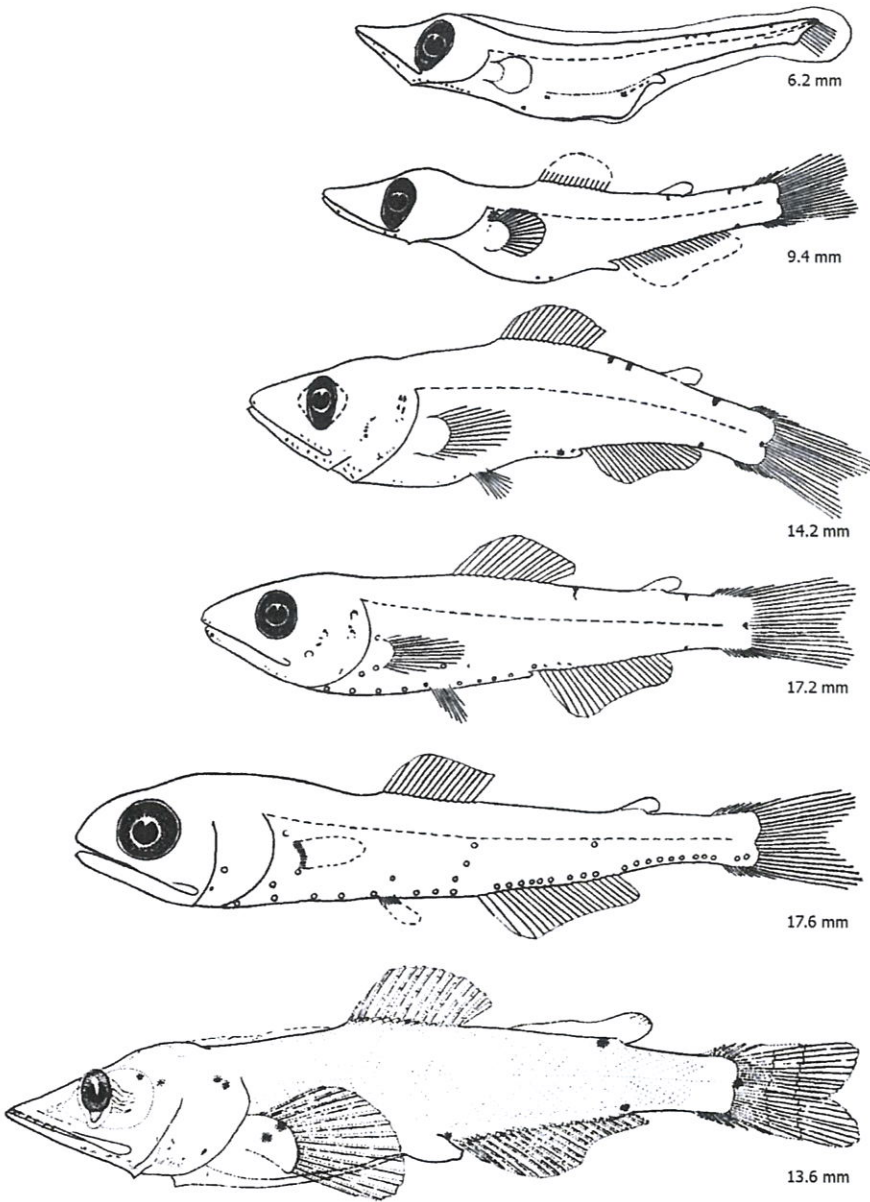


Plate 15- Early life history stages of *Myctophum punctatum*. Shiganova (1977), Moser and Ahlstrom (1974).

MYCTOPHIDAE

Notolychnus valdiviae (Brauer, 1904)

MERISTICS

Fins:

- Dorsal rays – 10-12
- Anal rays – 12-14
- Pelvic rays - 6
- Pectoral rays – 12-13

Myomeres:

- Total number – 27-30

LIFE HISTORY

Range: Worldwide distribution in tropical, subtropical and temperate waters. Eastern Atlantic: west of British Isles and Bay of Biscay to South Africa. Western Atlantic: Canada to Argentina. Western Pacific: between 0 ° and 32 °S. Eastern Pacific: between 32 °N and 30 °S, but with 20 °S southern limit in Peruvian Transitional Zone. Eastern Indian Ocean: between 9 °-32 °S.

Habitat: bathypelagic depth range 25–700 m.

Spawning season: Spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Moser, H.G. (Ed.) (1996). *The early stages of fishes in the California Current region*. Calcofi Atlas no. 33: 1505pp.
- Moser, H.G., E.H. Ahlstrom (1974). Role of larval stages in systematic investigations of marine teleosts: the Myctophidae, a case study. *Fish. Bull. U.S.*, 72: 391-413.
- Richards, W.J. (ed) (2005). *Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic*. CRC Press Inc., U.S. Two volumes: 2640pp.
- Tåning, Å. V. (1918). Mediterranean Scopelidae (*Saurus*, *Aulopus*, *Chlorophthalmus* and *Myctophum*). *Rep. Danish Oceanogr. Exped. Medit.* 108-1910 Vol. II (A7): 154pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

- Capsule diameter - Unknown
- No. of oil globules - Unknown
- Shell surface - Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features – Unknown

LARVAE

- Hatching length - Unknown
- Yolk-sac absorption - Unknown
- Flexion length – 4-5 mm
- Transformation length – 9-10 mm
- Pigmentation – Usually 2 or 3 melanophores on lateral gut (flexion larvae). Postflexion larvae- 2-7 postanal ventral melanophores.
- Diagnostic features – Characteristic (unusual) shape of head body and gut. Eye shape varies (narrow to round). All photophores formed after transformation.
- Low pelvic ray count (6).

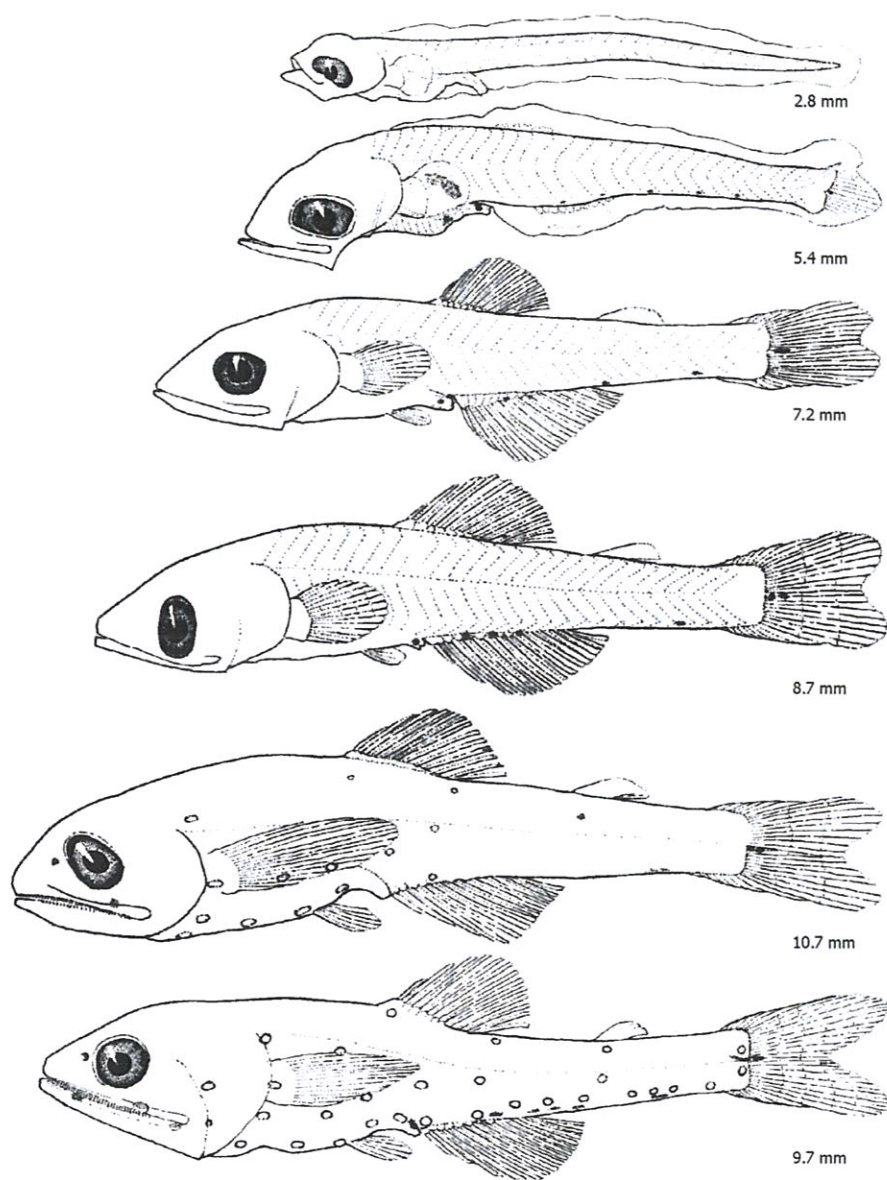


Plate 16- Early life history stages of *Notolychnus valdiviae*. Moser (1996).

PARALEPIDIDAE

Magnisudis atlantica (Krøyer, 1868)

MERISTICS

Fins:

Dorsal rays – 9-11
Anal rays – 20-24
Pelvic rays - 9
Pectoral rays – 15-17

Myomeres:

Total number – 60-68, preanal (32-34)

LIFE HISTORY

Range: All oceans and polar seas from the Arctic to Antarctic. Common in northern Atlantic and Pacific. Eastern Pacific: southeast Alaska (59 °N) to Chile. Northwest Pacific: Bering Sea, Kamchatka and Kuril Islands.

Habitat: Oceanic species of medium depth range. Large adults approach the coasts in temperate and polar zones.

Spawning season: Spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Ege, V. (1930). Sudidae (*Paralepis*). *Rep. Danish Oceanogr. Exp. Medit. 1908-1910*, Vol II (A13): 201pp.
- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Richards, W.J. (ed) (2005). Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic. CRC Press Inc., U.S. Two volumes: 2640pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown
No. of oil globules - Unknown
Shell surface - Unknown
Pigment - Unknown
Yolk - Unknown
Diameter of oil globules - Unknown
Diagnostic features – Unknown

LARVAE

Hatching length - < 8.5 mm
Yolk-sac absorption - Unknown
Flexion length – 8.5-10.5 mm
Transformation length – 23-47 mm
Pigmentation – Heavy peritoneal pigmentation. Pigment on top of head. Single melanophores near Dorsal and Anal fins.
Diagnostic features - Duck-billed shape of head. Fewer total myomeres than other Paralepididae.

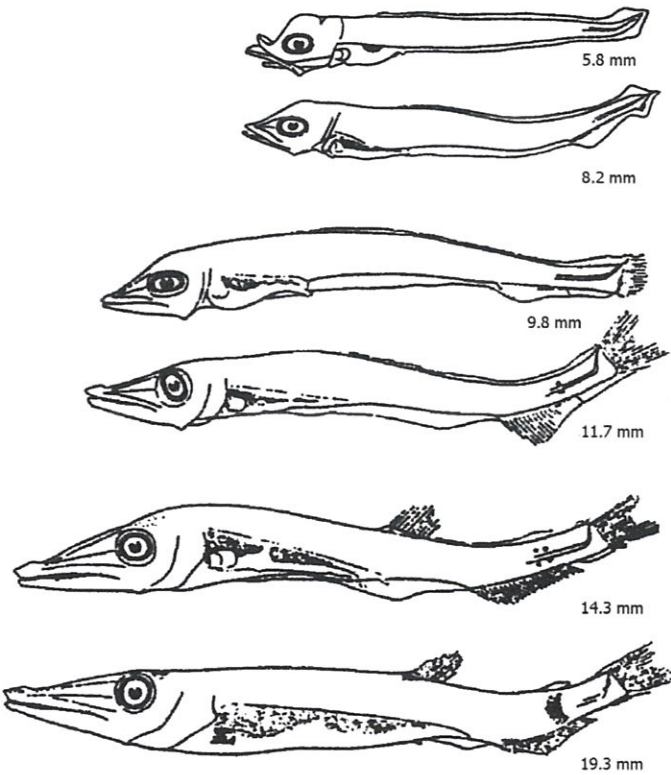


Plate 17- Early life history stages of *Magnisudis atlantica*. Ege (1930), Fahay (1983).

PARALEPIDIDAE

Paralepis coregonoides Risso, 1820

MERISTICS

Fins:

- Dorsal rays – 8-11
- Anal rays – 21-25
- Pelvic rays - 9
- Pectoral rays – 13-16

Myomeres:

- Total number – 70-74, preanal (34-36)

LIFE HISTORY

Range: Atlantic Ocean: restricted to the North Atlantic and adjacent seas.

Habitat: Depth range from 50-1000 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Ege, V. (1930). Sudidae (*Paralepis*). *Rep. Danish Oceanogr. Exp. Medit. 1908-1910*, Vol II (A13): 201pp.
- Fahay, M.P. (1983). Guide to the early stages of marine fishes occurring in the Western North Atlantic Ocean, Cape Hattaras to the southern Scotian Shelf. *J. Northwest Atl. Fish. Sci.*, 4 : 1-423.
- Richards, W.J. (ed) (2005). Early Stages of Atlantic Fishes: An Identification Guide for the Western Central Atlantic. CRC Press Inc., U.S. Two volumes: 2640pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

- Capsule diameter - Unknown
- No. of oil globules - Unknown
- Shell surface - Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features – Unknown

LARVAE

- Hatching length - <6 mm
- Yolk-sac absorption - Unknown
- Flexion length – 10-15 mm
- Transformation length – 25 mm
- Pigmentation – 1 to 2 peritoneal patches (preflexion larvae). Long internal series of pigments above and below the notochord (flexion larvae).
- Diagnostic features – Small head, snout shorter than *M. atlantica*. Other *Paralepis* lack internal pigments above and below the notochord.

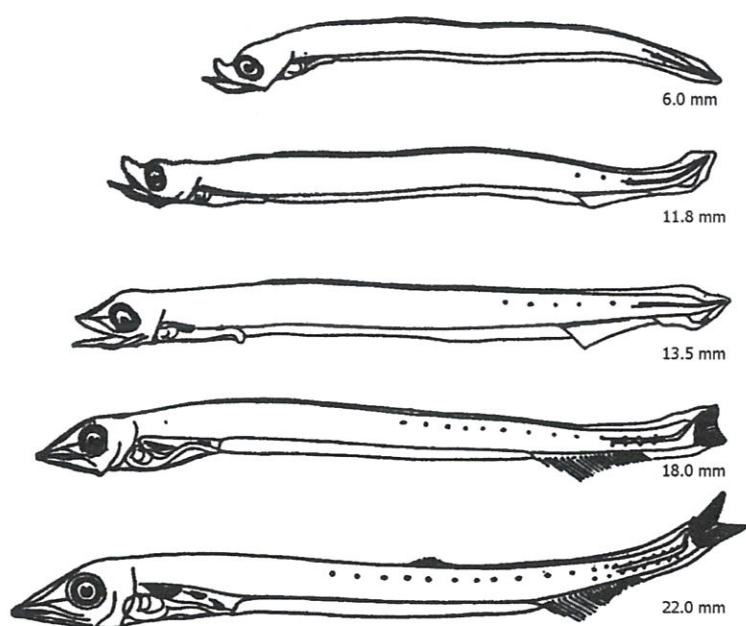


Plate 18- Early life history stages of *Paralepis coregonoides*. Ege (1930), Fahay (1983).

ANGUILLIDAE

Anguilla anguilla (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays -
- Anal rays -
- Pelvic rays -
- Pectoral rays -

Myomeres:

Total number – 110-119

LIFE HISTORY

Range: Catadromous. Migrates to the depths of the Sargasso Sea to spawn. leptocephali larvae are transported to the coasts of Europe by the Gulf Stream in 7 to 11 months and can last for up to 3 years. These are transformed into elvers, enter the estuaries and colonize continental waters.

Habitat: Atlantic Ocean: Atlantic coast from Scandinavia to Morocco and rivers of North Atlantic, Baltic and Mediterranean seas.

Spawning season: Spawning takes place in late winter and spring in the Sargasso Sea. Juveniles are caught throughout the whole year inside estuaries and lagoons (mainly in spring and summer).

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Boëtius, J. (1976). Elvers, *Anguilla anguilla* and *Anguilla rostrata* from two Danish localities. Size, body weight, developmental stage and number of vertebrae related to time of ascent. *Meddr Danm. Fisk.- og Havunders.*, NS: 199-220.
- García A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de da Bahía de Cádiz*. Instituto de Ciencias Marinas de Andalucía. Consejo Superior de Investigaciones Científicas, Cádiz: 163pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Schmidt, J. (1909). Remarks on the metamorphosis and distribution of the larvae of the eel (*Anguilla vulgaris*, Turton). *Medd. Komm. Havunds., Fiskeri*, 3 (3): 1-17.
- Schmidt, J. (1923). Breeding places and migrations of the Eel. *Nature*, 3 (2776): 51-54.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 0.9-1.38 mm
- No. of oil globules - 1
- Shell surface - smooth
- Pigment - none
- Yolk - unsegmented
- Diameter of oil globules – 0.25-0.36 mm
- Diagnostic features – Initially many oils globules that coalesce into one. In later stages of development, dendritic melanophores appear over the anterior hemisphere of the oil globule.

LARVAE

- Hatching length – 6 mm
- Yolk-sac absorption – 6 mm
- Flexion length -
- Transformation length -
- Pigmentation – Newly hatched larva unpigmented. Late leptocephalus – a few melanophores caudal area.
- Diagnostic features - Newly hatched larva with protruding teeth. Leptocephalus stage – morphology of the larva changes dramatically (the body becomes very high and laterally compressed). Head very small relative to body. Transparent with distinct myomeres (110-119). Pelvic fins absent. *A. anguilla* can be distinguished from *A. rostrata* by the number of myomeres (110-119 versus 102-111). Juveniles are caught throughout the whole year inside estuaries and lagoons (mainly in spring and summer).

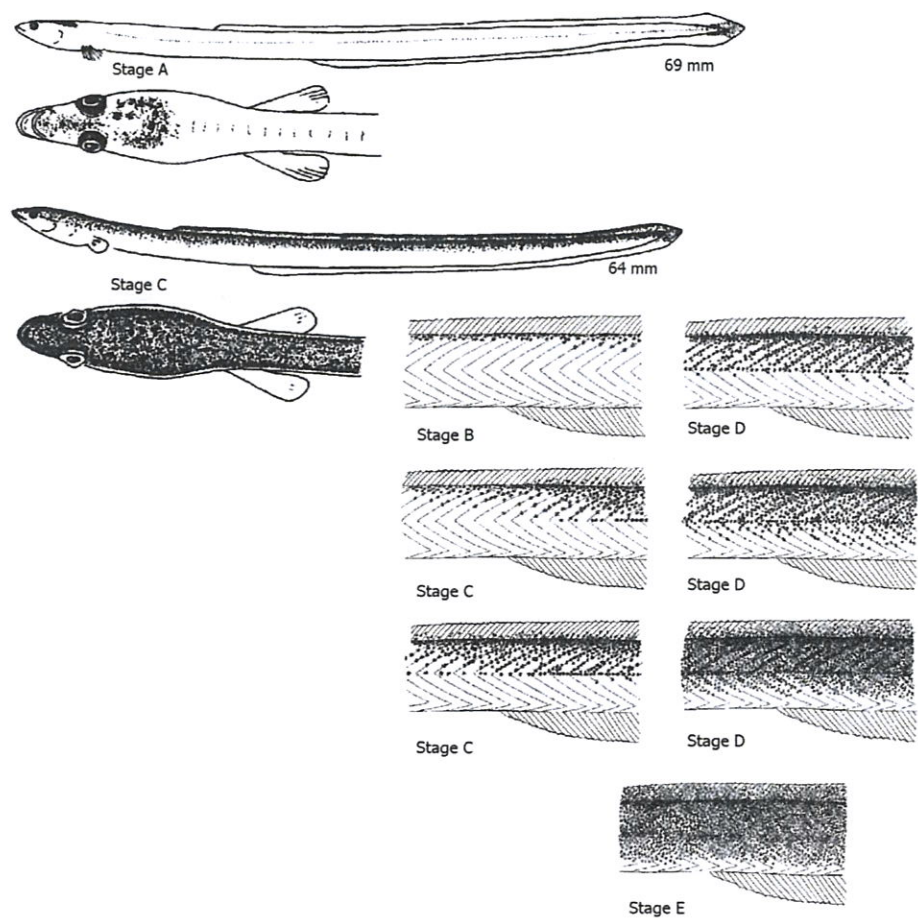


Plate 19- Juveniles of *Anguilla anguilla*. Garcia and Moyano (1990).

MURAENIDAE

Muraena helena Linnaeus, 1758

MERISTICS

Fins:

- Dorsal rays -
- Anal rays -
- Pelvic rays -
- Pectoral rays -

Myomeres:

Total number – 145-150 (14 mm), preanal (76-80). Later 139-144 myomeres.

LIFE HISTORY

Range: Eastern Atlantic: south of British Isles to Senegal, including the Mediterranean, Azores, Madeira, Canary Islands, and Cape Verde.

Habitat: A nocturnal and territorial species commonly lurking in holes, and writhing snakelike through crevices, under rocks or corals.

Spawning season: summer and autumn.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

D'Ancona, U. (1931-1933). Apodes (Muraenoidei). *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.38.*: 84-146.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 5.0-5.5 mm
- No. of oil globules - 0
- Shell surface - smooth
- Pigment - none
- Yolk - segmented
- Diameter of oil globules -
- Diagnostic features – Large perivitelline space.

LARVAE

- Hatching length – 10.5-11 mm
- Yolk-sac absorption -
- Flexion length -
- Transformation length -
- Pigmentation – Few pigments.
- Diagnostic features – Typical shape. Eel like. Tube-like gut. Teeth clearly visible.

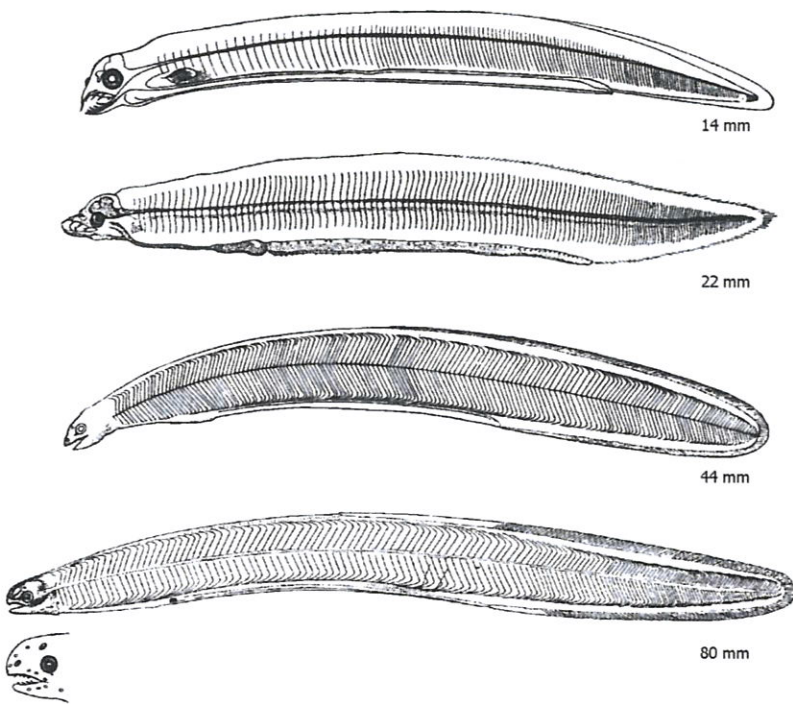


Plate 20- Early life history stages of *Muraena Helena*. D'Ancona (1931-1933).

CONGRIDAE

Conger conger (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays -
- Anal rays -
- Pelvic rays -
- Pectoral rays -

Myomeres:

Total number – 148-155

LIFE HISTORY

Range: Eastern Atlantic: Norway and Iceland to Senegal. Also in the Mediterranean and Black Sea.

Habitat: Found on rocky and sandy bottoms. Depth range from 0-500 m. It stays near the coast when young and moves toward deeper waters upon reaching adulthood.

Spawning season: Spawns in summer in the Atlantic off Portugal and in the Mediterranean.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

D'Ancona, U. (1931-1933). Apodes (Muraenoidei). *Uova, larve e stadi Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.*38.: 84-146.

EARLY LIFE HISTORY DESCRIPTION

EGGS:

- Undescribed
- Capsule diameter - Unknown
- No. of oil globules - Unknown
- Shell surface - Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features – Unknown

LARVAE

- Hatching length - <8 mm
- Yolk-sac absorption - Unknown
- Flexion length -
- Transformation length – 150 mm
- Pigmentation - No melanophores on head or trunk. Tail with single melanophore.
- Peritoneal pigmentation - row of melanophores.
- Diagnostic features – Characteristic shape. Eel like. Tube-like gut. Teeth clearly visible.

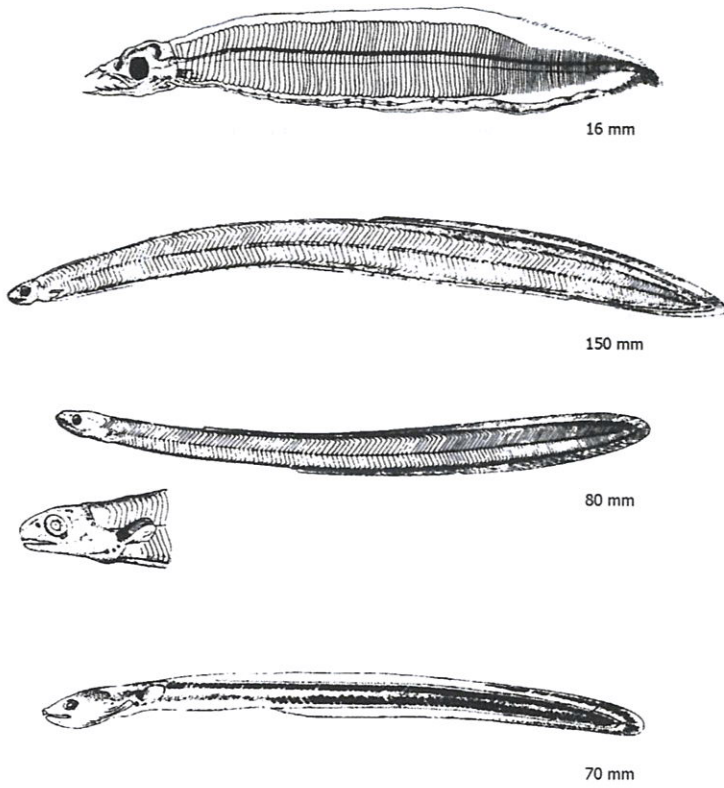


Plate 21- Early life history stages of *Conger conger*. D'Ancona (1931-1933).

OPHICHTIDAE

Ophisurus serpens (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays -
- Anal rays -
- Pelvic rays -
- Pectoral rays -

Myomeres:

Total number – 200-208, preanal (89-94)

LIFE HISTORY

Range: Eastern Atlantic: northern coast of Iberian Peninsula to South Africa, also Madeira and western Mediterranean. Western Indian Ocean: southern Mozambique to South Africa. Western Pacific: Japan and Australasia.

Habitat: reef-associated; brackish; marine; depth range 0-300 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

D'Ancona, U. (1931-1933). Apodes (Muraenoidei). *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 84-146.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 2.5-3.5 mm
- No. of oil globules – 11-28
- Shell surface - smooth
- Pigment - none
- Yolk - Segmented
- Diameter of oil globules – 0.08-0.16 mm
- Diagnostic features – Large perivitelline space

LARVAE

- Hatching length - >8 mm (191 myomeres)
- Yolk-sac absorption -
- Flexion length -
- Transformation length -
- Pigmentation – Larvae with 15 mm have 5 abdominal melanophores. Three postanal ventral melanophores.
- Diagnostic features - Eel like. Tube-like gut. Typical pigmentation. Elongated snout. Upper jaw shorter than lower. Each jaw with 4 teeth.

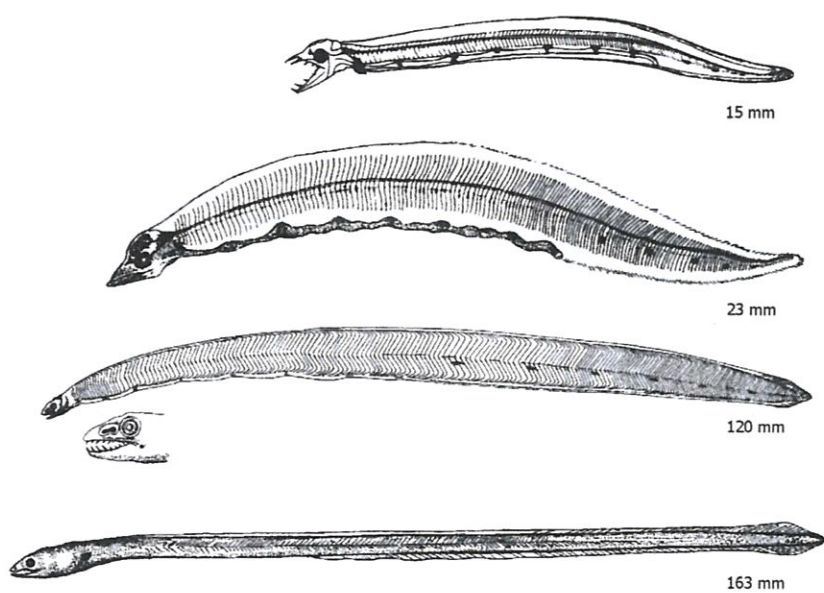


Plate 22- Early life history stages of *Ophisurus serpens*. D'Ancona (1931-1933).

BELONIDAE

Belone belone (Linnaeus, 1761)

MERISTICS

Fins:

Dorsal rays – 16-20

Anal rays – 19-23

Pelvic rays -

Pectoral rays –

Myomeres:

Total number – 75-84

LIFE HISTORY

Range: Eastern Atlantic and Mediterranean Sea. Three subspecies are recognized *Belone belone belone* (Linnaeus, 1761) (Northeast Atlantic); *Belone belone euxini* Günther, 1866 (Black Sea and Sea of Azov); *Belone belone acus* Risso, 1827 (Mediterranean Sea and adjacent parts of Atlantic Ocean, Madeira, Canary Islands, Azores, and south to Cape Verde; subspecies *Belone belone gracilis* Lowe, 1839 (France to the Canary Islands including the Mediterranean.

Habitat: Lives close to the surface and has a migratory pattern similar to the mackerel.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- D'Ancona, U. (1931). Scomberesocidae. In *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38 (1): 157-164.
- Dekhnik, T.V. (1973). *Ichthyoplankton of the Black Sea*. Naukova Dumka, Kiev: 235pp (in russian).
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Garcia A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de da Bahia de Cadiz*. Instituto de Ciencias Marinas de Andalucía. Consejo Superior de Investigaciones Científicas, Cadiz: 163pp.
- M'intosh, W.S., A.T. Masterman (1897). *The life-histories of the British marine food-fishes*. C. J. Clay London: 467p.
- Moser, H.G., W.J. Richards, D.M. Cohen, M.P. Fahay, A.W. Kendall, S.L. Richardson (eds.) (1984). *Ontogeny and systematics of fishes*. American Society of Ichthyologists and Herpetologists ed., Special publication Number 1: 760pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 2.8-3.5 mm

No. of oil globules - 0

Shell surface – filamentous processes

Pigment - none

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features – large size, 60 to 80 long filamentous processes (4-18 mm) on shell surface. Eggs can be found attached to floating objects or demersal algae.

LARVAE

Hatching length – 9-13 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – newly hatched larva

completely covered with a large number of black and yellow chromatophores.

Melanophores arranged along myomeres in the dorsal part of the body.

Diagnostic features - lower jaw strongly projecting. Elongation of lower jaw starts at 18 mm. Pelvic fins appear at a length of 20-24 mm

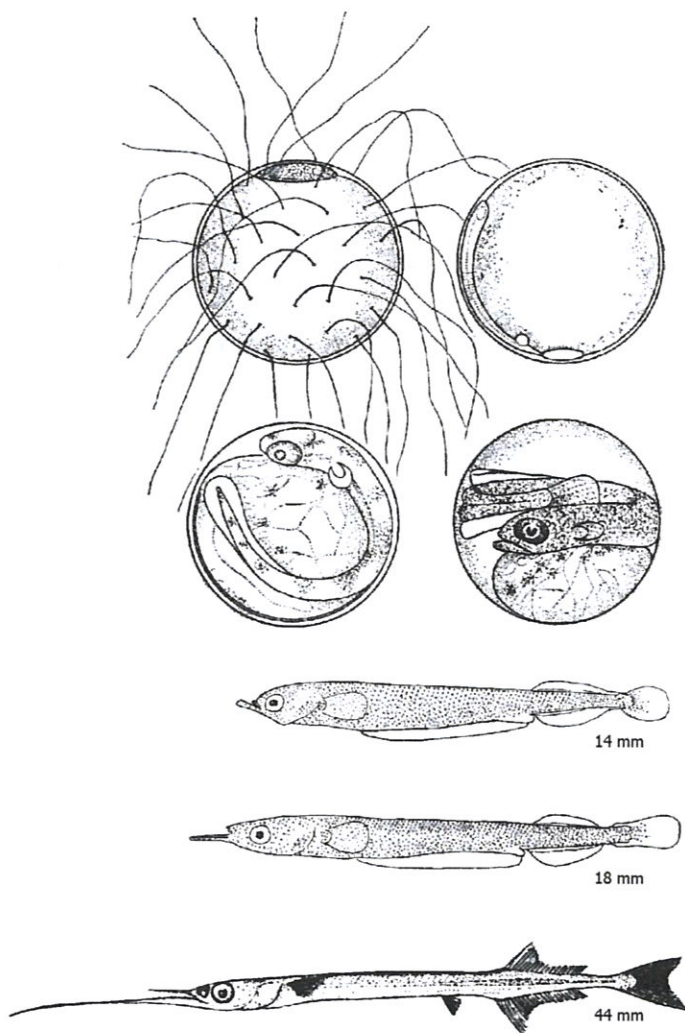


Plate 23- Early life history stages of *Belone belone*. Dekhnik (1973), Russell (1976), Moser *et al.* (1984)

MERISTICS**Fins:**

Dorsal rays – 6-8 (spines) 11-13 (soft)
 Anal rays - 18
 Pelvic rays -
 Pectoral rays –

Myomeres:

Total number – 24-25, 10 (preanal)

LIFE HISTORY

Range: Western Atlantic: off the east coast of the USA and the Greater Antilles; also northern South America and Argentina. Eastern Atlantic and Mediterranean. Indo-West Pacific. Mainly in temperate latitudes between 20 ° and 40 °N.

Habitat: demersal; marine; depth range 25–600 m.

Spawning season: spring

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Macrorhamphosidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 299-306.
- Hardy, J.D. (1978). Macrorhamphosidae. *Development of fishes of the Mid-Atlantic Bight*. Fish and Wildlife Service, U.S. Department of the Interior. Volume II: 377-386.
- Spartà, A. (1936). Contributo alla conoscenza di uova, stadi embrionali e post-embrionali in *Macroramphosus scolopax* L.. *R. Com. talassog. Ital. Mem.* 225: 14pp.

EARLY LIFE HISTORY DESCRIPTION**EGGS**

Capsule diameter – 1.0 mm
 No. of oil globules - 1
 Shell surface - smooth
 Pigment – scattered melanophores on sides of embryo.
 Yolk - unsegmented
 Diameter of oil globules – 0.2 mm
 Diagnostic features – Viteline membrane light amber, yolk with rose or violet halo depending on viewing light, single oil globule.

LARVAE

Hatching length – 3.0 mm
 Yolk-sac absorption -
 Flexion length -
 Transformation length -
 Pigmentation – Newly-hatched larvae: melanophores concentrated in posterodorsal region and in a continuous line along ventral surface of body from behind the eye to caudal region. Larvae: eye completely pigmented with metallic reflections. Melanophores concentrated on posterodorsal surface and along ventral line of body.
 Diagnostic features – Snout somewhat elongate. Laterally compressed. Supraorbital crest prominent at 6.0 mm. Typical pigmentation.

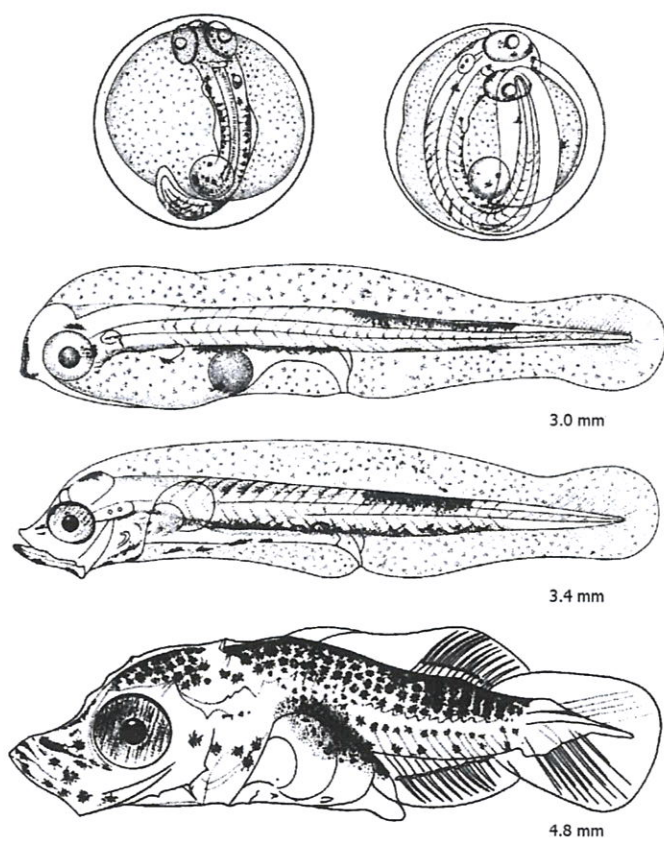


Plate 24- Early life history stages of *Macroramphosus scolopax*. Spartà (1936).

SYNGNATHIDAE

Entelurus aequoreus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – 37-47
Anal rays -
Pelvic rays -
Pectoral rays –

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Iceland and Norway to Azores and also enters Baltic Sea.

Habitat: Inhabits inshore waters, among algae.

Spawning season: spring and summer.

ELH pattern: Ovoviviparous. The male carries the eggs in a brood pouch, which is found under the tail.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
Le Danois, E. (1913). Contribution à l'Étude systématique et biologique des poissons de la Manche Occidentale. *Ann. Inst. Océanogr., Paris*, 5: 1-214.
Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter -
No. of oil globules -
Shell surface -
Pigment -
Yolk -
Diameter of oil globules -
Diagnostic features - Pear-shaped eggs in brood pouch (400-1000 eggs).

LARVAE

Hatching length -
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation - 12 - 13 dorsal clusters of melanophores.
Diagnostic features – Newly hatched larvae with primordial and pectoral fins. Anus below the posterior part of the dorsal fin. Sides of body with 90 - 95 tooth-like projections. Larval characteristics remain until length of about 100 mm. Pectoral fins disappear when the larva settles.

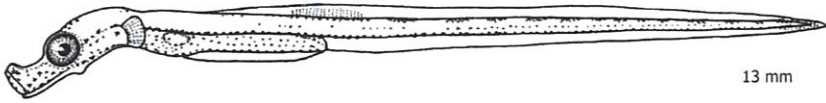


Plate 25- Early life history stages of *Entelurus aequoraeus*. Le Danois (1913).

SYNGNATHIDAE

Hippocampus guttulatus Cuvier, 1829

MERISTICS

Fins:

Dorsal rays – 19-22
Anal rays - 4
Pelvic rays -
Pectoral rays – 15-18

Myomeres:

Total number – 51-52

LIFE HISTORY

Range: Eastern Atlantic: British Isles to Morocco, Canary Islands, Madeira, and the Azores including the Mediterranean. International trade is monitored through a licensing system (CITES II, since 20040514).

Habitat: Occurs mostly in shallow inshore waters among algae and eel grass.

Spawning season: spring and summer.

ELH pattern: Ovoviparous. Incubation of the eggs takes place in a marsupial pouch found in front of the tail of the males.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Syngnathidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 281-289.
- García A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de la Bahía de Cádiz*. Instituto de Ciencias Marinas de Andalucía. Consejo Superior de Investigaciones Científicas, Cádiz: 163pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.9-2.0 mm
No. of oil globules -
Shell surface -
Pigment -
Yolk -
Diameter of oil globules -
Diagnostic features - Pear-shaped. Large perivitelline space.

LARVAE

Hatching length – 10 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Melanophores uniformly distributed on head and body.
Diagnostic features – Eye diameter comprised more than twice in the preorbital space. Bony crests on head. Dorsal, anal and pectoral fins completely developed at hatching.

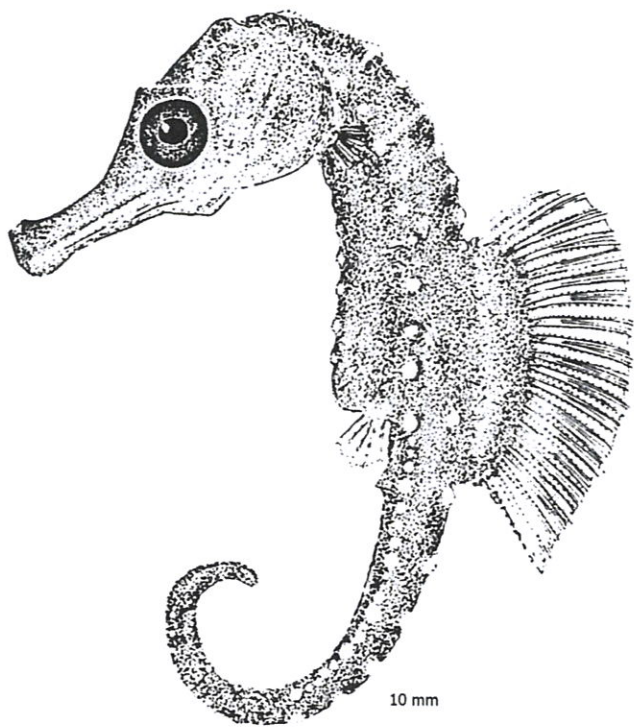


Plate 27- Early life history stages of *Hippocampus guttulatus*. Garcia and Moyano (1990).

SYNGNATHIDAE

Hippocampus hippocampus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – 16-19
Anal rays - 4
Pelvic rays -
Pectoral rays – 13-15

Myomeres:

Total number – 47-51

LIFE HISTORY

Range: Eastern Atlantic: Wadden Sea southward to the Gulf of Guinea, Canary Islands and along the African coast to Guinea. Also in the Mediterranean Sea. International trade is monitored through a licensing system (CITES II, since 20040514).

Habitat: shallow inshore waters among algae.

Spawning season: spring and summer.

ELH pattern: Ovoviviparous. Incubation of the eggs takes place in a marsupial pouch found in front of the tail of the males.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Syngnathidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 281-289.
- Garcia A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de da Bahía de Cadiz*. Instituto de Ciencias Marinas de Andalucía. Consejo Superior de Investigaciones Científicas, Cadiz: 163pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.34-1.82 mm
No. of oil globules – numerous oil globules of different size.
Shell surface - smooth
Pigment -
Yolk -
Diameter of oil globules -
Diagnostic features - Pear-shaped. Large perivitelline space.

LARVAE

Hatching length – 8 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation - Melanophores on head and trunk.
Diagnostic features – Horizontal diameter of the eye comprised *ca.* 1.5 times in the preorbital space. Dorsal profile of the snout concave. Length of the lower jaw roughly equal to the eye diameter. Prominent occipital crest. Dorsal, anal and pectoral fins completely developed at hatching.



Plate 26- Early life history stages of *Hippocampus hippocampus*. Garcia and Moyano (1990).

SYNGNATHIDAE

Nerophis lumbriciformis (Jenyns, 1835)

MERISTICS

Fins:

- Dorsal rays – 24-28
- Anal rays -
- Pelvic rays -
- Pectoral rays –

Myomeres:

- Total number –

LIFE HISTORY

Range: Eastern Atlantic: southern Norway, Kattegat and British Isles to Rio de Oro in Western Sahara.

Habitat: Intertidal to about 30 m, among seaweeds at high tide and underneath loose stones during ebb tide.

Spawning season: throughout the whole year with a marked reduction during summer and autumn.

ELH pattern: Ovoviviparous. Male carries the eggs in a brood pouch, which is found under the tail.

MAIN REFERENCES

- Le Danois, E. (1913). Contribution à l'Étude systématique et biologique des poissons de la Manche Occidentale. *Ann. Inst. Océanogr., Paris*, 5: 1-214.
- Monteiro, N., V. Almada, M.N. Vieira (2003). Early life history of the pipefish *Nerophis lumbriciformis* (Pisces: Syngnathidae). *J. Mar. Biol. Assoc. U.K.*, 83 (6): 1179-1182.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolla, Denmark: 215pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 0.7-1.72 (major axis)
- No. of oil globules -
- Shell surface – smooth, transparent
- Pigment -
- Yolk -
- Diameter of oil globules -
- Diagnostic features – orange yolk, variable shape

LARVAE

- Hatching length – 10 mm
- Yolk-sac absorption -
- Flexion length -
- Transformation length -
- Pigmentation - 12 pigmentation marks in upper trunk and tail, 4 to 5 marks in the ventral margin of primordial fin.
- Diagnostic features – Yolk-sac is completely absorbed at hatching. Primordial fin and pectoral fins present at hatching. Duck-billed shape of head. Mouth functional.

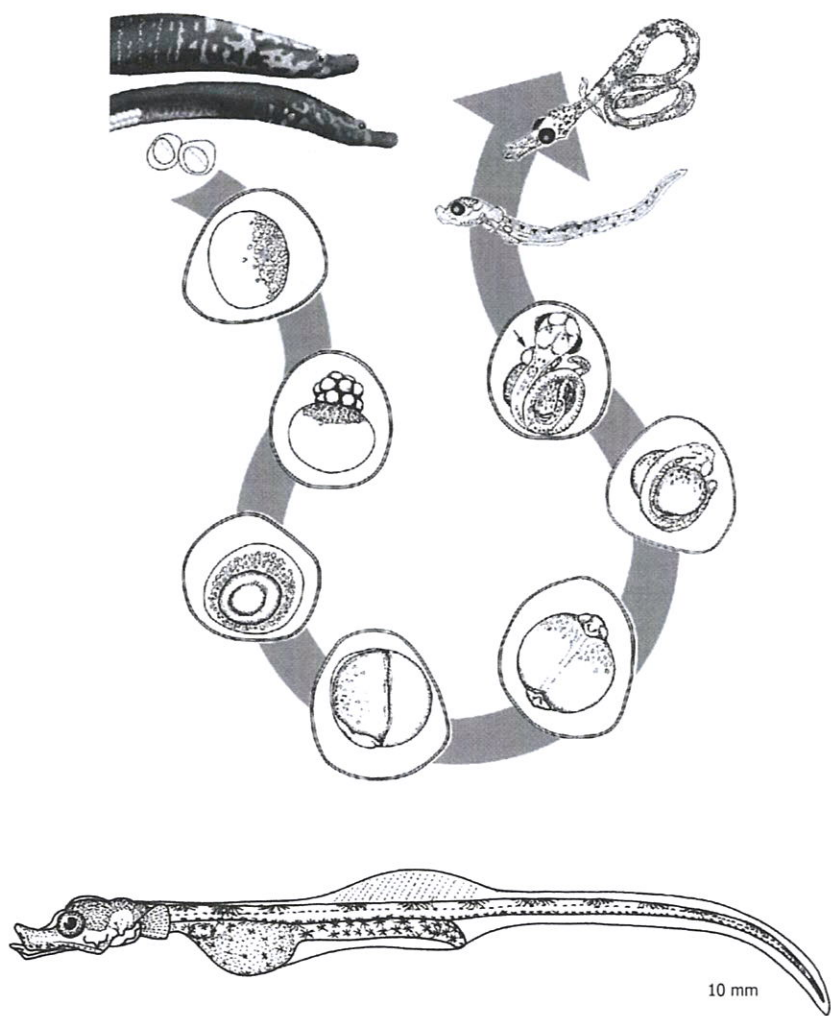


Plate 28- Early life history stages of *Nerophis lumbriciformis*. Le Danois (1913), Monteiro *et al.* (2003).

SYNGNATHIDAE

Nerophis ophidion (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays – 35-40
- Anal rays -
- Pelvic rays -
- Pectoral rays –

Myomeres:

- Total number –

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco (excluding region from Denmark to Netherlands), also throughout the Mediterranean and the Black Sea.

Habitat: Inhabits algal zone or eel-grass.

Spawning season: spring, summer and autumn.

ELH pattern: Ovoviviparous. Male carries the eggs in a brood pouch, which is found under the tail.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- García A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los caños de las salinas de la Bahía de Cádiz*. Instituto de Ciencias Marinas de Andalucía. Consejo Superior de Investigaciones Científicas, Cádiz: 163pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 1.0-1.39 mm
- No. of oil globules - numerous oil globules of different size.
- Shell surface – smooth, spherical
- Pigment -
- Yolk -
- Diameter of oil globules -
- Diagnostic features – Broad perivitelline space

LARVAE

- Hatching length – 10 mm
- Yolk-sac absorption -
- Flexion length -
- Transformation length -
- Pigmentation - Numerous brownish melanophores on head and body.
- Diagnostic features – Newly hatched larva with primordial and pectoral fins.
- Characteristic shape.

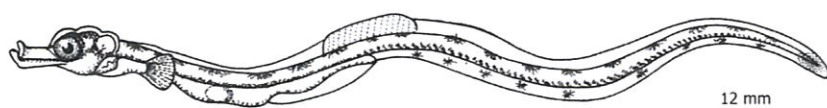


Plate 29- Early life history stages of *Nerophis ophidion*. Ehrenbaum (1905-1909).

SYNGNATHIDAE

Syngnathus abaster Risso, 1826

MERISTICS

Fins:

Dorsal rays – 29-32
Anal rays - 3
Pelvic rays –
Pectoral rays – 13-14

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: southern Biscay to Gibraltar, and also the Mediterranean and Black seas.

Habitat: Euryhaline, found among detritus or vegetation over sand or mud. Estuarine species.

Spawning season: spring and summer.
Larvae found throughout the whole year.

ELH pattern: Ovoviparous. Male carries the eggs in a brood pouch.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Syngnathidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 281-289.
- Garcia A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de da Bahia de Cadiz*. Instituto de Ciencias Marinas de Andalucia. Consejo Superior de Investigaciones Cientificas, Cadiz: 163pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.65-1.98 mm
No. of oil globules – numerous orange-red oil globules
Shell surface – smooth
Pigment – redish pigment
Yolk -
Diameter of oil globules -
Diagnostic features - Pear-shaped.

LARVAE

Hatching length – 23 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Head and body covered with melanophores.
Diagnostic features – Newly hatched larva without yolk. Eye diameter comprised 1.5 times in the preorbital space. Short snout, height about half of it's length. All fins formed at the time of hatching. Dorsal with 29-32 rays.

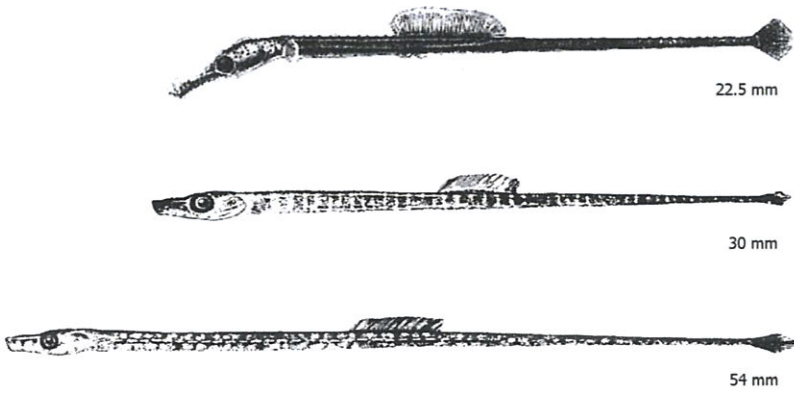


Plate 30- Early life history stages of *Syngnathus abaster*.
D'Ancona (1931-1933), Garcia and Moyano (1990).

SYNGNATHIDAE

Syngnathus acus Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – 35-45
Anal rays – 3-4
Pelvic rays -
Pectoral rays – 11-14

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Norway, Faroes and British Isles to Western Sahara, Senegambia, and from Namibia to Cape of Good Hope and northward to the coast of Zululand in the western Indian Ocean. Also throughout the Mediterranean, Aegean and Black seas.

Habitat: coastal and estuarine waters to depths of at least 110 m.

Spawning season: spring and summer.
Larvae found throughout the whole year.

ELH pattern: Ovoviviparous. Male carries the eggs in a brood pouch.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Syngnathidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 281-289.
- García A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de da Bahía de Cadiz*. Instituto de Ciencias Marinas de Andalucía. Consejo Superior de Investigaciones Científicas, Cadiz: 163pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.82-1.98 mm
No. of oil globules - numerous orange-red oil globules
Shell surface - smooth
Pigment – orange-red
Yolk -
Diameter of oil globules -
Diagnostic features -

LARVAE

Hatching length – 24-28 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Head and body covered with melanophores.
Diagnostic features - Primordial fin absent.
Dorsal fin with 35-39 rays, extending over 8 segments, longer than the head. Eye more than twice the primordial space.

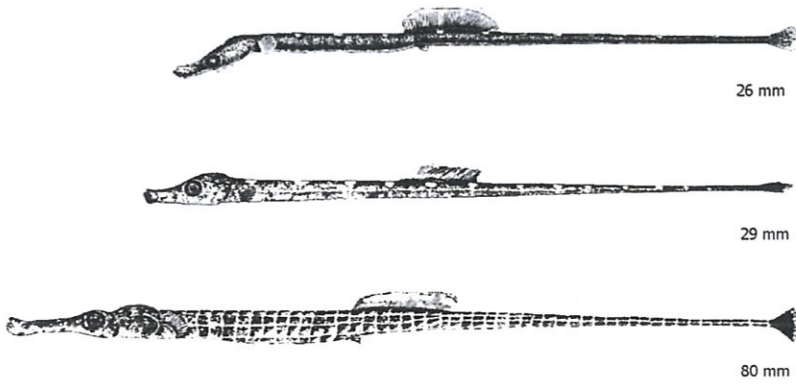


Plate 31- Early life history stages of *Syngnathus acus*.
D'Ancona (1931-1933), Garcia and Moyano (1990).

SYNGNATHIDAE

Syngnathus typhle Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – 34-38
Anal rays - 3
Pelvic rays -
Pectoral rays – 14-17

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Norway, Baltic Sea and the British Isles to Morocco. Also throughout the Mediterranean, Black Sea and Sea of Azov.

Habitat: Usually found along the coasts and estuaries at a temperature range of 8 ° to 24 °C.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Syngnathidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 281-289.
- Garcia A.M.A., P.D. Moyano (1990). *Estados juveniles de la ictiofauna en los canos de las salinas de da Bahia de Cadiz*. Instituto de Ciencias Marinas de Andalucia. Consejo Superior de Investigaciones Científicas, Cadiz: 163pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.98-2.42 mm
No. of oil globules - numerous oil globules
Shell surface - smooth
Pigment – yellowish-orange
Yolk -
Diameter of oil globules -
Diagnostic features -

LARVAE

Hatching length – 20-25 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation - Body and head covered with brownish chromatophores. Melanophores on head and trunk. Tail completely covered with melanophores.
Diagnostic features - Snout slightly elongate. Dorsal fin 34-38 rays.

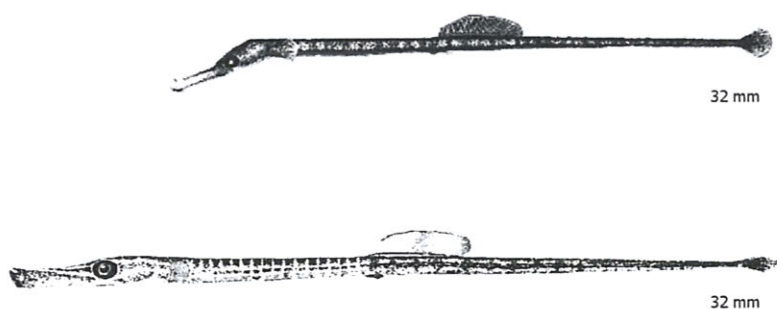


Plate 32- Early life history stages of *Syngnathus typhle*.
D'Ancona (1931-1933), Garcia and Moyano (1990).

MERLUCCIIDAE

Merluccius merluccius (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – D₁-8-11, D₂-36-40

Anal rays – 36-40

Pelvic rays - 7

Pectoral rays – 10-15

Myomeres:

Total number – 50-52

LIFE HISTORY

Range: Eastern Atlantic: Norway and Iceland, southward to Mauritania. Also in the Mediterranean Sea and along the southern coast of the Black Sea.

Habitat: demersal; depth range 30–1000 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Gadidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 178-255.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Raffaele, F. (1888). Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1907). On the post-larval development of the hake (*Merluccius vulgaris* Flem.). *Meddr Kommn Havunders., Ser. Fiskeri*, 2, Nr 7: 10pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.94-1.03 mm

No. of oil globules - 1

Shell surface - smooth

Pigment – Black and yellow pigment on embryo. Characteristic postanal pigmentation on embryo, end of development (three bars).

Yolk - unsegmented

Diameter of oil globules – 0.25-0.28 mm

Diagnostic features -

LARVAE

Hatching length – 3 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva with three postanal melanophores.

Melanophores on head and in the abdominal cavity. Abdominal pigment abundant after yolk sac absorption. Very characteristic three bars on the postanal part of the body (mediolateral).

Pigmentation pattern does not vary until a length of 16 mm.

Diagnostic features – Characteristic pigmentation. Early development of pectoral fins (6 mm).

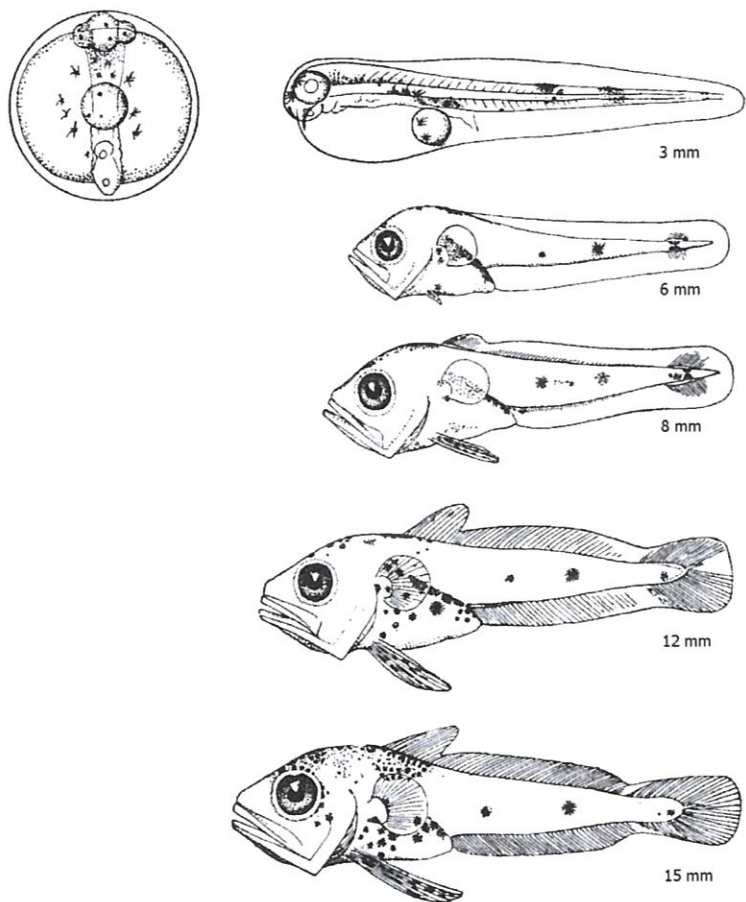


Plate 33- Early life history stages of *Merluccius merluccius*. Raffaele (1888), Schmidt (1907).

GADIDAE

Ciliata mustela (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays - D₂-45-55

Anal rays - 40-46

Pelvic rays - 7-8

Pectoral rays - 14-16

Myomeres:

Total number -

LIFE HISTORY

Range: Northeast Atlantic: Lisbon north to Finnmark, around the British Isles, in the Skagerrak and Kattegat and Iceland.

Habitat: demersal; depth range 0-20 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.66-0.98 mm

No. of oil globules - 1

Shell surface - smooth

Pigment - Small melanophores arranged in two rows on embryo. Several melanophores on the oil globule.

Yolk - unsegmented

Diameter of oil globules - 0.12-0.16 mm

Diagnostic features -

LARVAE

Hatching length - 2 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation - Newly hatched larvae with stellate melanophores on head and peritoneum. Postanal pigmentation consists of two groups of ventral melanophores and a few dorsal melanophores. Pelvic fins extremely elongated and pigmented in pre-flexion larvae.

Diagnostic features - Characteristic pigmentation. Elongated and pigmented pelvic fins.

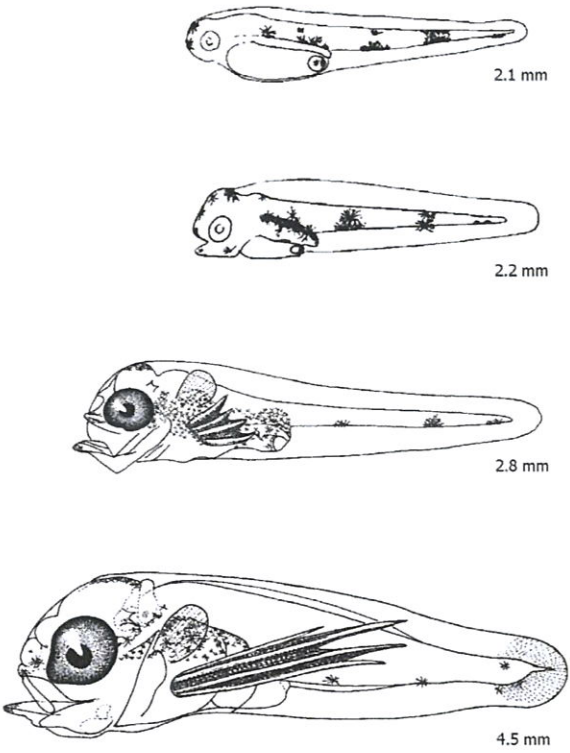


Plate 34- Early life history stages of *Ciliata mustela*. Russell (1976), Ehrenbaum (1905-1909).

GADIDAE

Gadiculus argenteus Guichenot, 1850

MERISTICS

Fins:

Dorsal rays - D₁-9-13, D₂-14-17, D₃-15-16

Anal rays - A₁-17-18, A₂-15

Pelvic rays - 6

Pectoral rays - 14-15

Myomeres:

Total number -

LIFE HISTORY

Range: Northeast Atlantic: found in the western Mediterranean and in the Atlantic around the Strait of Gibraltar and to the south along the Moroccan coast.

Habitat: pelagic; non-migratory; marine; depth range 100 - 1000 m.

Spawning season: spring, summer and autumn.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Gadidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 178-255.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Raffaele, F. (1888). Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1906). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part II. Meddr Kommn Havunders., Ser. Fiskeri*, 2, Nr 2: 18pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

Pigmentation - One dorso-ventral cluster in the posterior part of the tail. At 7.5 mm the pelvic fins begin to develop.

Diagnostic features - Characteristic pigmentation.

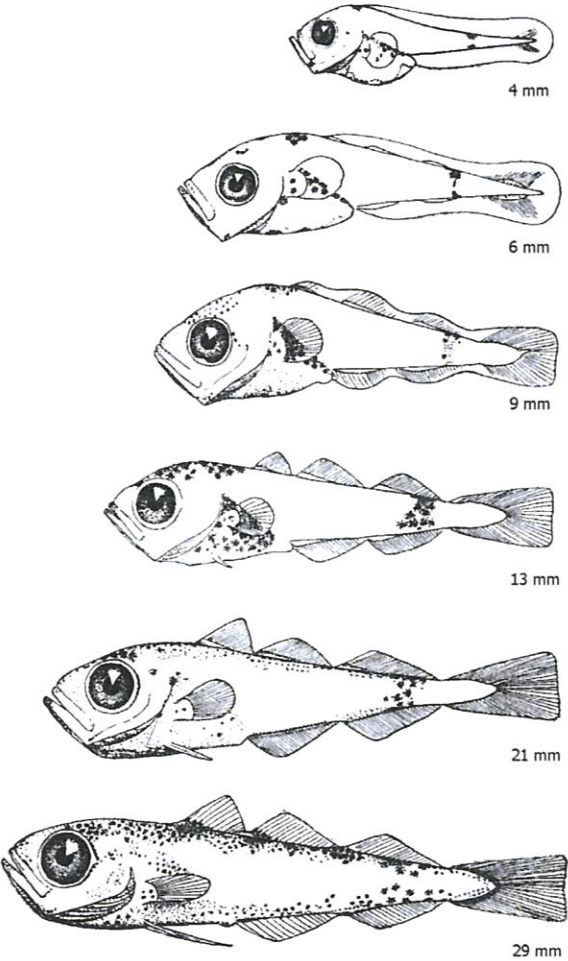


Plate 35- Early life history stages of *Gadiculus argenteus*. Schmidt (1906).

GADIDAE

Micromesistius poutassou (Risso, 1827)

MERISTICS

Fins:

Dorsal rays - D₁-11-14, D₂-10-14, D₃-20-24

Anal rays - A₁-34-38, A₂-20-26

Pelvic rays - 6

Pectoral rays - 20-26

Myomeres:

Total number -

LIFE HISTORY

Range: Northeast Atlantic: Barents Sea south through the eastern Norwegian Sea, around Iceland, then in the western Mediterranean, and south along the African coast to Cape Bojador. Northwest Atlantic: southern Greenland and off southeast Canada and the northeastern coast of the USA.

Habitat: pelagic; depth range 150 – 3000 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Gadidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 178-255.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1905). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part I. Meddr Kommn Havunders., Ser. Fiskeri*, 1, Nr 4: 77pp.
- Schmidt, J. (1906). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part II. Meddr Kommn Havunders., Ser. Fiskeri*, 2, Nr 2: 18pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.04-1.28 mm

No. of oil globules - 0

Shell surface - smooth

Pigment – Two rows of melanophores running from the snout to approximately five sixths of the way along the trunk.

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 2.0-2.2 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larvae with the same pigment found in the embryo.

Characteristic pigmentation at 3.3 mm (dorsal and ventral bar on the trunk, pigmented eyes and mouth open).

Diagnostic features – Characteristic pigmentation. Paired dorsal and ventral streak of melanophores. The dorsal pigment extends further back than the ventral. Unpigmented mediolateral region. Marked occipital pigmentation.

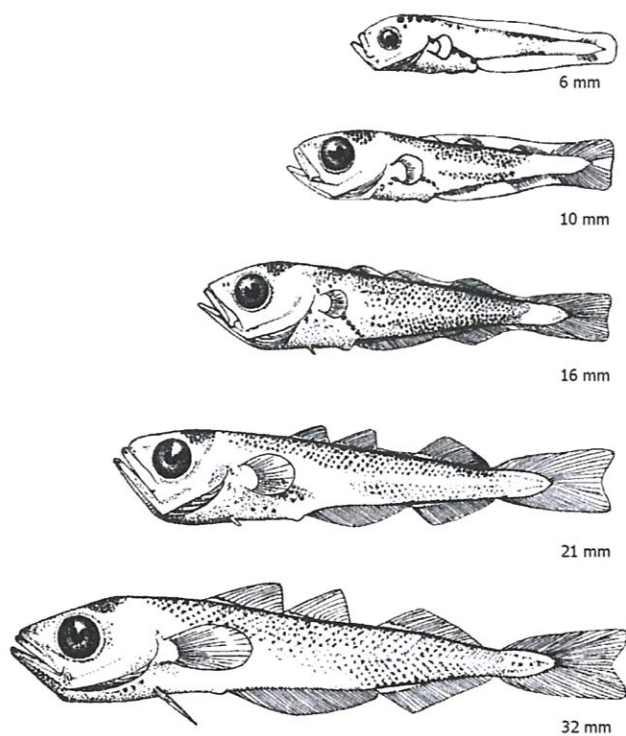


Plate 36- Early life history stages of *Micromesistius poutassou*. Schmidt (1905, 1906).

GADIDAE

Pollachius pollachius (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays - D₁-11-12, D₂-15-21, D₃-15-20

Anal rays - A₁-23-31, A₂-16-21

Pelvic rays - 6

Pectoral rays - 16-19

Myomeres:

Total number - 52-55

LIFE HISTORY

Range: Northeast Atlantic: Norway, the Faeroes, and Iceland to the Bay of Biscay.

Habitat: benthopelagic; depth range 0-200 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Gadidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 178-255.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1905). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part I. Meddr. Kommn Havunders., Ser. Fiskeri*, 1, Nr 4: 77pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 1.10-1.22 mm

No. of oil globules - 0

Shell surface - smooth

Pigment - Weak pigmentation on embryo.

Tail free of melanophores.

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

Pigmentation - Pigmentation concentrated in continuous paired dorsal and ventral contour rows of melanophores (tail region unpigmented). Mediolateral pigmentation appears at 5 mm and becomes very conspicuous. Body densely pigmented at a size of 15 mm.

Diagnostic features - Characteristic pigmentation. Paired dorsal and ventral contour rows of melanophores. Conspicuous mediolateral row.

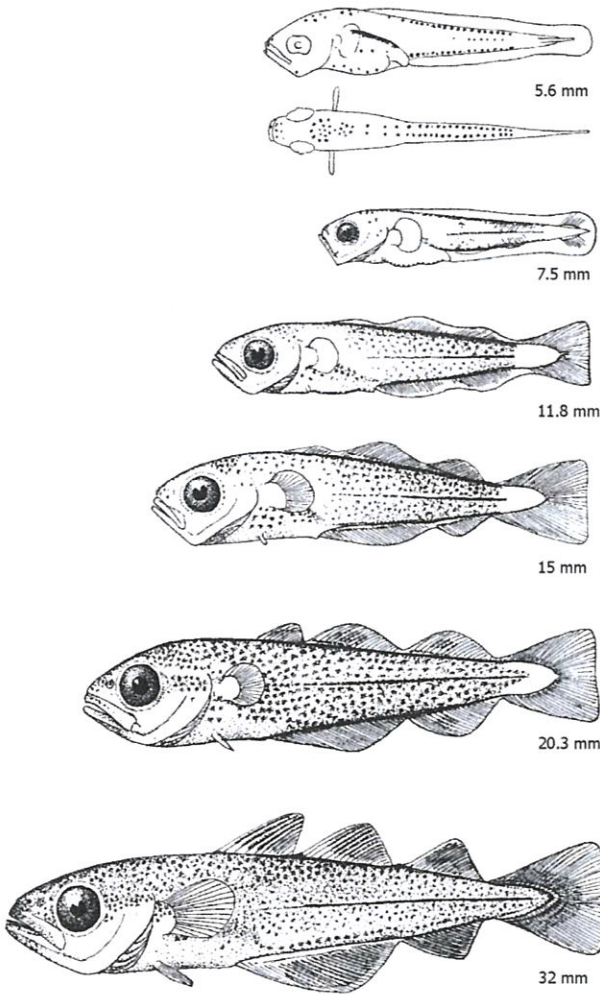


Plate 37- Early life history stages of *Pollachius pollachius*. Schmidt (1905), Russell (1976).

GADIDAE

Trisopterus luscus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays - D₁-12-15, D₂-21-26, D₃-18-22

Anal rays - A₁-27-36, A₂-18-22

Pelvic rays - 6

Pectoral rays - 19-20

Myomeres:

Total number -

LIFE HISTORY

Range: Eastern Atlantic: British Isles and Skagerrak to the African coast, including offshore islands. Also in the western Mediterranean.

Habitat: benthopelagic; brackish; marine; depth range 30-100 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- D'Ancona, U. (1931-1933). Gadidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 178-255.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1905). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part I. Meddr Kommn Havunders., Ser. Fiskeri*, 1, Nr 4: 77pp.
- Schmidt, J. (1906). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part II. Meddr Kommn Havunders., Ser. Fiskeri*, 2, Nr 2: 18pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.9-1.23 mm

No. of oil globules - 0

Shell surface - smooth

Pigment - Many small melanophores on dorsal side of embryo. Unpigmented tail.

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 3 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation - Newly hatched larva with scattered melanophores all over the body.

Dorsal and ventral pigmentation conspicuous. Marked occipital pigmentation. Dorsal and ventral streaks of melanophores evident. No mediolateral pigmentation.

Diagnostic features - Characteristic pigmentation, Well-marked dorsal and ventral pigment streaks that end abruptly (unpigmented tail).

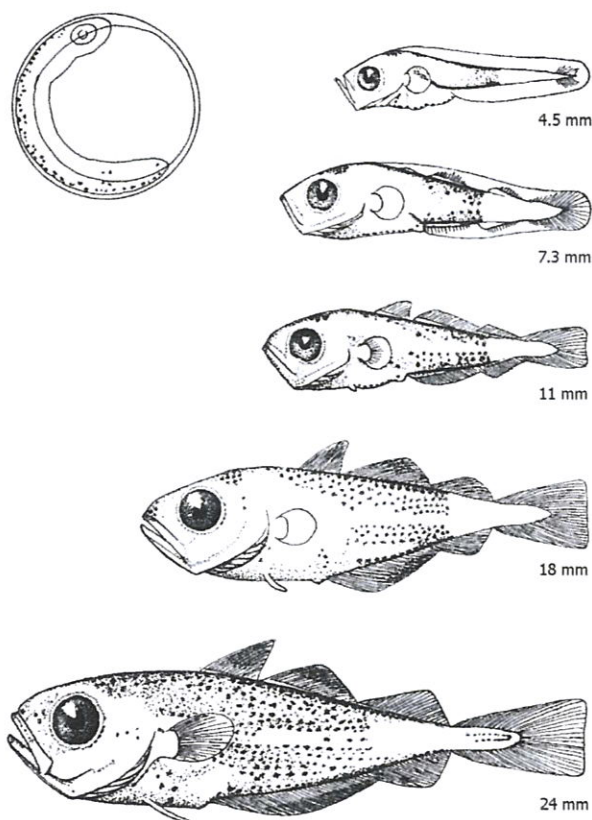


Plate 38- Early life history stages of *Trisopterus luscus*. Ehrenbaum (1905-1909), Schmidt (1905, 1906).

GADIDAE

Trisopterus minutus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays - D₁-11-15, D₂-20-26, D₃-19-23

Anal rays - A₁-25-31, A₂-20-24

Pelvic rays - 6

Pectoral rays - 17-19

Myomeres:

Total number -

LIFE HISTORY

Range: Eastern Atlantic: Trondheim Fjord and the Faeroe Islands to Portugal and along the Atlantic coast of Morocco; also in the Mediterranean.

Habitat: benthopelagic; non-migratory; marine; depth range 0-400 m.

Spawning season: spring and summer

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Schmidt, J. (1905). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part I. Meddr Kommn Havunders.*, Ser. Fiskeri, 1, Nr 4: 77pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Schmidt, J. (1906). The pelagic post-larval stages of the Atlantic species of *Gadus*. *Part II. Meddr Kommn Havunders.*, Ser. Fiskeri, 2, Nr 2: 18pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.95-1.03 mm

No. of oil globules - 0

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 2.3-2.4 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation - Dorsal and ventral unpaired contour rows of large stellate melanophores (8-10) extending posteriorly for approximately equal distances to the base of the caudal fin area. No occipital pigmentation. Two melanophores on the head above the eyes. A few ventral preanal melanophores. No mediolateral pigmentation.

Diagnostic features - Characteristic pigmentation. Dorsal and ventral row of melanophores.

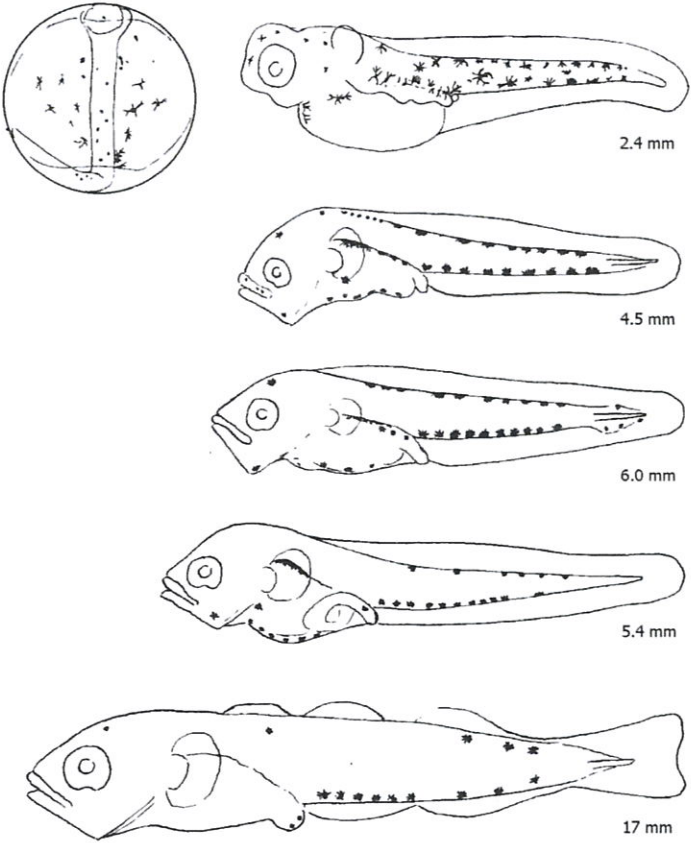


Plate 39- Early life history stages of *Trisopterus minutus*. Russell (1976).

ZEIDAE

Zeus faber Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – D₁-IX-X, D₂- 22-25

Anal rays – A₁-III-IV, A₂- 20-23

Pelvic rays – I+5-7

Pectoral rays – 12-14

Myomeres:

Total number – 32-33

LIFE HISTORY

Range: Worldwide in distribution. Eastern Atlantic: Norway to South Africa, also the Mediterranean and Black Sea. Western Pacific: Japan, Korea, Australia and New Zealand. Also known from the Indian Ocean.

Habitat: benthopelagic; brackish; marine; depth range 5-400 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Clark, R. S. (1914). General report on the larval and post-larval teleosts in Plymouth waters. *J. mar. biol. Ass. U. K.*, 10: 327-394.
- Moser, H.G., W.J. Richards, D.M. Cohen, M.P. Fahay, A.W. Kendall, S.L. Richardson (eds.) (1984). *Ontogeny and systematics of fishes*. American Society of Ichthyologists and Herpetologists ed., Special publication Number 1: 760pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Sanzo, L. (1931). Uova e larve di *Zeus faber* L. *Archo zool. Ital.*, 15: 475-483.
- Sanzo, L. (1956). Zeidae, Caproidae. *Fauna e Flora Golfo Napoli Monogr.* 38: 461-470.
- Schmidt, J. (1908). On the post-larval stages of the John Dory (*Zeus faber* L.) and some other Acanthopterygian fishes. *Meddr Kommn Havunders., Ser. Fiskery*, 2, Nr 9: 12pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.96-2.0 mm

No. of oil globules - 1

Shell surface - smooth

Pigment – Melanophores scattered evenly over the yolk and on embryo except on tail region.

Yolk - unsegmented

Diameter of oil globules – 0.36-0.40 mm

Diagnostic features – Large size, single oil globule, scattered melanophores.

LARVAE

Hatching length – 4.3 mm

Yolk-sac absorption -

Flexion length – 6 mm

Transformation length -

Pigmentation – Whole body covered with large stellate melanophores (extending to the dorsal fin membrane). Caudal end of the body without pigmentation. Body high in pre-flexion and flexion larvae.

Melanophores on head and trunk. Large and heavily pigmented pelvic fins.

Diagnostic features – Characteristic shape. Large and pigmented pelvic fins.

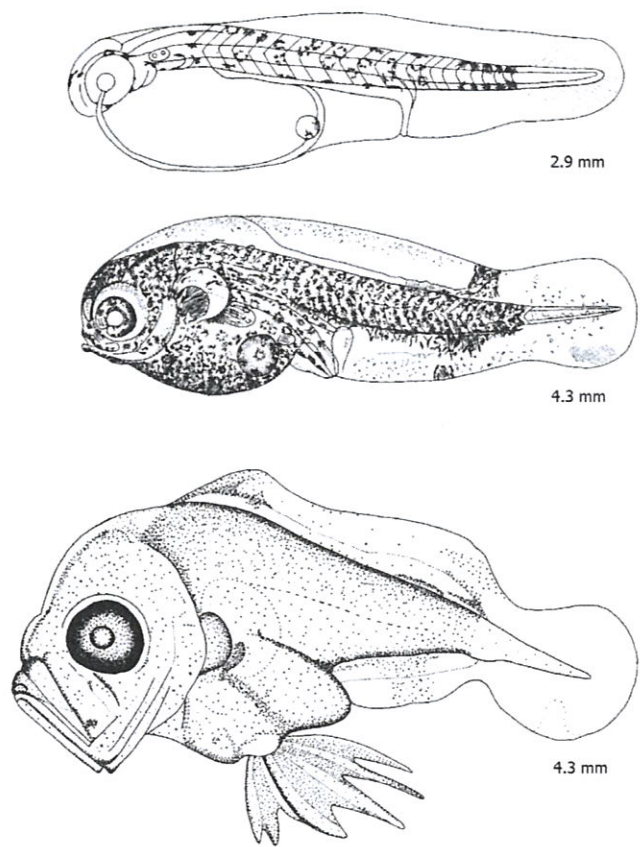


Plate 40- Early life history stages of *Zeus faber*. Sanzo (1931, 1956), Moser *et al.* (1984).

CAPROIDAE

Capros aper (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – IX-X+23-25

Anal rays – III+23-24

Pelvic rays – I+5

Pectoral rays – 13-14

Myomeres:

Total number – 21-23

LIFE HISTORY

Range: Eastern Atlantic: western Norway, Skagerrak, Shetlands and western Scotland to Senegal. Also in the Mediterranean.

Habitat: demersal; depth range 40-700 m.

Spawning season: summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
Sanzo, L. (1956). Zeidae, Caproidae. *Fauna e Flora Golfo Napoli Monogr.* 38: 461-470.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.90-1.01 mm

No. of oil globules - 1

Shell surface - smooth

Pigment – Row of melanophores on each side of embryo.

Yolk - unsegmented

Diameter of oil globules – 0.15-0.17 mm

Diagnostic features -

LARVAE

Hatching length – 2.0-2.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Whole body covered with melanophores arranged in concentric rows on the postanal region. Tail free of pigment.

Diagnostic features – Characteristic rhomboid shape of body. Small spines all over the body, and a spiny crest on the head.

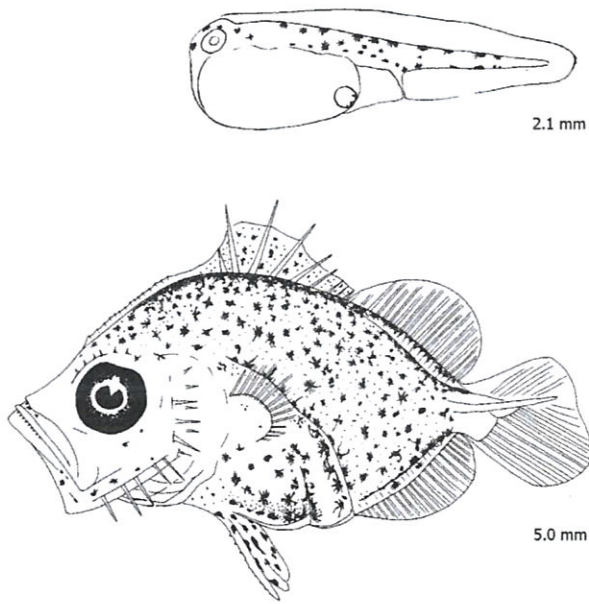


Plate 41- Early life history stages of *Capros aper*. Russell (1976).

SERRANIDAE

Serranus cabrilla (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – X+13-15

Anal rays – III+7-8

Pelvic rays – I+5

Pectoral rays – 14-15

Myomeres:

Total number – 10-19

LIFE HISTORY

Range: Eastern Atlantic: English Channel southward round the Cape of Good Hope to Natal, South Africa, including Azores, Madeira and the Canary Islands. Also in the Mediterranean and western Black Sea and possibly in the Red Sea.

Habitat: demersal; marine; depth range 0-500 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Bertolini, F. (1933). Serranidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38. Publi. In 4 parts: 310-321.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Marinaro, J-Y (1971). Contribution à l'étude des oeufs et larves pélagiques de poissons méditerranéens. V. Oeufs pélagiques de la Baie d'Alger. *Pelagos*, 3 (1): 1-118.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolla, Denmark: 215pp.
- Raffaele, F. (1888). Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.85-0.97 mm

No. of oil globules - 1

Shell surface - smooth

Pigment - A few pale yellow

chromatophores along the sides of the body and smaller rather inconspicuous melanophores uniformly distributed over the body. A little yellow and black pigment over the oil globule.

Yolk - unsegmented

Diameter of oil globules – 0.14-0.15 mm

Diagnostic features -

LARVAE

Hatching length – 1.8-2.4 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Melanophores on head and trunk. Pigmented peritoneum. One dorsal and one ventral melanophore on body contours about the middle of the postanal region.

Diagnostic features – Newly hatched larva: oil globule situated behind the anterior end of the yolk sac nearer to the midpoint. Primordial fin with many stellate chromatophores. Third dorsal ray very long. At 6.5 mm, the first 8 rays of the dorsal fin are well developed. Elongated pelvic fins.

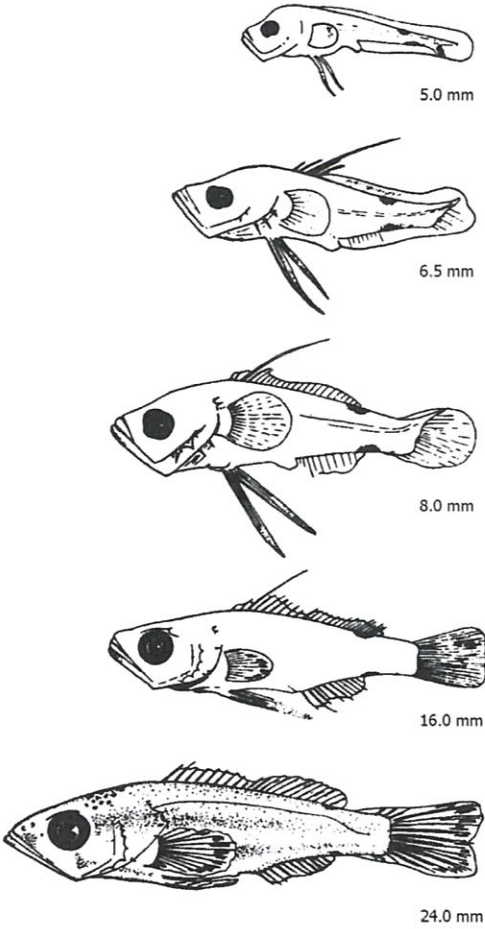


Plate 42- Early life history stages of *Serranus cabrilla*. Bertolini (1933).

MORONIDAE

Dicentrarchus labrax (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – D₁ VIII-IX D₂ I-II+11-12

Anal rays – III+10-12

Pelvic rays – I+5

Pectoral rays – 15-16

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco, the Canary Islands and Senegal. Reported from Iceland. Also known from the Mediterranean and Black Sea.

Habitat: demersal; freshwater; brackish; marine; depth range 10-100 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Barnabé, G., F. Boulineau-Coatanea, F. Rene (1976). Chronologie de la morphogenese chez le loup ou bar *Dicentrarchus labrax* (L.) (Pisces, Serranidae) obtenu par reproduction artificielle. *Aquaculture*, 8: 351-363.
- Bertolini, F. (1933). Serranidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38. Publi. In 4 parts: 310-321.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Raffaele, F. (1888) - Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.10-1.52 mm

No. of oil globules - 1

Shell surface - smooth

Pigment - Yellow and black chromatophores on the yolk and on the large yellowish oil globule.

Yolk - unsegmented

Diameter of oil globules – 0.31-0.46 mm

Diagnostic features -

LARVAE

Hatching length – 3.61-4.05 mm

Yolk-sac absorption – 5-6 mm

Flexion length – 9 mm

Transformation length -

Pigmentation – Newly hatched larva: Anus situated some distance behind the yolk sac. A row of ventral melanophores on the upper side of the alimentary canal. Late larvae: Continuous line of melanophores stretching from the snout to the base of the caudal fin. Dorsal and lateral row of melanophores only in the posterior part of the tail.

Diagnostic features – Typical pigmentation.

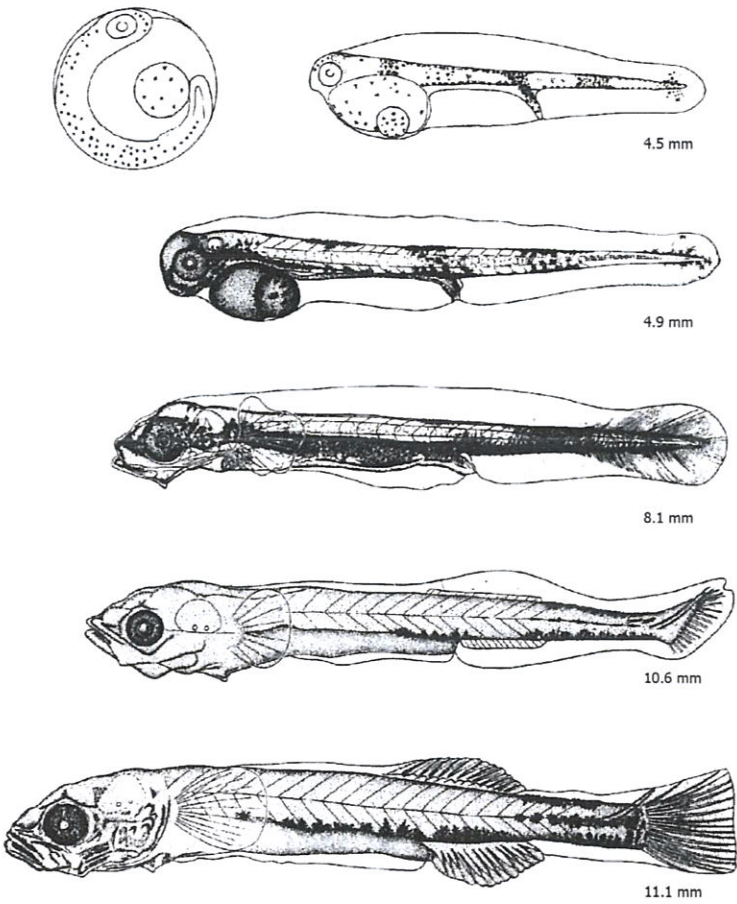


Plate 43- Early life history stages of *Dicentrarchus labrax*. Russell (1976), Barnabé *et al.* (1976).

CEPOLIDAE

Cepola macrophthalmia Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – 67-74
Anal rays – 60-70
Pelvic rays – I+5
Pectoral rays – 12-18

Myomeres:

Total number – 15+54

LIFE HISTORY

Range: Eastern Atlantic: British Isles to north of Senegal, including the Mediterranean.

Habitat: demersal; marine; depth range 15–400 m.

Spawning season: spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Clark, R. S. (1920) . The pelagic young and early bottom stages of Teleosteans. *J. mar. biol. Ass. U. K.*, 12: 159-240.
Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped . 1908-10 Medit . adjac. Seas*, 2, Biology A3: 1-154.
Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.72 mm
No. of oil globules - 1
Shell surface - smooth
Pigment - unknown
Yolk -
Diameter of oil globules – 0.14 mm
Diagnostic features -

LARVAE

Hatching length - unknown
Yolk-sac absorption - unknown
Flexion length -
Transformation length -
Pigmentation – Melanophores on the head, jaw, snout and abdomen. 1 to 3 caudal melanophores.
Diagnostic features - The most characteristic features are the occipital, supraorbital and 7-9 preopercular spines. Row of denticles (6-7) along the lower margin of the jaw. Occipital spines (begins as 2 spines and later changes into a toothed ridge with a longer posterior spine). Supraorbital ridge with 4 to 5 teeth.

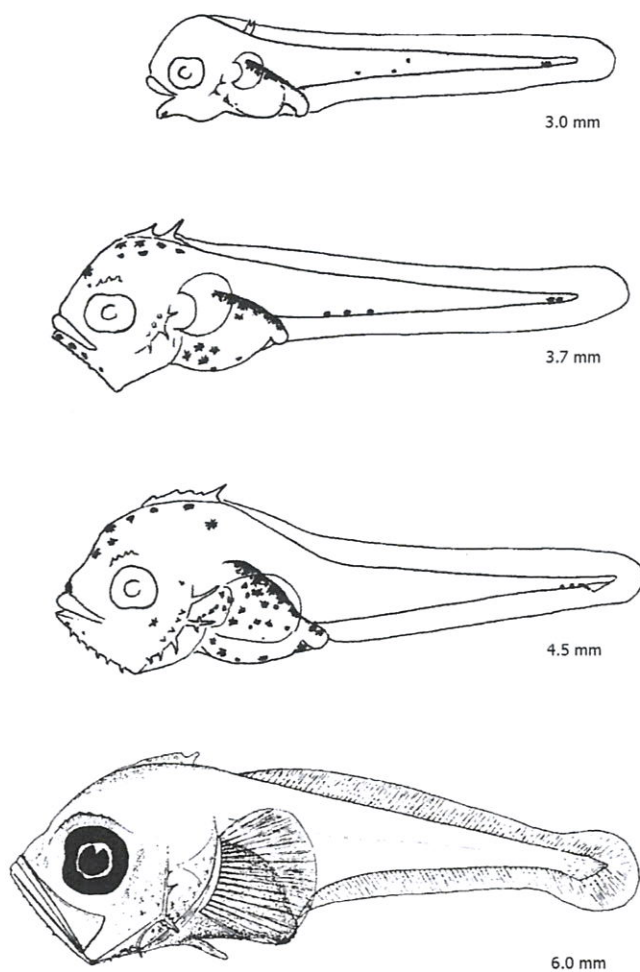


Plate 44- Early life history stages of *Cepola macrophthalmia*. Fage (1918), Russell (1976).

CARANGIDAE

Trachurus trachurus (Linnaeus 1758)

MERISTICS

Fins:

Dorsal rays – D₁ VIII, D₂ I+28-34

Anal rays – A₁ II, A₂ I+25-34

Pelvic rays – I+5

Pectoral rays – 20-21

Myomeres:

Total number – 25

LIFE HISTORY

Range: Eastern Atlantic: Iceland to Senegal, including the Mediterranean and Marmara seas, and the Black Sea. Also western Atlantic, Indian, and western Pacific.

Habitat: pelagic; marine, depth range 0–1050 m.

Spawning season: spawning occurs throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Brownell, C.L. (1979). Stages in the early development of 40 marine fish species with pelagic eggs from the cape of Good Hope. *Ichthyological Bulletin of the J.L.B. Smith Institute of Ichthyology, Rhodes University, Grahamstown*, (40): 84pp.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Marinero, J-Y (1971). Contribution à l'étude des oeufs et larves pélagiques de poissons méditerranéens. V. Oeufs pélagiques de la Baie d'Alger. *Pelagos*, 3 (1): 1-118.
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- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.76-1.04 mm

No. of oil globules - 1

Shell surface - smooth

Pigment - Yolk brownish-yellow and black pigment appear along the body contours on embryo.

Yolk - segmented

Diameter of oil globules – 0.19-0.29

Diagnostic features -

LARVAE

Hatching length – 2.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation - Numerous melanophores on lower jaw, along abdomen and on head and upper surface of stomach. Dorsal and ventral body contour of melanophores and a mediolateral row. As the larva grows the number of melanophores increase covering almost the whole body (with the exception of the caudal region).

Diagnostic features – Newly hatched larva: anterior edge of yolk-sac slightly beyond the anterior point of head. Anus well behind the yolk-sac. Anterior position of oil globule. Larvae 4 mm long: 4-5 opercular spines on the outer row and about 5 on the inner row, becoming more in the late larvae. Characteristic pigmentation.

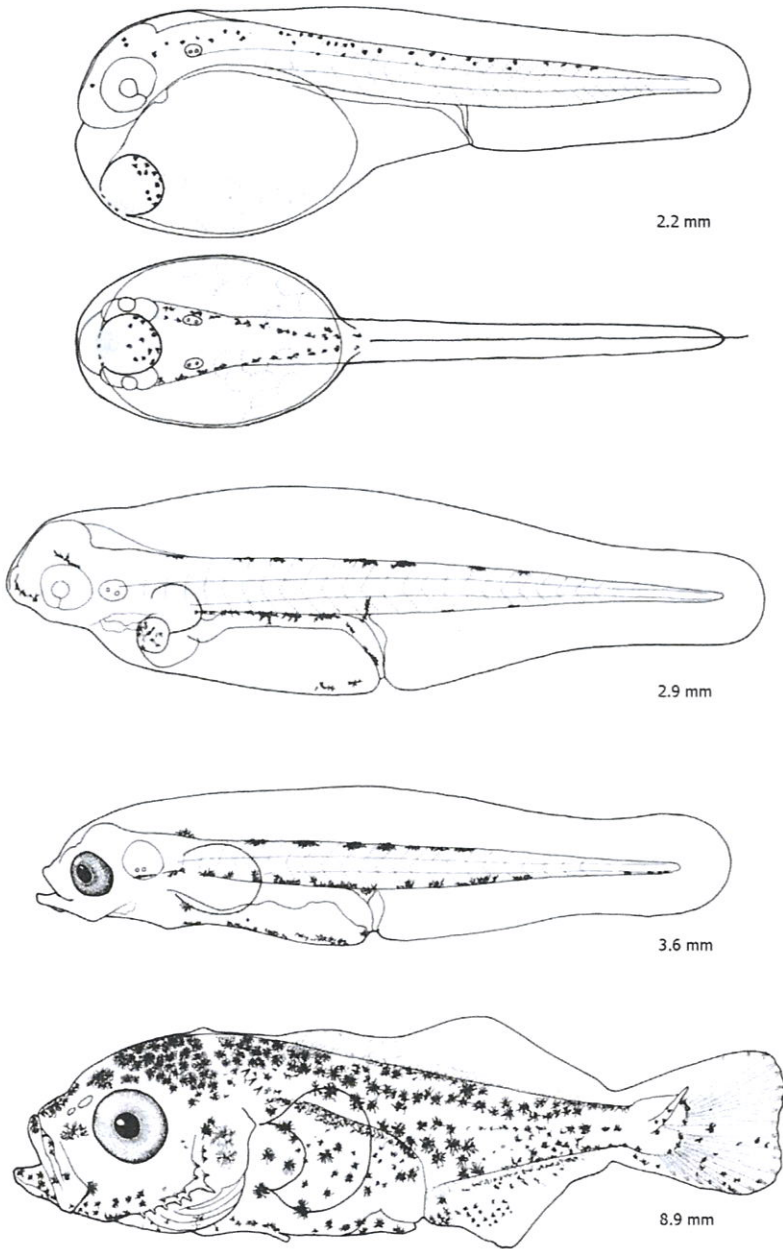


Plate 45- Early life history stages of *Trachurus trachurus*. Brownell (1979).

MULLIDAE

Mullus surmuletus Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – D₁ VII-VIII, D₂ 9

Anal rays – II+6-7

Pelvic rays – I+5

Pectoral rays – 15-18

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Western Norway, English Channel (rare in North Sea) to Dakar, Senegal and the Canary Islands, including the Mediterranean and the Black Sea.

Habitat: demersal; marine; depth range 0–400 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Raffaele, F. (1888). Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.81-0.91 mm

No. of oil globules - 1

Shell surface -

Pigment - Melanophores on the posterior half of the oil globule. When the embryo is about half way round the yolk 2 lateral rows of melanophores develop on the body and yolk.

Yolk – peripherally segmented

Diameter of oil globules – 0.23-0.25 mm

Diagnostic features -

LARVAE

Hatching length – 2.8 mm

Yolk-sac absorption -

Flexion length – 7 mm

Transformation length -

Pigmentation - At 4 mm, 10-12 melanophores on the ventral row extending from the anus to about 2/3 of the postanal length. At 8 mm additional melanophores appear all over the sides of the body. Well developed mediolateral and peritoneal pigmentation.

Diagnostic features – Newly-hatched larva: the yolk sac projects 0.3 mm beyond the snout. Anus situated close behind the posterior end of the yolk. 1-2 dorsal and 2 ventral melanophores on caudal area. Marked mediolateral and peritoneal pigmentation.

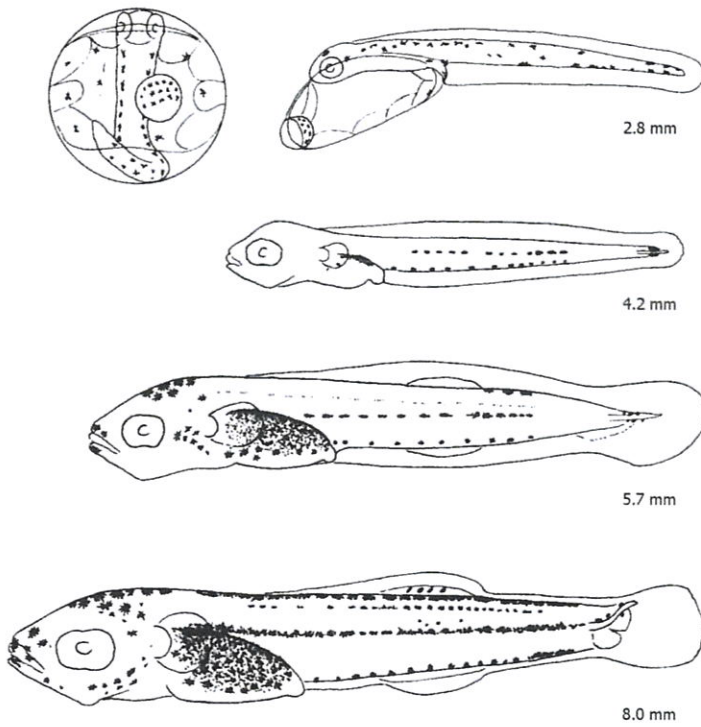


Plate 46- Early life history stages of *Mullus surmuletus*. Russell (1976).

SPARIDAE

Boops boops (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XIII-XV+14-16

Anal rays – III+15-16

Pelvic rays – I+5

Pectoral rays – 16-17

Myomeres:

Total number – 24

LIFE HISTORY

Range: Eastern Atlantic: Norway to Angola, including the Canary Islands, Cape Verde, and the Sao Tome-Principe Islands.

Common from Bay of Biscay to Gibraltar. Also found in the Mediterranean and the Black Sea.

Habitat: demersal; marine; depth range 0–350 m.

Spawning season: spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Raffaele, F. (1888). Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Ranzi, S. (1931-1933). Sparidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 330-375.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.89 mm

No. of oil globules - 1

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules – 0.2 mm

Diagnostic features -

LARVAE

Hatching length – 3.0 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva with numerous yellow chromatophores. Ventral postanal row of melanophores. At a length of 10 mm there is one melanophore behind the second dorsal fin and two on the upper side of the head.

Diagnostic features - Ventral postanal row of melanophores.

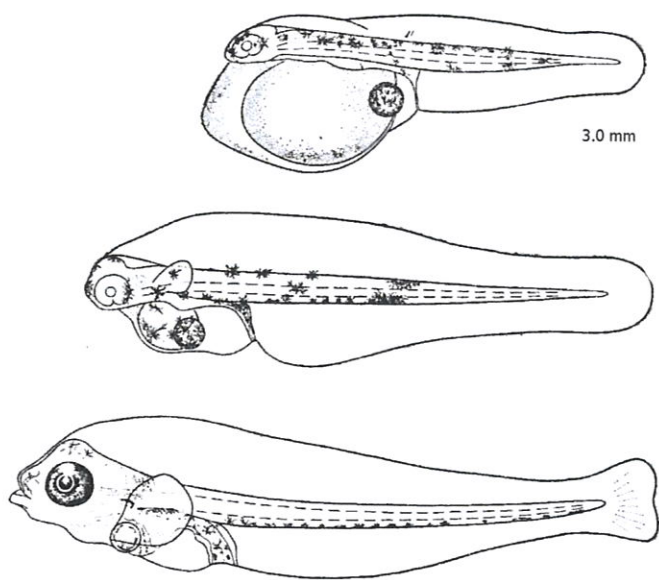


Plate 47- Early life history stages of *Boops boops*. Dekhnik (1973).

SPARIDAE

Diplodus sargus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XI-XII+12-15

Anal rays – III+12-14

Pelvic rays – I+5

Pectoral rays – 15-16

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Bay of Biscay and Mediterranean to South Africa.

Habitat: demersal; brackish; marine; depth range 0–50 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Raffaele, F. (1888). Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Ranzi, S. (1931-1933). Sparidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 330-375.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – *ca.* 1.0 mm

No. of oil globules - 1

Shell surface - smooth

Pigment – Pigment on embryo congregate mainly in four large spots located above and under the eyes, along the whole trunk, tail and scattered on the yolk.

Yolk - unsegmented

Diameter of oil globules – 0.18-0.20 mm

Diagnostic features -

LARVAE

Hatching length – *ca.* 3 mm

Yolk-sac absorption – *ca.* 4 mm

Flexion length -

Transformation length -

Pigmentation – Two large dorsal and ventral postanal melanophores (not always present). Ventral row of postanal melanophores. Peritoneal pigmentation.

Diagnostic features – Typical pigmentation.

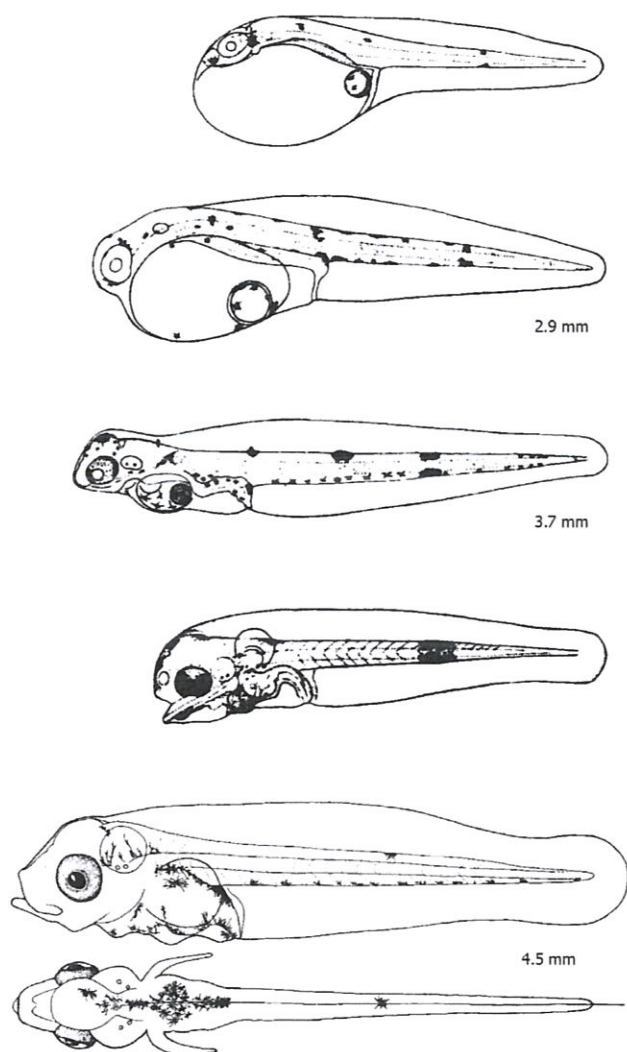


Plate 48- Early life history stages of *Diplodus sargus*. Raffaele (1888), Ranzi (1931-1933), Brownell (1973).

SPARIDAE

Pagellus bogaraveo (Brünnich, 1768)

MERISTICS

Fins:

Dorsal rays – XII-XIII+11-13

Anal rays – III+10-12

Pelvic rays – I+5

Pectoral rays – 15-17

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Norway, Strait of Gibraltar to Cape Blanc in Mauritania, Madeira, Canary Islands, and western Mediterranean (rare beyond the Sicilian Strait). Reported from Iceland.

Habitat: marine; benthopelagic; depth range 0-700 m.

Spawning season: winter, spring and summer.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Ranzi, S. (1931-1933). Sparidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e svergiato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 330-375.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

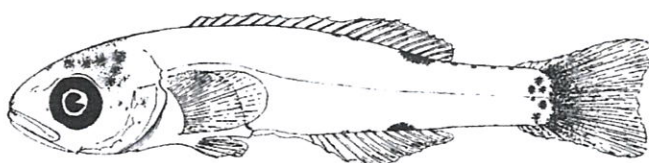
Pigmentation – Postanal well developed ventral and dorsal melanophore.

Pigmented urostyle. Peritoneal pigmentation.

Diagnostic features - At 10 mm operculum with two crests; the inner with 3 or 4 low teeth; the outer with 6 teeth, the fourth of which is the longest.



6 mm



12 mm

Plate 49- Early life history stages of *Pagellus bogaraveo*. Fage (1918).

SPARIDAE

Pagrus pagrus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XII+10-11

Anal rays – III+8-9

Pelvic rays – I+5

Pectoral rays – 15

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Strait of Gibraltar to 15 °N (rare southward 20 °N), including Madeira and the Canary Islands; Mediterranean and northward to the British Isles. Western Atlantic: New York, USA and northern Gulf of Mexico to Argentina, including the continental coast of the Caribbean Sea.

Habitat: benthopelagic; marine; depth range 0-250 m.

Spawning season: spring.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Ranzi, S. (1931-1933). Sparidae. *Uova, larve e stadii giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 330-375.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - Unknown

No. of oil globules - 1

Shell surface - smooth

Pigment - Unknown

Yolk - unsegmented

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Little pigmentation. Ventral row of postanal melanophores. Peritoneal pigmentation.

Diagnostic features - Strong occipital spine.

Two opercular crests with very well-developed teeth. Few pigments.

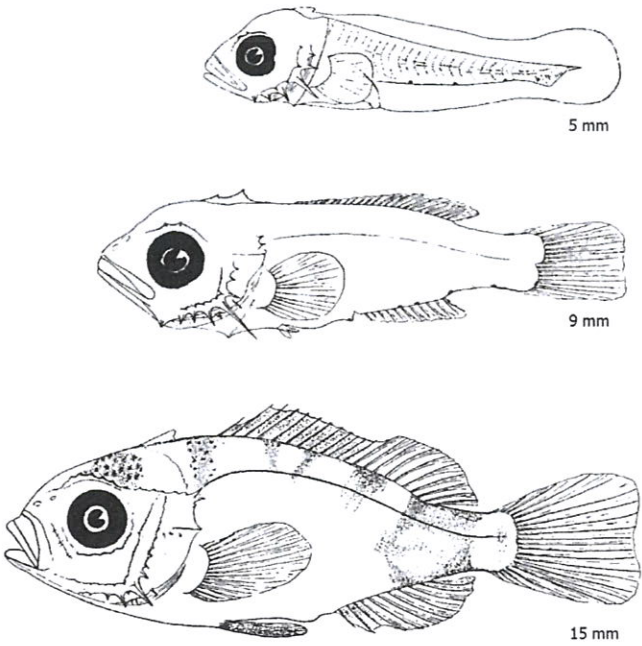


Plate 50- Early life history stages of *Pagrus pagrus*. Fage (1918).

SPARIDAE

Spondyliosoma cantharus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XI+11-12

Anal rays – III+9-11

Pelvic rays – I+5

Pectoral rays – 14-16

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Scandinavia to northern Namibia, including the Strait of Gibraltar, Mediterranean and the Black Sea, Madeira, Canary Islands, and Cape Verde.

Habitat: benthopelagic; marine; depth range 5-300 m.

Spawning season: late spring and early summer.

ELH pattern: Oviparous, demersal eggs (adhesive in a single layer) and planktonic larvae.

MAIN REFERENCES

Camus, P., L. Besseau (1986). Sparidae, *Spondyliosoma cantharus*. Fich. Ident. Plankton, 177: 4 pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.0-1.2 mm

No. of oil globules - 1

Shell surface - smooth

Pigment – Yolk with scattered melanophores. Oil globule yellow and unpigmented.

Yolk - unsegmented

Diameter of oil globules – 0.20-0.25 mm

Diagnostic features -

LARVAE

Hatching length – ca. 2 mm

Yolk-sac absorption -

Flexion length – 6.0 mm

Transformation length -

Pigmentation – Early larvae: Ventral row of postanal melanophores. Ventro-lateral scattered pigments developing at 4.0 mm and becoming more numerous with development. Late larvae: Internal row of pigment spots on each side of notochord. Postanal ventral and lateral pigmentation. Pigments developing at the base of dorsal and anal fins.

Diagnostic features - Small preopercular spines at 5.0 mm. Melanophore at lower jaw angle, in shoulder region, and medio-lateral postanal and ventro-lateral pigmentation.

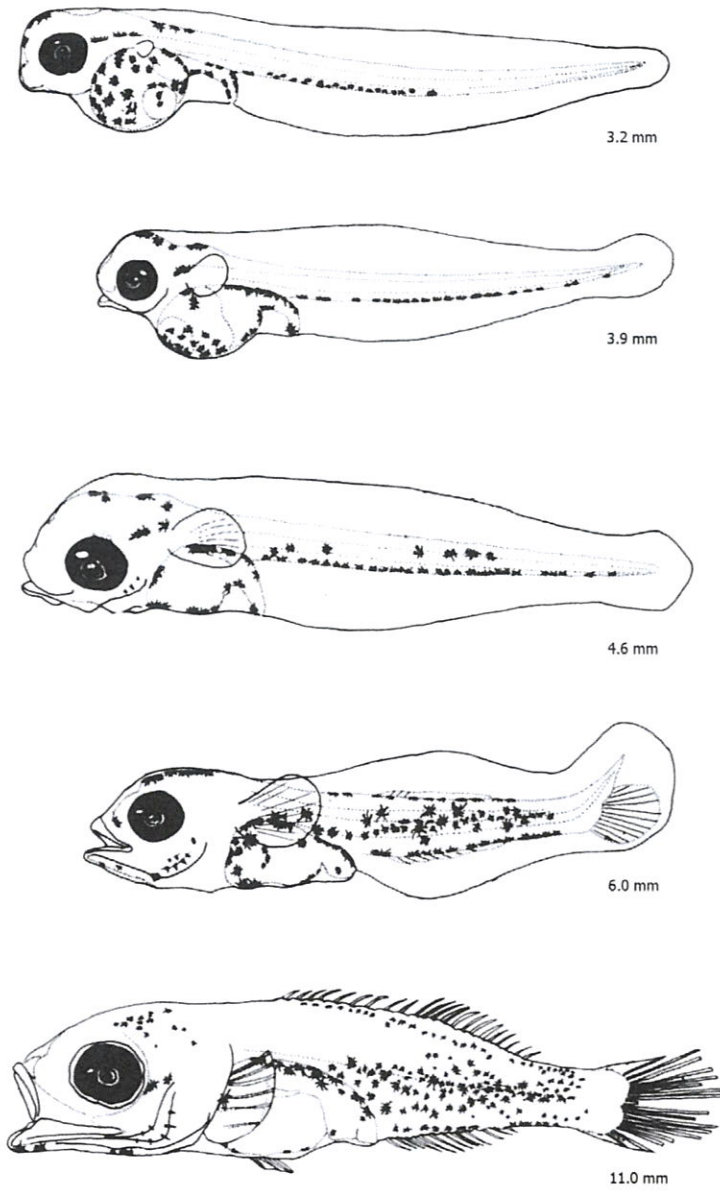


Plate 51- Early life history stages of *Spondyliosoma cantharus*. Camus and Besseau (1986).

CENTRACANTHIDAE

Centracanthus cirrus Rafinesque, 1810

MERISTICS

Fins:

Dorsal rays – XIII+9-10

Anal rays – III+10

Pelvic rays – I+5

Pectoral rays – 15

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Portugal, Morocco (off south coast), Azores, Madeira, Canary Islands and the Mediterranean. Reported from Mauritania.

Habitat: marine; benthopelagic; depth range 0-500 m.

Spawning season: spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

Marinero, J-Y (1971). Contribution à l'étude des oeufs et larves pélagiques de poissons méditerranéens. V. Oeufs pélagiques de la Baie d'Alger. *Pelagos*, 3 (1): 1-118.

Thomopoulos, A. (1954). Sur quelques oeufs planctoniques de Téléostéens de la baie de Villefranche. *Bulletin de l'Institut Océanographique*, 1043: 15pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.84-0.97 mm

No. of oil globules - 1

Shell surface - smooth

Pigment - unpigmented

Yolk - unsegmented

Diameter of oil globules – 0.18-0.20 mm

Diagnostic features – Spherical with a characteristic dome.

LARVAE

Hatching length – 2.3 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation -

Diagnostic features – Newly hatched larva: one oil globule posterior pigmented. Dorsal and ventral rows of melanophores. Tail with single melanophore.

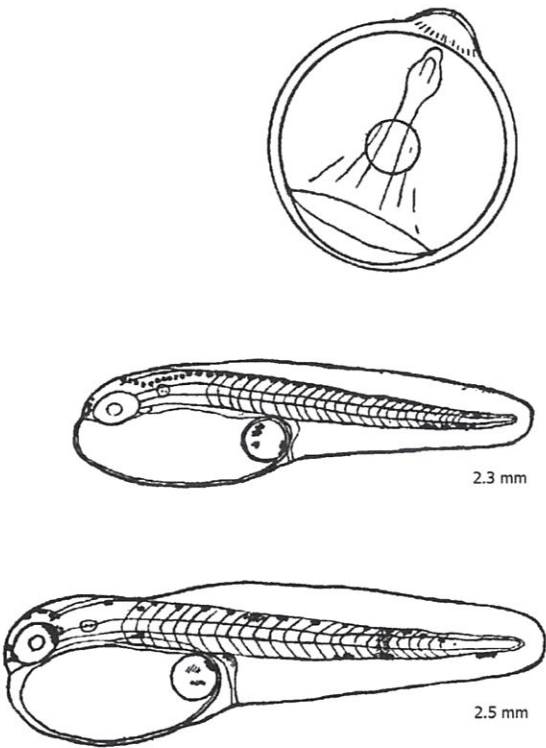


Plate 52- Early life history stages of *Centracanthus cirrus*. Thomopoulos (1954).

LABRIDAE

Centrolabrus exoletus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XVIII-XX+6-7

Anal rays – V+7-8

Pelvic rays – I+5

Pectoral rays – 14

Myomeres:

Total number – 17+18

LIFE HISTORY

Range: Eastern Atlantic: Norway to Portugal; also eastern Greenland.

Habitat: marine; reef-associated.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Fives, J.M. (1976) Labridae of the eastern North Atlantic. *Fiches d'Identification du Zooplancton*, 149: 7pp.
- Ford, E. (1922b). On the Post-larvae of the Wrasses occurring near Plymouth. *J. mar. biol. Ass. U.K.*, 12: 693-699.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length – ca. 3 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva: Anal fin membrane without melanophores.

Some pigment along the posterior margin of the posterior ventral margin of the body and on the primordial fin. Late larvae:

Paired crescent-shaped group of melanophores on the head. Pigmentation covers only anterior half of tail. No melanophores on the anal fin.

Diagnostic features – Characteristic pigmentation. Paired crescent-shaped group of melanophores on the head. No melanophores on the anal fin.

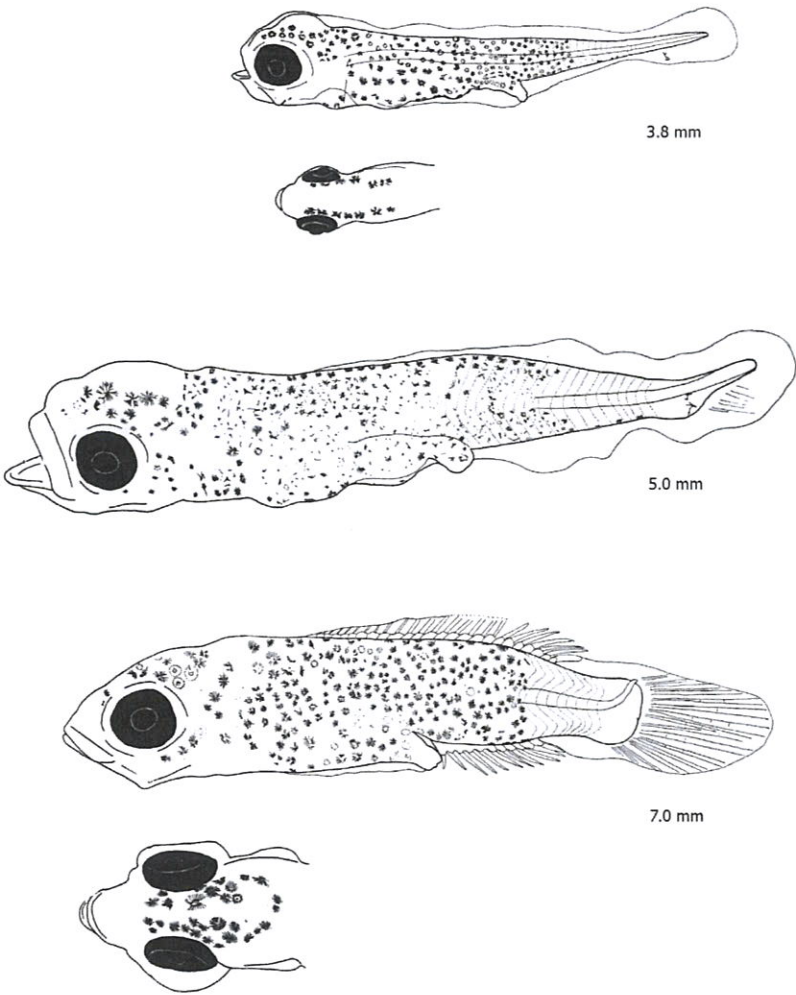


Plate 53- Early life history stages of *Centrolabrus exoletus*. Fives (1976).

LABRIDAE

Coris julis (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – IX+12-13
Anal rays – III+11-13
Pelvic rays – I+5
Pectoral rays – 12-14

Myomeres:

Total number – 25-26

LIFE HISTORY

Range: Eastern Atlantic: Sweden to south of Cape Lopez, Gabon. Also known from the Mediterranean Sea.

Habitat: Occurs in the littoral zone, near rocks and eelgrass beds. Usually found between 1-60 m.

Spawning season:

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Ford, E. (1922b). On the Post-larvae of the Wrasses occurring near Plymouth. *J. mar. biol. Ass. U.K.*, 12: 693-699.
- Holt, E.W. L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Marinero, J-Y (1971). Contribution à l'étude des oeufs et larves pélagiques de poissons méditerranéens. V. Oeufs pélagiques de la Baie d'Alger. *Pelagos*, 3 (1): 1-118.
- Raffaele, F. (1888) - Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Stn Neapel*, 8: 1-85.
- Sparta, A. (1931-1956). Labridae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 576-594.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.6-0.7 mm
No. of oil globules - 1
Shell surface - smooth
Pigment – yellow egg
Yolk - unsegmented
Diameter of oil globules – 0.12-0.16 mm
Diagnostic features -

LARVAE

Hatching length – 2.5 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation - One dorso-ventral cluster of melanophores in the posterior half of the tail. Another dorso-ventral cluster above the anus. Body typically slender, tail fin convex.
Diagnostic features – Newly-hatched larva: Yolk sac projects beyond the snout. Oil globule anterior. Late larvae: Characteristic pigmentation.

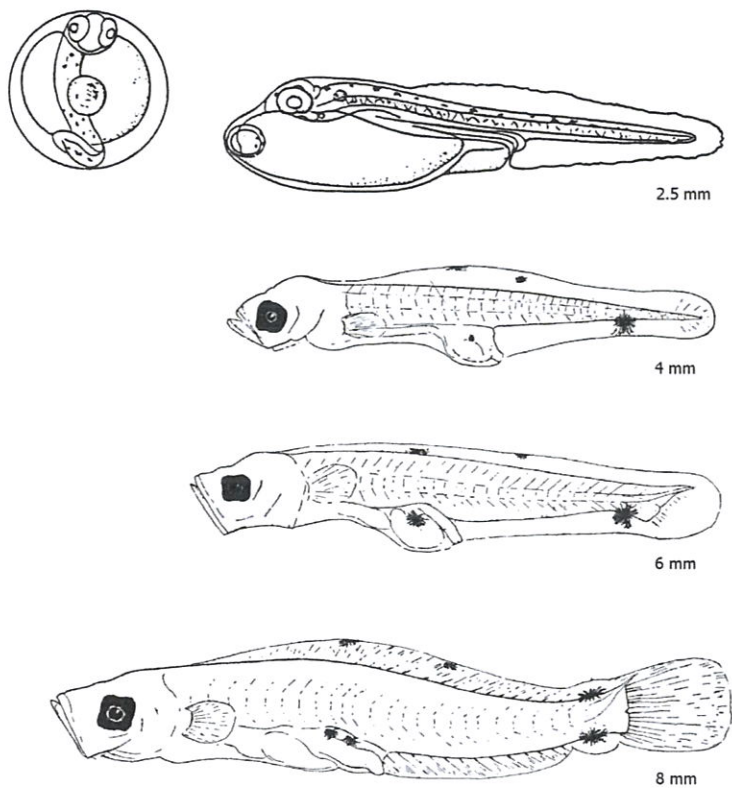


Plate 54- Early life history stages of *Coris julis*. Raffaele (1888), Fage (1918).

LABRIDAE

Ctenolabrus rupestris (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XVI-XVIII+8-10

Anal rays – III+7-8

Pelvic rays – I+5

Pectoral rays – 14-15

Myomeres:

Total number – 15+20

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco.

Also known from the Mediterranean and Black Sea.

Habitat: On rocky, weed-covered shores (1-50 m); larger specimens deeper than young.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Fives, J.M. (1976). Labridae of the eastern North Atlantic. *Fiches d'identification du Zooplancton*, 149: 7pp.
- Ford, E. (1922b). On the Post-larvae of the Wrasses occurring near Plymouth. *J. mar. biol. Ass. U.K.*, 12: 693-699.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.86-1.01 mm

No. of oil globules - 0

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features – Large perivitelline space.

LARVAE

Hatching length – ca. 2.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Dorsal head pigment vary from one to three large melanophores.

One large melanophore above the anus, in the middle of the ventral contour, and in the urostyle region. No dorsal melanophores.

A few peritoneal melanophores on the gas bladder.

Diagnostic features – Characteristic pigmentation.

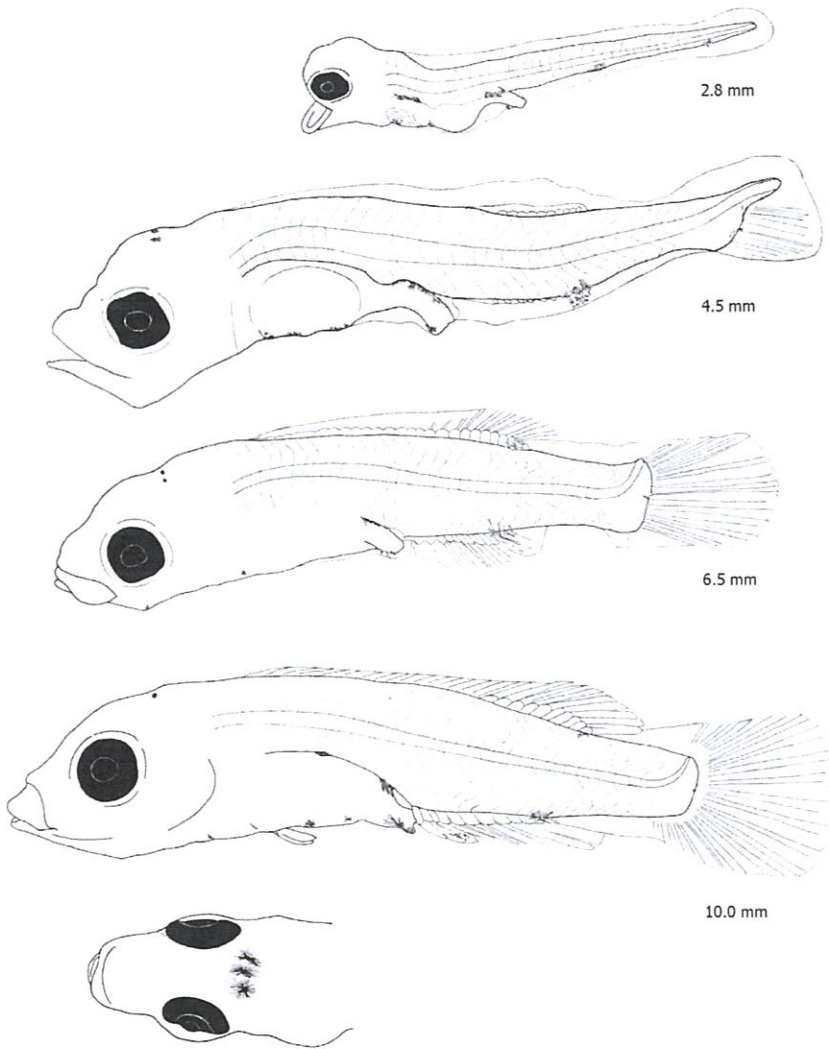


Plate 55- Early life history stages of *Ctenolabrus rupestris*. Fives (1976).

SPARIDAE

Labrus bergylta Ascanius 1767

MERISTICS

Fins:

Dorsal rays – XVIII-XX1+9-11

Anal rays – III+8-9

Pelvic rays – I+5

Pectoral rays – 15

Myomeres:

Total number – 19+19

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco, including Madeira, the Azores and the Canary Islands. Doubtful records from Mediterranean, Adriatic and Marmara seas.

Habitat: marine; demersal; reef-associated; depth range 1–50 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Fives, J.M. (1976). Labridae of the eastern North Atlantic. *Fiches d'Identification du Zooplancton*, 149: 7pp.
- Ford, E. (1922b). On the Post-larvae of the Wrasse occurring near Plymouth. *J. mar. biol. Ass. U.K.*, 12: 693-699.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.7-1.15 mm

No. of oil globules - 0

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 2.75-3.0 mm

Yolk-sac absorption -

Flexion length – 7.0 mm

Transformation length -

Pigmentation - Head pigment restricted to two crescent-shaped areas running longitudinally on either side of the mid-dorsal line. Anal fin pigment restricted to the anterior anal fin region.

Diagnostic features – Characteristic pigmentation (head).

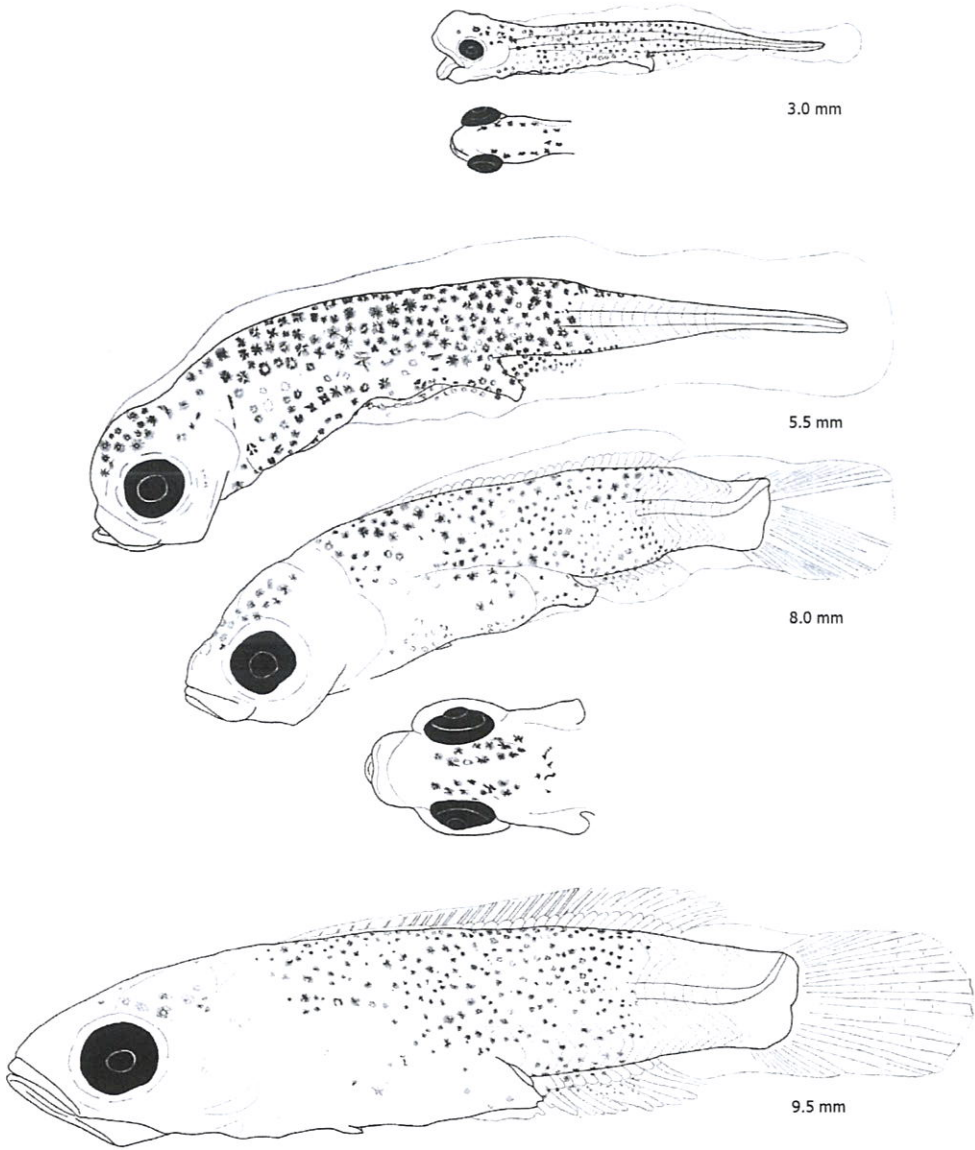


Plate 56- Early life history stages of *Labrus bergylta*. Fives (1976).

LABRIDAE

Labrus merula Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – XVII-XIX+11-13

Anal rays – III+8-10

Pelvic rays – I+5

Pectoral rays – 14-15

Myomeres:

Total number – 38-39

LIFE HISTORY

Range: Eastern Atlantic: Portugal to Morocco and Azores. Also in the Mediterranean.

Habitat: marine; demersal; reef-associated.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

Dulčić, J., V. Kozul, M. Kraljevic, B. Skaramuca, B. Glamuzina, P. Ré (1999). Embryonic and larval development of the labrid *Labrus merula* Linnaeus, 1758. *J. mar. biol. Ass. U. K.*, 79: 327-332.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.83-1.05 mm

No. of oil globules - 0

Shell surface -

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 3.8 mm

Yolk-sac absorption – 4.7 mm

Flexion length -

Transformation length -

Pigmentation – Early larvae: Small number of melanophores on head, without a definite crescent-shaped arrangement. No pigment along the anal fin-fold. Late larvae: Paired crescent-shaped groups of melanophores on head and pigmented dorsal fin. No melanophores on caudal region, snout or lower jaw. Pigmentation similar to *Labrus bergylta*.

Diagnostic features – Characteristic pigmentation (similar to *Labrus bergylta*).

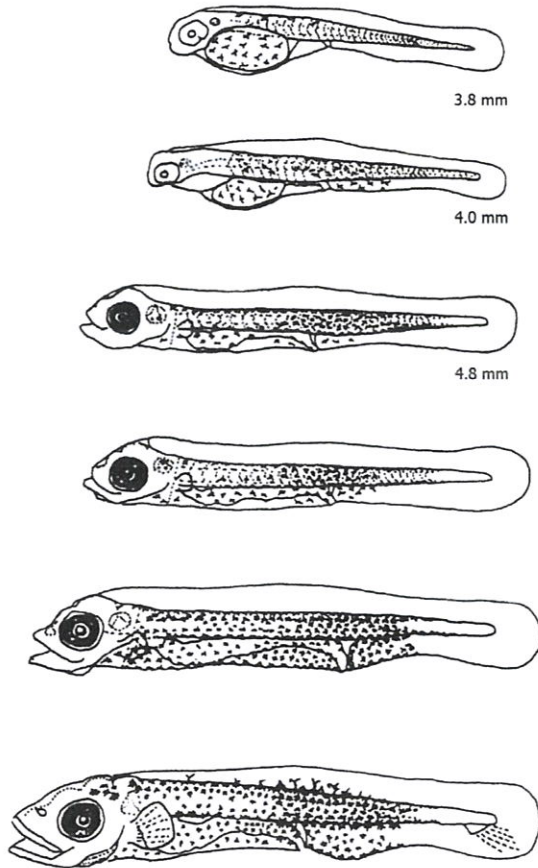


Plate 58- Early life history stages of *Labrus merula*. Dulčić *et al.* (1999).

LABRIDAE

Labrus mixtus Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – XVI-XIX+11-14

Anal rays – III-9-12

Pelvic rays – I+5

Pectoral rays – 14-17

Myomeres:

Total number – 17/18+21/22

LIFE HISTORY

Range: Eastern Atlantic: Norway south to Senegal, Azores and Madeira. Also in the Mediterranean.

Habitat: marine; demersal; reef-associated; non-migratory; depth range 2–200 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Fives, J.M. (1976). Labridae of the eastern North Atlantic. *Fiches d'Identification du Zooplancton*, 149: 7pp.
- Ford, E. (1922b). On the Post-larvae of the Wrasses occurring near Plymouth. *J. mar. biol. Ass. U.K.*, 12: 693-699.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length -

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Body pigments confined to dorsal and ventral margins of body and gut. Five larve melanophores along the dorsal margin and three to four along the ventral postanal margin. Some melanophores along dorsal and ventral gut and on lower jaw.

Diagnostic features – Characteristic pigmentation.

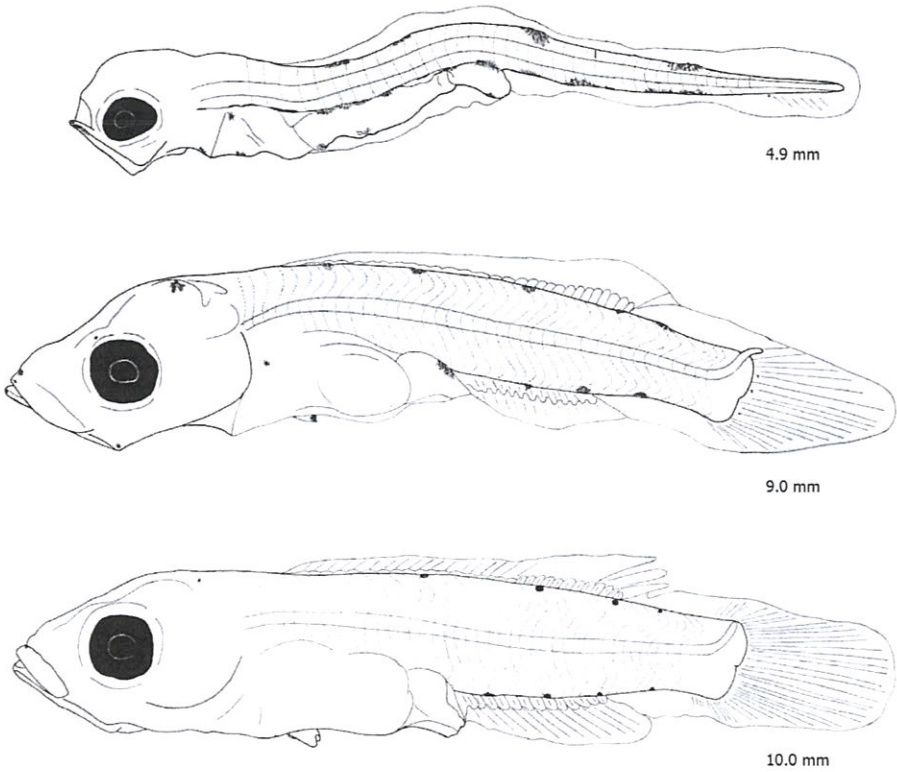


Plate 57- Early life history stages of *Labrus mixtus*. Fives (1976).

LABRIDAE

Symphodus melops (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XIV-XVII+8-11

Anal rays – III+9-11

Pelvic rays – I+5

Pectoral rays – 14-15

Myomeres:

Total number – 14+19

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco and the Azores. Also known from the western Mediterranean and Adriatic seas.

Habitat: marine; demersal; reef-associated.

Spawning season: Spawns throughout the whole year.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Fives, J.M. (1976). Labridae of the eastern North Atlantic. *Fiches d'Identification du Zooplancton*, 149: 7pp.
- Ford, E. (1922b). On the Post-larvae of the Wrasses occurring near Plymouth. *J. mar. biol. Ass. U.K.*, 12: 693-699.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.8-0.85 mm

No. of oil globules - 0

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 2.5-3.0 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation - Anterior half of tail covered with melanophores. Melanophores along the whole length of the anal fin. No crescent-shaped arrangement of the melanophores on the head. Ventral lip pigment present.

Diagnostic features – Characteristic pigmentation. No crescent-shaped arrangement of the melanophores on the head. Pigmentation of anal fin. Body pigment less dense than *Labrus bergylta* and *Centrolabrus exoletus*.

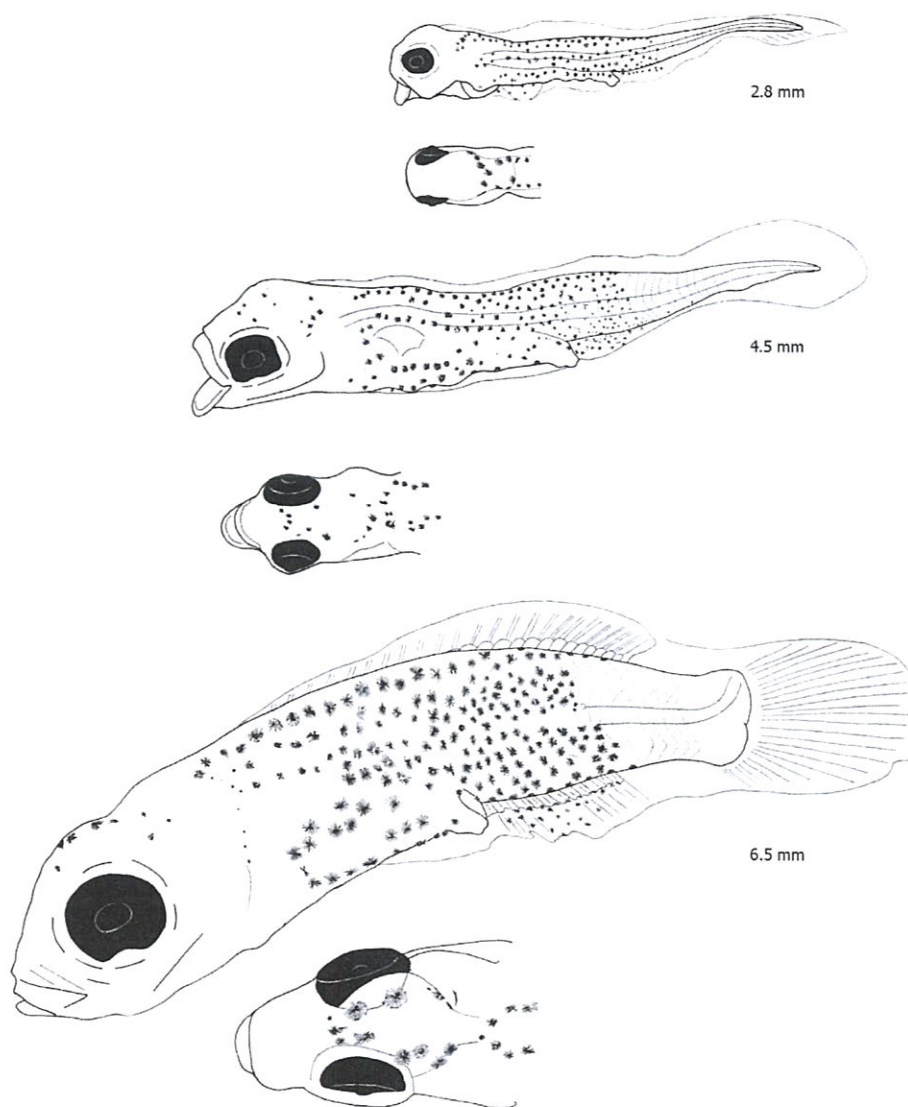


Plate 59- Early life history stages of *Symphodus melops*. Fives (1976).

AMMODYTIDAE

Ammodytes tobianus Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – 50-56
Anal rays – 25-31
Pelvic rays -
Pectoral rays – 10-14

Myomeres:

Total number – 60-66

LIFE HISTORY

Range: Northeast Atlantic: Murmansk to Spain, including Iceland and the Baltic and the Mediterranean.

Habitat: demersal; marine; brackish.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Einarsson, H. (1955). On the post-larval stages of *Ammodytes lancea* Cuvier. *Acta Naturalia Islandica*, II (1): 7pp.
Macer, C.T. (1967). Ammodytidae. *Fiches d'identification des oeufs et larves de poissons*, N° 2: 6pp.
Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

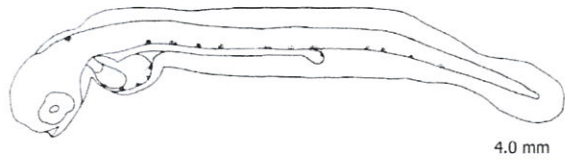
EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.72-0.97 mm
No. of oil globules - 1
Shell surface – smooth, ovoid
Pigment -
Yolk -
Diameter of oil globules – 0.25-0.31 mm
Diagnostic features -

LARVAE

Hatching length – 4 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Dorsal body melanophores absent or limited to 1-3 in caudal region; ventral body row of melanophores extending from anus to base of tail, not to tip of notochord, row of dorsal gut melanophores.
Diagnostic features - Absence of ventral gut melanophores, weak development of caudal pigmentation and extension of dorsal body melanophore row to the level of the anus. Late larvae very similar to *Hyperoplus immaculatus*.



4.0 mm



9.7 mm



16.0 mm



25.0 mm

Plate 60- Early life history stages of *Ammodytes tobianus*. Macer (1967).

AMMODYTIDAE

Gymnammodytes semisquamatus (Jourdain, 1879)

MERISTICS

Fins:

- Dorsal rays – 56-59
- Anal rays – 28-32
- Pelvic rays -
- Pectoral rays – 14-15

Myomeres:

- Total number –

LIFE HISTORY

Range: Northeast Atlantic: southern coast of Norway and the Shetlands to Spain, including all coasts of the British Isles and the North Sea, but not the Baltic.

Habitat: demersal; marine.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Cameron, J. (1959). The larval and post-larval stages of *Gymnammodytes semisquamatus* (Jourdain). *J. Mar. Biol. Ass. U.K.*, 38: 17-25.
- Ford, E. (1920). The post-larval stages of *Ammodytes* species captured during the cruises of S.S. "Oithona" in Plymouth waters in the year 1919. *J. mar. biol. Ass. U.K.*, 12: 249-252.
- Macer, C.T. (1967). Ammodytidae. *Fiches d'identification des oeufs et larves de poissons, N° 2*: 6pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter - Unknown
- No. of oil globules - 1
- Shell surface - Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features - Unknown

LARVAE

- Hatching length – ca. 3 mm
- Yolk-sac absorption -
- Flexion length – 9 mm
- Transformation length -
- Pigmentation – Newly hatched larvae: No head, dorsal, caudal or ventral gut melanophores; Dorsal gut pigmentation of about 16 melanophores, postanal ventral pigment of about 15 melanophores, ventral margin of the primordial fin: 13 melanophores.
- Diagnostic features – Characteristic pigmentation. The only Ammodytidae species to possess ventral fin-membrane pigmentation (from hatching to 20 mm) and denticles on pre-maxilla (7-25 mm).

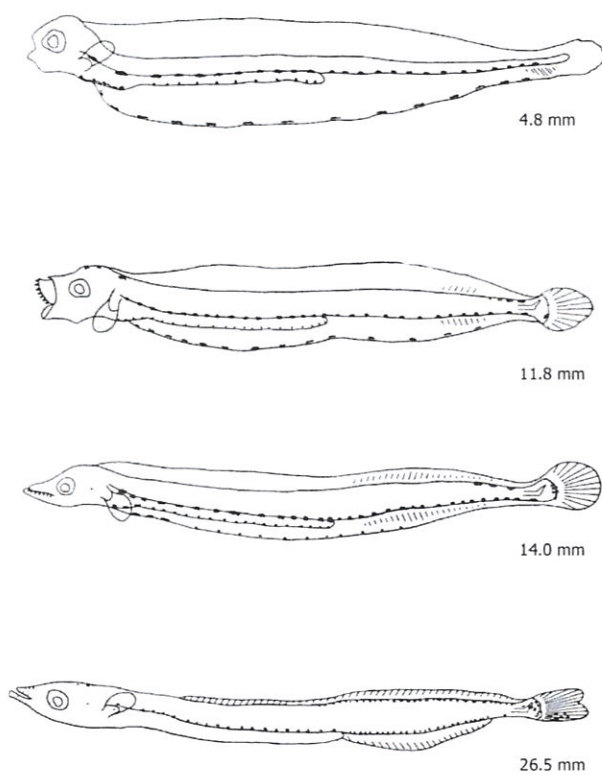


Plate 61- Early life history stages of *Gymnammodytes semisquamatus*. Macer (1967).

AMMODYTIDAE

Hyperoplus lanceolatus (Le Sauvage, 1824)

MERISTICS

Fins:

Dorsal rays – 52-61
Anal rays – 28-33
Pelvic rays -
Pectoral rays – 12-14

Myomeres:

Total number – 66-69

LIFE HISTORY

Range: Northeast Atlantic: Murman and Spitzbergen to Portugal, including Iceland and much of the Baltic.

Habitat: demersal; marine.

Spawning season: winter.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Einarsson, H. (1951). The post-larval stages of Sand-eels (Ammodytidae) in Faroe, Iceland and W-Greenland waters. *Acta Naturalia Islandica*, 1, N° 7: 1-54.
- Ford, E. (1920). The post-larval stages of *Ammodytes* species captured during the cruises of S.S. "Oithona" in Plymouth waters in the year 1919. *J. mar. biol. Ass. U.K.*, 12: 249-252.
- Macer, C.T. (1967). Ammodytidae. *Fiches d'identification des oeufs et larves de poissons*, N° 2: 6pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

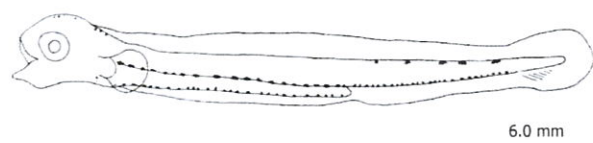
EARLY LIFE HISTORY DESCRIPTION

EGGS

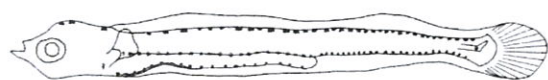
Capsule diameter - Unknown
No. of oil globules - 1
Shell surface - Unknown
Pigment - Unknown
Yolk - Unknown
Diameter of oil globules – 0.25-0.31
Diagnostic features - Unknown

LARVAE

Hatching length – ca. 4.5 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Early larvae: Black pigmentation on dorsal and postanal body rows, and dorsal and ventral gut rows. The rectum does not reach the fin margin. Late larvae: Early forward extension of the dorsal body row of melanophores, to the head, and presence of heavy ventral gut melanophores. In later stages, the caudal pigmentation is characteristic of the species.
Diagnostic features – Very heavy pigmentation, especially in the dorsal row, which usually extends from tail to anus (8-10 mm) and to the head (11-16 mm).
Vomerine teeth visible at 20-25 mm.



6.0 mm



11.0 mm



15.5 mm



23.0 mm

Plate 62- Early life history stages of *Hyperoplus lanceolatus*. Macer (1967).

TRACHINIDAE

Echiichthys vipera (Cuvier, 1829)

MERISTICS

Fins:

Dorsal rays – D₁ V-VII, D₂ 21-25

Anal rays – I+24-26

Pelvic rays – I+5

Pectoral rays – 14

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: North Sea to the Mediterranean, Morocco and Madeira. Reported from the Canary Islands.

Habitat: demersal; marine.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Marinero, J-Y (1971). Contribution à l'étude des oeufs et larves pélagiques de poissons méditerranéens. V. Oeufs pélagiques de la Baie d'Alger. *Pelagos*, 3 (1): 1-118.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Trachinidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 687-697.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.95-1.37 mm

No. of oil globules – 6-30 scattered

Shell surface - smooth

Pigment – yellow oil globules

Yolk - unsegmented

Diameter of oil globules – 0.024-0.12 mm

Diagnostic features – pelvic fins apparent when embryo surrounds the yolk.

LARVAE

Hatching length – 3 mm

Yolk-sac absorption -

Flexion length – 6 mm

Transformation length -

Pigmentation – Early larvae: pigmented eyes. Continuous dorsal and ventral contour rows of melanophores extending posteriorly behind half way along the postanal region. Well developed and pigmented pelvic fins (black and yellow). Two bars of melanophores on the body and melanophores on snout, head and peritoneum. Late larvae: One or two ventral melanophores near the tail. At a length of 5 mm, the dorsal fin begins to form. Preopercular and opercular spinal armature starts to develop at an early stage. Heavy peritoneal pigmentation and distinct row of melanophores at the base of the caudal fin.

Diagnostic features – Large pigmented pelvic fins. Well developed preopercular and opercular spines. Characteristic shape.

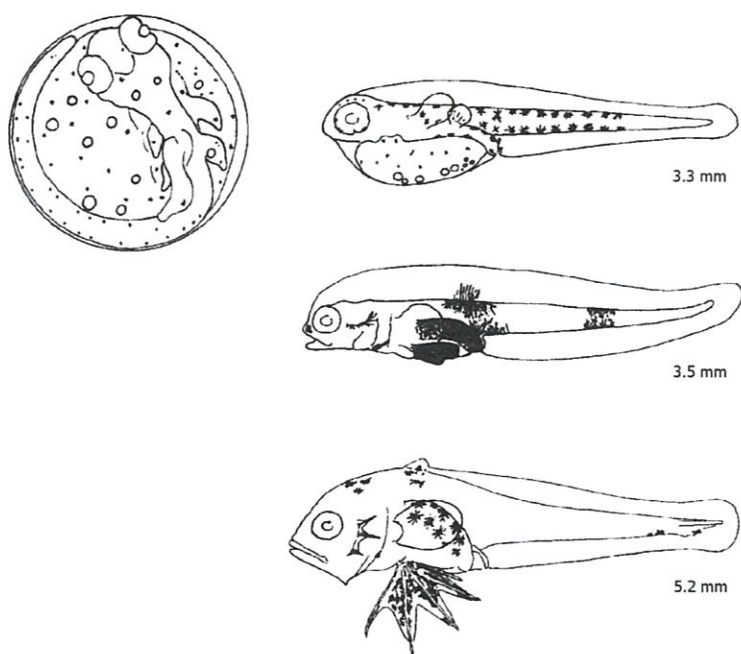


Plate 63- Early life history stages of *Echiichthys vipera*. Russell (1976).

TRACHINIDAE

Trachinus draco Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays - D₁ V-VII, D₂ 29-32

Anal rays - II+28-34

Pelvic rays - I+5

Pectoral rays - 15-16

Myomeres:

Total number -

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco, Madeira and Canary Islands, including the Mediterranean and the Black Sea. Reported from Mauritania.

Habitat: demersal; marine; depth range 1-150 m.

Spawning season: summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Clark, R. S. (1920). The pelagic young and early bottom stages of Teleosteans. *J. mar. biol. Ass. U. K.*, 12: 159-240.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
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- Padoa, E. (1933-1956). Trachinidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 687-697.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.9-1.1 mm

No. of oil globules - 1

Shell surface - smooth

Pigment - Advanced embryo: 1

melanophore on the snout, 2 behind the eyes, 2 behind the otocyst, 1 near the anus, and a postanal ventral row of melanophores.

Yolk - unsegmented

Diameter of oil globules - 0.19-0.23 mm

Diagnostic features - embryo pigmentation.

LARVAE

Hatching length - 2.4 mm

Yolk-sac absorption - 3.5 mm

Flexion length - 7.5 mm

Transformation length -

Pigmentation - Early larvae: Less pigmented than *E. vipera*. Late larvae: At 6.5 mm the postanal row of pigments is restricted to the posterior half of the postanal region. Heavy peritoneal pigmentation.

Diagnostic features - Early larvae: Anus close to the posterior end of the yolk sac. The pelvic fin, which develops early in *E. vipera*, has not yet appeared. Oil globule situated at the anterior end of the yolk sac. At 6.5 mm, spines develop on the preoperculum, at 12 mm, there are 5 spines and two melanophores above the eye, several occipital melanophores, two on the well-formed first dorsal fin, and 10 in the ventral postanal row. Large pigmented pelvic fins.

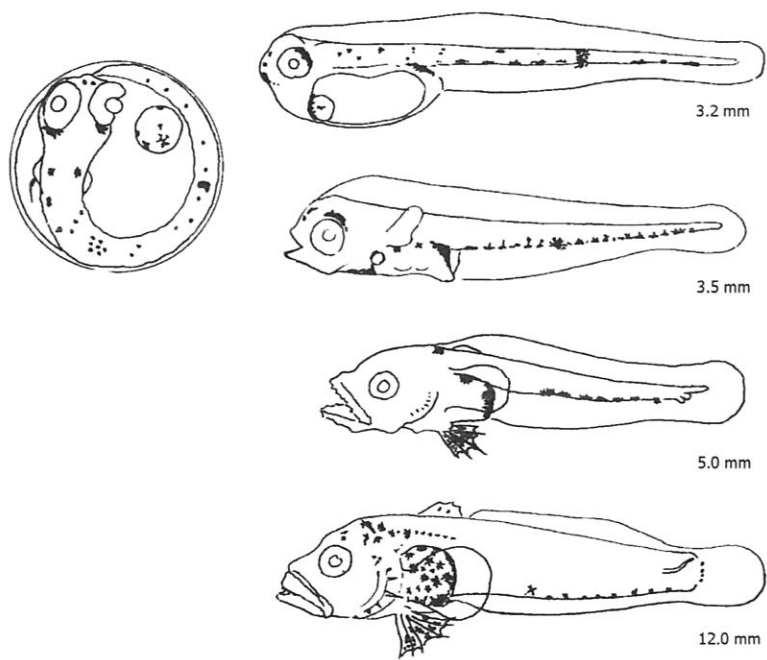


Plate 64- Early life history stages of *Trachinus draco*. Russell (1976).

SCOMBRIDAE

Scomber japonicus Houttuyn, 1782

MERISTICS

Fins:

Dorsal rays - D₁ VIII-XIII, D₂ 9-14+4-6

Anal rays - I-II+9-14

Pelvic rays - I+5

Pectoral rays - 19-22

Myomeres:

Total number - 30-32

LIFE HISTORY

Range: Circumglobal, east coast of America from Nova Scotia, Canada to east Argentina.

Habitat: pelagic; marine; depth range 0-300 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Berrien, P.L. (1975). A description of Atlantic mackerel *Scomber scombrus*, eggs and early larvae. *Fish. Bull. U.S.*, 73 (1): 186-192.
- Berrien, P.L. (1978). Eggs and larvae of *Scomber scombrus* and *Scomber japonicus* in continental shelf waters between Massachusetts and Florida. *Fish. Bull. U.S.*, 76: 95-115.
- Moser, H.G. (Ed.) (1996). *The early stages of fishes in the California Current region*. Calcofi Atlas no. 33: 1505pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.80-1.35 mm

No. of oil globules - 1

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules - 0.22-0.31 mm

Diagnostic features -

LARVAE

Hatching length - 3 mm

Yolk-sac absorption -

Flexion length - 6-7 mm

Transformation length - 12-19 mm

Pigmentation - Early larvae: group of melanophores on head and gut. Row along the ventral margin of tail. Late larvae: Heavy head pigmentation. Midlateral pigmentation.

Diagnostic features - Typical shape and pigmentation. Pigment along ventral margin of tail and lateral midline.

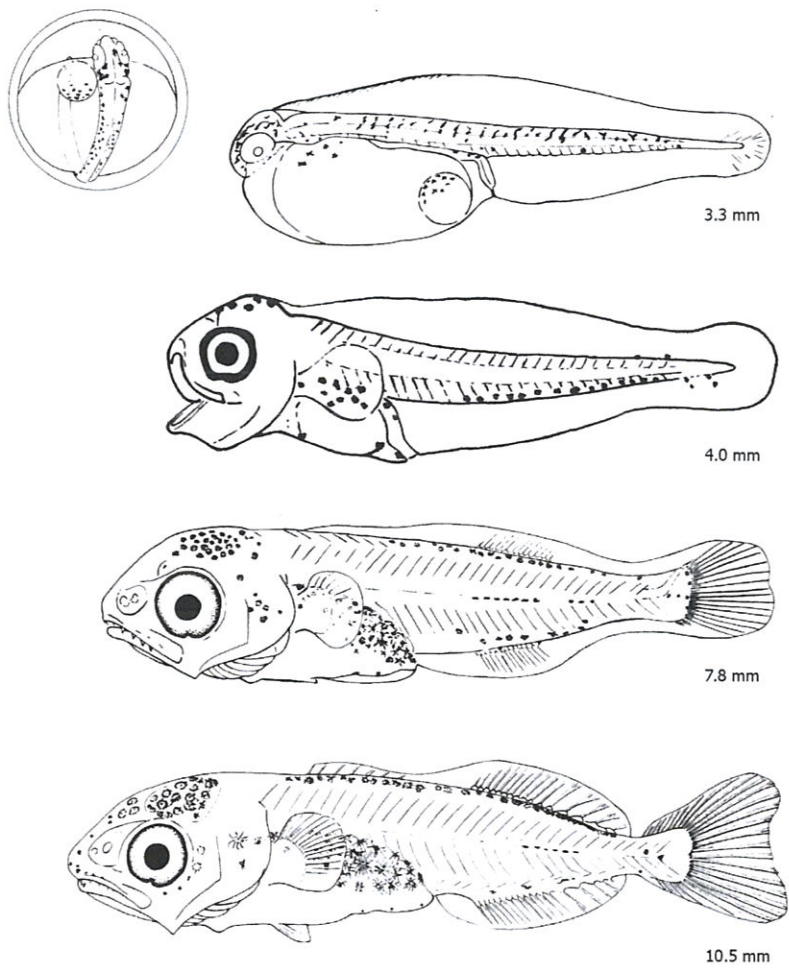


Plate 66- Early life history stages of *Scomber japonicus*. Moser *et al.* (1984).

SCOMBRIDAE

Scomber scombrus (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays - D₁ VII-X, D₂ 13+5-6
Anal rays - I+12+5-6
Pelvic rays - I+5
Pectoral rays - 19-21

Myomeres:

Total number - 31

LIFE HISTORY

Range: Eastern Atlantic: including the southwestern Baltic Sea, the Mediterranean and Black Sea. Western Atlantic: Labrador to Cape Lookout.

Habitat: pelagic; marine; depth range 0-1000 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Berrien, P.L. (1975). A description of Atlantic mackerel *Scomber scombrus*, eggs and early larvae. *Fish. Bull. U.S.*, 73 (1): 186-192.
- Cunningham, J.T. (1889). Studies of the reproduction and development of teleostean fishes occurring in the neighbourhood of Plymouth. *J. mar. bio. Ass. U.K.*, 1: 370-375.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Scombridae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e svergiato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.*38: 471-507.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.9-1.4 mm
No. of oil globules - 1
Shell surface - smooth
Pigment - yellow oil globule
Yolk - unsegmented
Diameter of oil globules - 0.28-0.35
Diagnostic features -

LARVAE

Hatching length - 3.3 mm
Yolk-sac absorption - 5 mm
Flexion length - 7 mm
Transformation length -
Pigmentation - Early larvae: A group of melanophores on the head. Peritoneal black pigment occurs on the upper half of the abdomen. Vent opens at the margin of the finfold. Late larvae: Sharp teeth on upper and lower jaws. Typical form of the stomach and rectum. Melanophores on the head. Ventral and dorsal melanophores start at a definite distance behind the anus. There are never any melanophores on the sides of the body between the dorsal and ventral contour rows.
Diagnostic features - Characteristic pigmentation. Presence of sharp teeth on upper and lower jaws that become apparent at 5 mm.

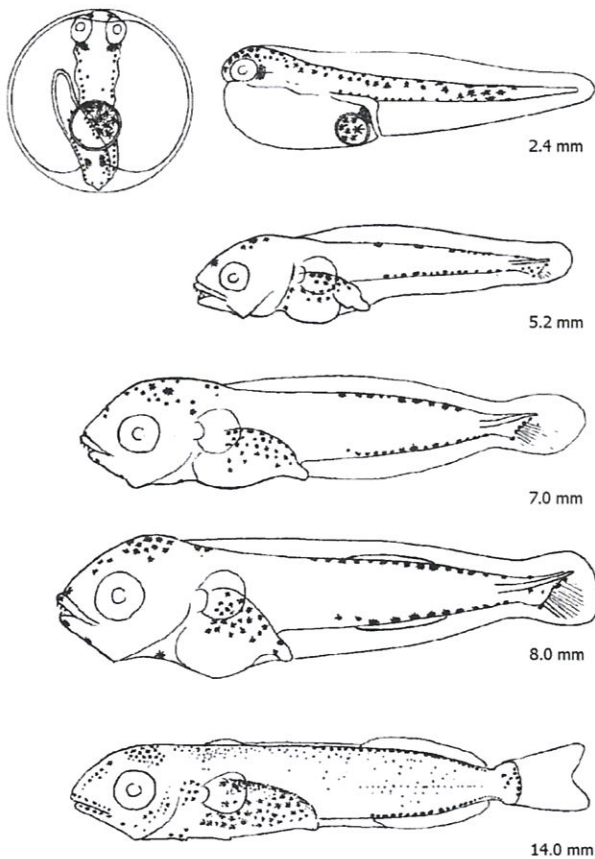


Plate 65- Early life history stages of *Scomber scombrus*. Russell (1976).

MERISTICS**Fins:**Dorsal rays – D₁ IV-V, D₂ I+11-13

Anal rays – I+13-14

Pelvic rays – I+5

Pectoral rays – 17-18

Myomeres:

Total number – 27 (26-28)

LIFE HISTORY

Range: Atlantic Ocean: Trondheim to Morocco. Also known from the Mediterranean and Black Sea.

Habitat: demersal; marine; depth range 0-80 m.

Spawning season: summer and autumn.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
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- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION**EGGS:** Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

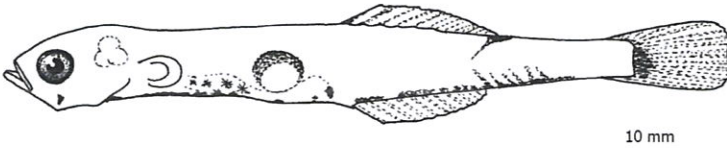
Pigmentation – Very few pigments.

Melanophore on angle of lower jaw.

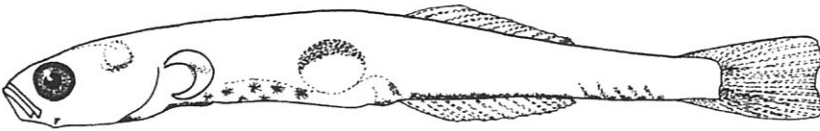
Stellate melanophores on ventral abdomen. Row of melanophores from the anus extending almost to caudal fin.

Melanophores on base of caudal fin.

Diagnostic features - At 7 mm the pectoral fins are present as minute flaps. At 10 mm the second dorsal fin and the anal fin are fully developed. Behind the anal fin are about 5-6 diagonal stripes situated on the ventral half of the body. Prominent gas bladder well back in the body. Fewer myomeres than other Gobiids. The late larva is very similar to the adult.



10 mm



17 mm

Plate 67- Early life history stages of *Aphia minuta*. Petersen (1919).

GOBIIDAE

Crystallogobius linearis (Düben, 1845)

MERISTICS

Fins:

Dorsal rays - D₁ II-III, D₂ I+18-20

Anal rays - I+20-21

Pelvic rays - I+5

Pectoral rays -

Myomeres:

Total number - 39 (29-31)

LIFE HISTORY

Range: Eastern Atlantic: Lofotens, Norway, to Gibraltar. Also known from the Mediterranean Sea.

Habitat: demersal; marine; depth range 1-400 m.

Spawning season: summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadii Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e svergiato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

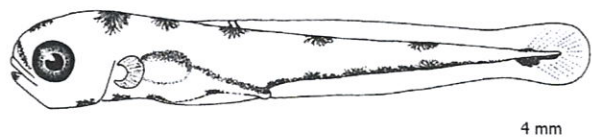
Yolk-sac absorption - Unknown

Flexion length -

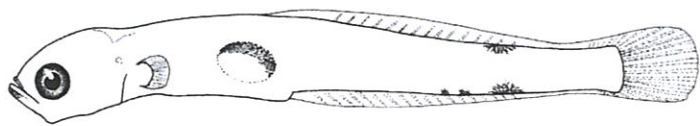
Transformation length -

Pigmentation - Heavily pigmented early larva. Melanophores in front of the eye and on tip of the lower jaw. Five large melanophores on head, neck and dorsal postanal body contour. Melanophores develop on the abdomen and there is a continuous row of postanal ventral pigment. At 7-9 mm the pigmentation is reduced to a single dorsal branched melanophore and a few melanophores along the ventral contour. At 11 mm additional melanophores are present along the ventral postanal region.

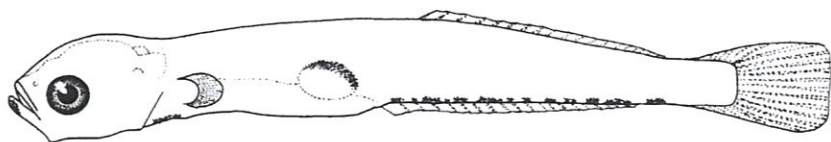
Diagnostic features - Characteristic pigmentation. Prominent gas bladder.



4 mm



9 mm



11 mm

Plate 68- Early life history stages of *Crystallogobius linearis*. Petersen (1919).

GOBIIDAE

Gobius cobitis Pallas, 1814

MERISTICS

Fins:

Dorsal rays - D₁ VI, D₂ I+13

Anal rays - I+10-12

Pelvic rays - I+5

Pectoral rays - 19-22

Myomeres:

Total number -

LIFE HISTORY

Range: Eastern Atlantic: southwestern England to Agadir, Morocco, throughout the Mediterranean and Black Sea.

Habitat: demersal; marine; depth range 0-10 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

Gil, F., E.J. Gonçalves, C. Faria, V.C. Almada, C. Baptista, H. Carreiro (1997). Embryonic and larval development of the giant goby *Gobius cobitis* (Pisces: Gobiidae). *Journal of Natural History*, 31: 799-804.

Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 3.59x1.18 mm

No. of oil globules -

Shell surface - smooth, fusiform

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 5.5 mm

Yolk-sac absorption - 5.5-5.6 mm

Flexion length - 7.5 mm

Transformation length - 17-19 mm

Pigmentation - Newly hatched larva: eyes fully pigmented, gas bladder formed but not filled, reduced yolk. Ventral row of melanophores extending from behind the anus to the caudal region. Two large melanophores above the anus and three others at the dorsal midline near the caudal peduncle. Pigmented gas bladder. Late larva: dorsal row of melanophores extending from the head to the caudal region.

Diagnostic features - Pigmentation.

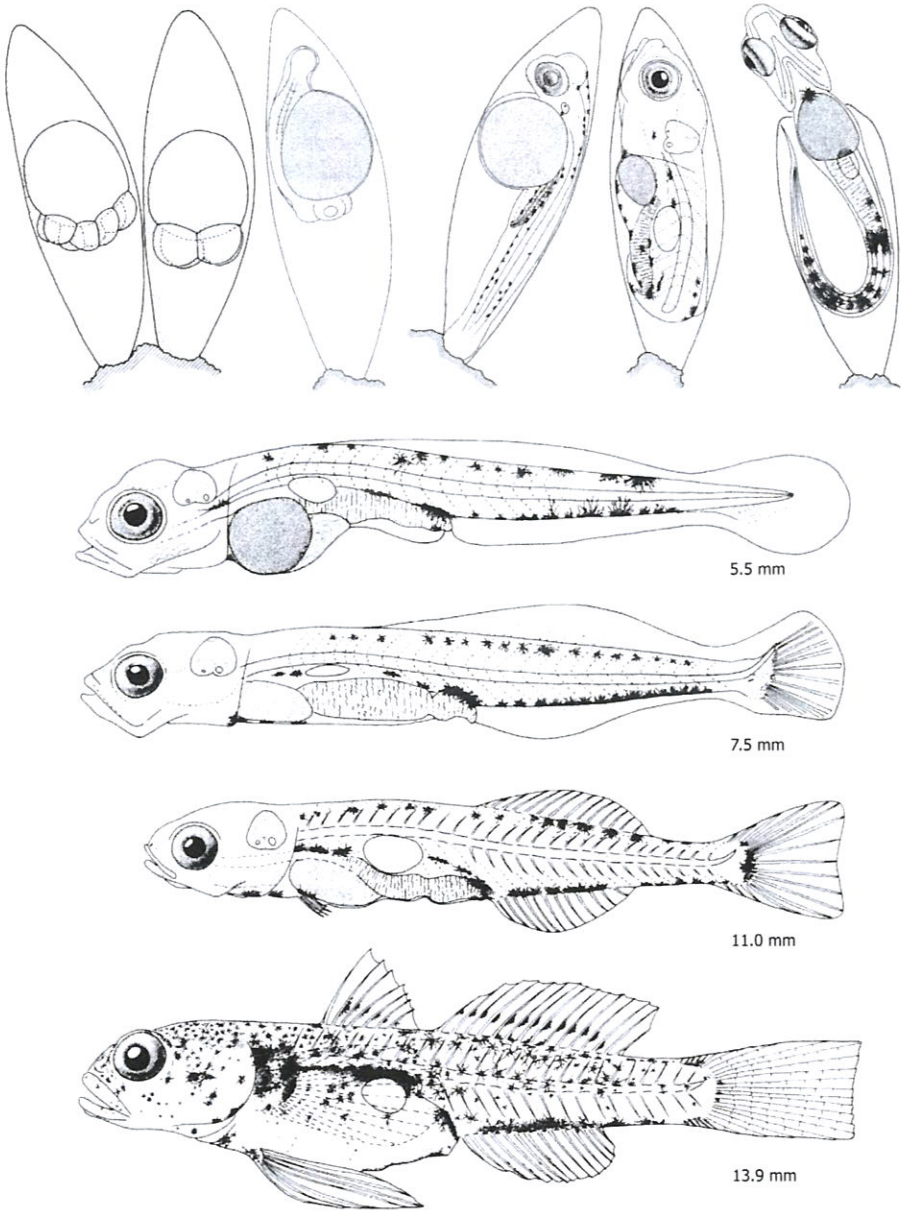


Plate 70- Early life history stages of *Gobius cobitis*. Gil *et al.* (1997).

GOBIIDAE

Gobius cruentatus Gmelin, 1789

MERISTICS

Fins:

Dorsal rays - D₁ VI, D₂ I+14

Anal rays - I+12-13

Pelvic rays - I+5

Pectoral rays - 20-21

Myomeres:

Total number -

LIFE HISTORY

Range: Eastern Atlantic: southwest Ireland to Morocco, Mediterranean and Senegal.

Habitat: demersal; marine; depth range 15-40 m.

Spawning season: Unknown.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

Gil, F., R. Borges, C. Faria, E.J. Gonçalves (2002). Early development of the red mouthed goby, *Gobius cruentatus* (Pisces: Gobiidae). *J. Mar. Biol. Ass. U.K.*, 82: 161-163.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 2.04x0.56 mm

No. of oil globules - 0

Shell surface - smooth, fusiform

Pigment - Late embryonic stages fully pigmented.

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 3.30 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation - Newly hatched larva: seven to nine ventral melanophores along gut and one above the anus. Continuous row of postanal melanophores with large stellate pigment in the middle of this row. Dorsal melanophores (between the head and trunk). Gas bladder prominent and fully pigmented.

Diagnostic features - Pigmentation.



Plate 71- Early life history stages of *Gobius cruentatus*. Gil *et al.* (2002).

MERISTICS**Fins:**Dorsal rays - D₁ V-VII, D₂ I+11-13

Anal rays - I+11-12

Pelvic rays - I+5

Pectoral rays - 15-20

Myomeres:

Total number - 27-29

LIFE HISTORY

Range: Eastern Atlantic and Mediterranean Sea: throughout North Africa from Cape Blanc, Mauritania north and eastwards to the Suez Canal; also along the eastern Atlantic coast northwards to Trondheim (Norway) and Baltic Sea. Also known from the Black Sea.

Habitat: demersal; marine; depth range 1-75 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadii giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.
- Petersen, C.G.J. (1892). On the eggs and breeding of our Gobiidae. *Reports of the Danish Biological Station*, 2: 1-9.
- Petersen, C.G.J. (1917). On the development of our common gobies (*Gobius*) from the egg to the adult stages etc.. *Reports of the Danish Biological Station*, 24: 5-16.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION**EGGS**

Capsule diameter - 1.5 mm

No. of oil globules - many oil globules

Shell surface - smooth, fusiform

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 2.5 mm

Yolk-sac absorption - 4.0-4.5 mm

Flexion length -

Transformation length -

Pigmentation - Newly hatched larva: no pigment on head. Three characteristic ventral melanophores, one below the yolk sac, one at the anus and one mid-way on the tail. Postanal row of melanophores, with one large ramified about mid-way along the postanal region. No postanal dorsal pigmentation. Late larvae: no significant change in pigmentation, head and jaws with no pigmentation. Gas bladder heavily pigmented. One melanophore on the ventral half of the caudal fin. More advanced in development than other related species at equivalent sizes.

Diagnostic features - Pigmentation. Prominent gas bladder. Fewer myotomes than *Pomatoschistus minutus* and *Pomatoschistus microps*.

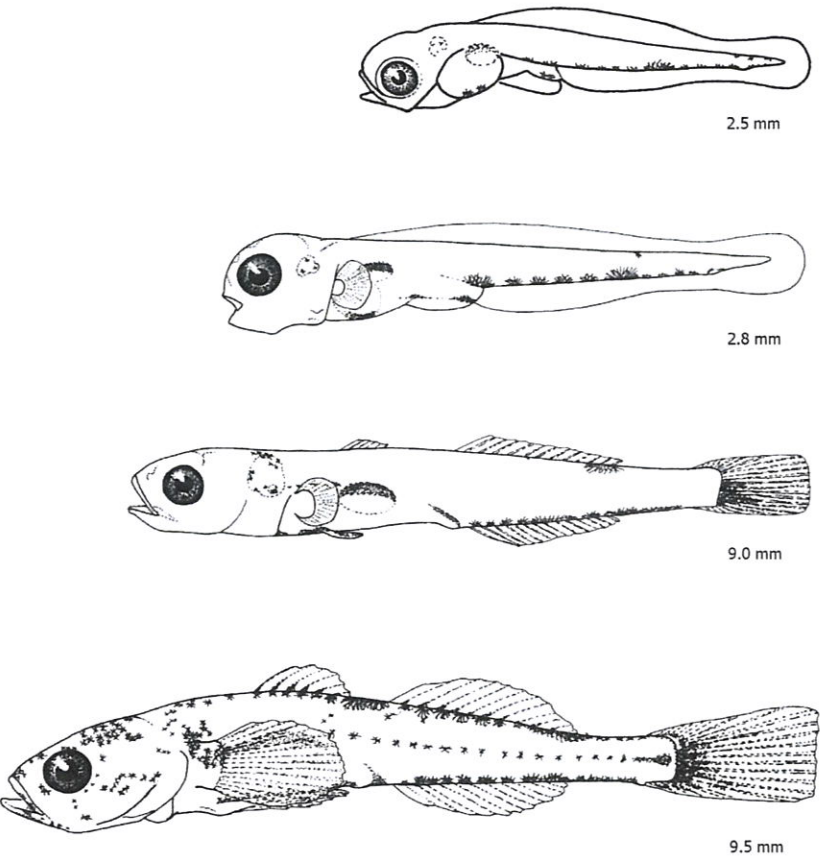


Plate 72- Early life history stages of *Gobius niger*. Petersen (1892, 1917, 1919).

GOBIIDAE

Gobius paganellus Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays - D₁ VI, D₂ I+13-14

Anal rays - I+10-13

Pelvic rays - I+5

Pectoral rays - 18-23

Myomeres:

Total number - 28

LIFE HISTORY

Range: Eastern Atlantic: western Scotland to Senegal. Also known from the Mediterranean and Black Sea. Indian Ocean: as lessepsian migrant in the Gulf of Eilat and Red Sea.

Habitat: demersal; marine; depth range 3-15 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Borges, R., C. Faria, F. Gil, E.J. Gonçalves, V.C. Almada (2003). Embryonic and larval development of *Gobius paganellus* (Pisces: Gobiidae). *J. Mar. Biol. Ass. U.K.*, 83: 1151-1156.
- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 1.84x3.0 mm

No. of oil globules -

Shell surface - smooth, fusiform

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 4.0-4.8 mm

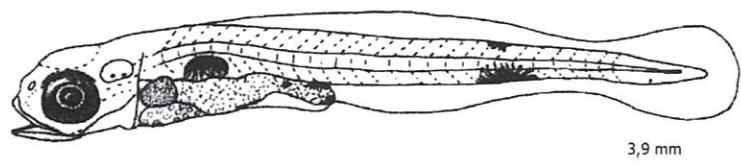
Yolk-sac absorption - 5 mm

Flexion length -

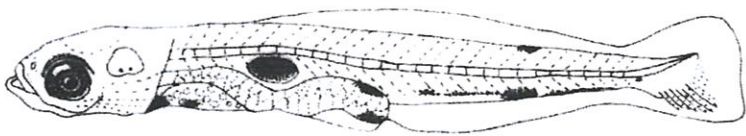
Transformation length -

Pigmentation - Newly hatched larva: no melanophores on head, postanal dorsal and ventral melanophores. Several melanophores above the anus and below the gut. Gas bladder fully pigmented. Late larva: postanal dorsal melanophores disappears (7 mm). No melanophores on head (until 11-12 mm). Row of melanophores from throat to anus. Large melanophore above the anus. Large stellate melanophores appears in the otocystic region.

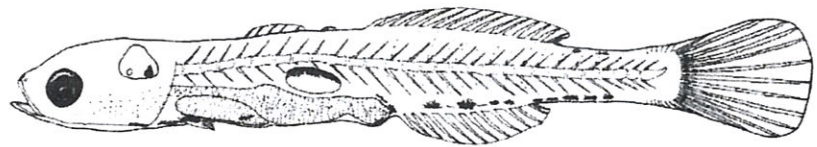
Diagnostic features - Pigmentation.



3,9 mm



6.2 mm



11.4 mm



22.2 mm

Plate 73- Early life history stages of *Gobius paganellus*. Borges *et al.* (2003).

MERISTICS**Fins:**Dorsal rays - D₁ VII, D₂ 14-16

Anal rays - I+14

Pelvic rays - I+5

Pectoral rays -

Myomeres:

Total number - 28

LIFE HISTORY

Range: Eastern Atlantic: northern Spain to Madeira and the Canary Islands; Mediterranean.

Habitat: demersal; marine.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

Monteiro, J., R. Borges, J. Robalo, V.C. Almada, S. Henriques, E.J. Gonçalves (submitted). Larval development of *Gobius xanthocephalus* and genetic validation of larval identification.

EARLY LIFE HISTORY DESCRIPTION**EGGS:** Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - 2.8 mm

Yolk-sac absorption -

Flexion length - 5.0-5.5 mm

Transformation length -

Pigmentation - Newly hatched larvae: No pigmentation at the lower jaw. Lacks dorsal pigmentation. Presence of a ventral postanal row of regularly spaced melanophores extending from the anus to the caudal fin.

Diagnostic features - Characteristic pigmentation. Meristics.

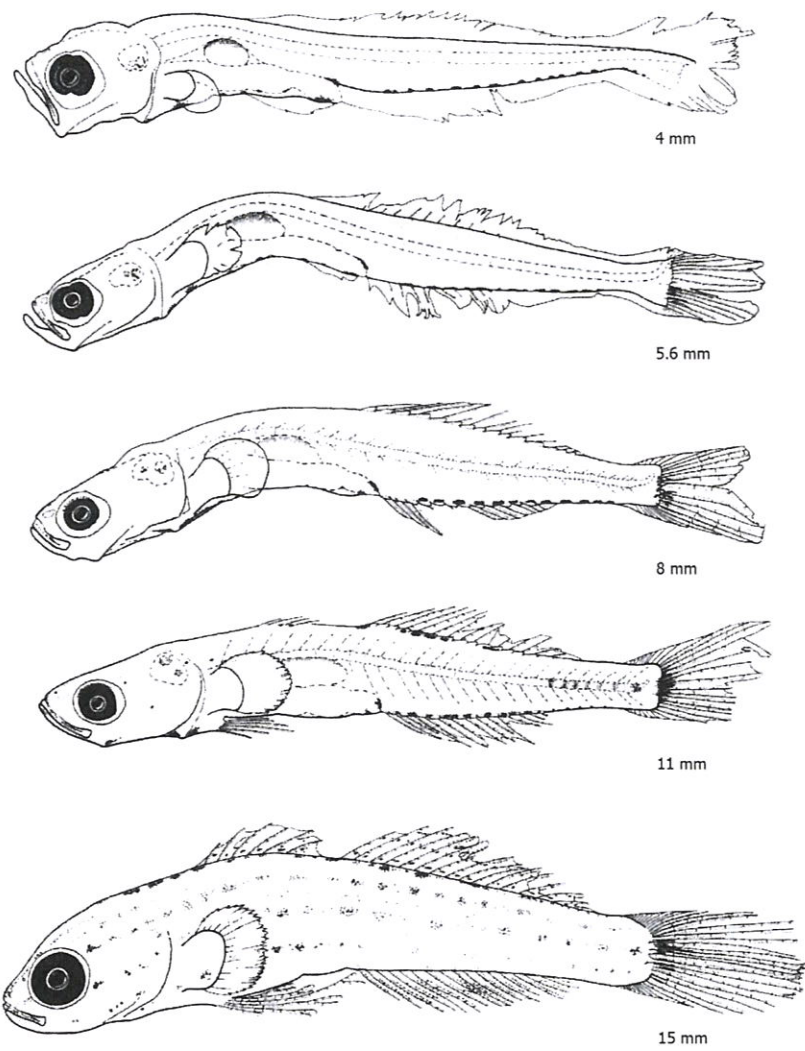


Plate 69- Early life history stages of *Gobius xanthocephalus*. Monteiro *et al.* (Submitted).

GOBIIDAE

Gobiusculus flavescens (Fabricius, 1779)

MERISTICS

Fins:

Dorsal rays - D₁ VII-VIII, D₂ I+9-10
Anal rays - I+10-11
Pelvic rays - I+5
Pectoral rays - 18-19

Myomeres:

Total number - 35-40

LIFE HISTORY

Range: Eastern Atlantic: Faeroes, Vesterålen (Norway), and western Baltic to north-west Spain, excluding south-eastern North Sea. Reported from Estonia. Mediterranean records, from Sicily and the Adriatic.

Habitat: demersal; marine; depth range 0-20m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs planktonic larvae.

MAIN REFERENCES

- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.
- Petersen, C.G.J. (1892). On the eggs and breeding of our Gobiidae. *Reports of the Danish Biological Station*, 2: 1-9.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.8-0.6 mm
No. of oil globules - reddish-brown oil globules
Shell surface - Egg pear-shaped, with round or pointed apex
Pigment -
Yolk -
Diameter of oil globules -
Diagnostic features -

LARVAE

Hatching length - 2.2-2.6 mm
Yolk-sac absorption - 4.0 mm
Flexion length -
Transformation length -
Pigmentation - Newly hatched larva: continuous row of ventral melanophores from throat to anus and a ventral postanal row and one or two dorsal postanal melanophores. One melanophore, mid-way along the tail, especially prominent. Sub-otocystic melanophore. Late larva: dorsal pigmentation disappears when the larva reaches 5 mm. A large melanophore develops in the otocystic region when the larva reaches 8-9 mm. Large melanophore above the anus.
Diagnostic features - Pigmentation.

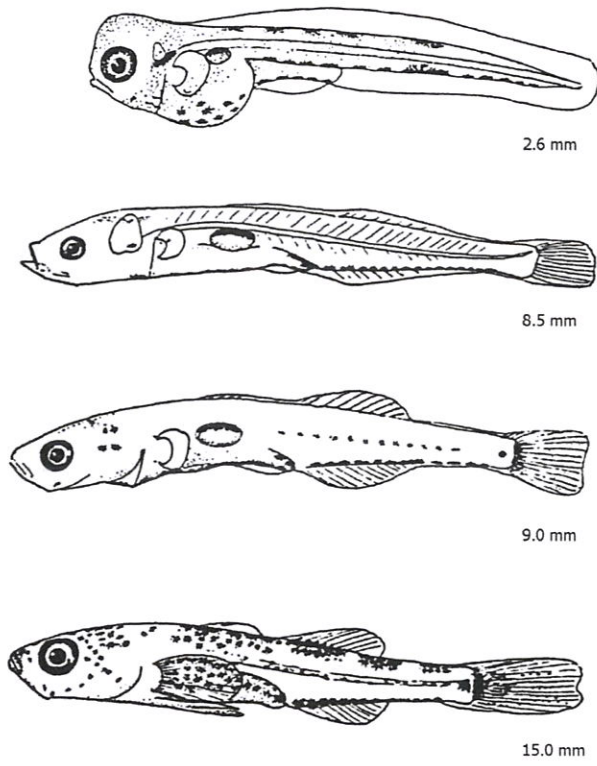


Plate 74- Early life history stages of *Gobiusculus flavescens*. Petersen (1919)

GOBIIDAE

Lebetus guilleleti (Le Danois, 1913)

MERISTICS

Fins:

Dorsal rays - D₁ VI, D₂ I+7-9

Anal rays - I+5-6

Pelvic rays - I+5

Pectoral rays - 15-17

Myomeres:

Total number - 25-26

LIFE HISTORY

Range: Eastern Atlantic: Kattegat and Belt seas to Portugal; also from Banyuls, western Mediterranean, and Canary Islands.

Habitat: demersal; reef-associated; depth range 0-30 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Demir, N., F. Russell (1971). On the postlarva of the goby *Lebetus*. *J. Mar. Biol. Ass. U.K.*, 51: 669-678.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Ré, P. (1980-1981). On the occurrence of postlarval stages of *Lebetus* (Pisces: Gobiidae) off Portugal. *Boletim da Sociedade Portuguesa de Ciências Naturais*, 20: 67-69.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

Pigmentation - Body well covered with melanophores except in the caudal region.

Well marked mediolateral row of melanophores. Row of melanophores between the bases of the anal fin rays.

Diagnostic features - Characteristic pigmentation. Larva more pigmented than that of *Lebetus scorpioides*. Pelvic fins develop quickly reaching nearly to the anus when the larva is only 5-6 mm long.

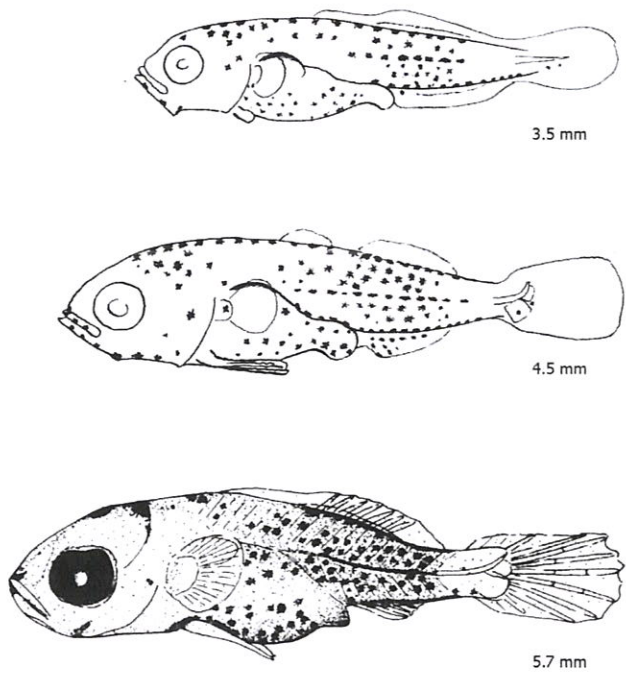


Plate 75- Early life history stages of *Lebetus guilleleti*. Russell (1976), Ré (1980-1981).

GOBIIDAE

Lebetus scorpioides (Collett, 1874)

MERISTICS

Fins:

Dorsal rays - D₁ VI-VII, D₂ I+9-10

Anal rays - I+7-8

Pelvic rays - I+5

Pectoral rays - 17-21

Myomeres:

Total number - 27-29

LIFE HISTORY

Range: Eastern Atlantic: southwest Iceland, the Faeroes and Hemnefjord, Norway, to northern Bay of Biscay.

Habitat: marine; reef-associated; depth range 30-375 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Demir, N., F. Russell (1971). On the postlarva of the goby *Lebetus*. *J. Mar. Biol. Ass. U.K.*, 51: 669-678.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter - Unknown

No. of oil globules - Unknown

Shell surface - Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules - Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

Pigmentation - Body covered with pigmentation except on caudal region. Well marked mediolateral row of melanophores.

Whole larva less pigmented than *L. guilleli*.

Diagnostic features - Pigmentation, meristics. Pelvis fins develop much slower than those of *L. guilleli*. These may not reach the anus in specimens with 8 mm.

Shape of body slender than *L. guilleli*.

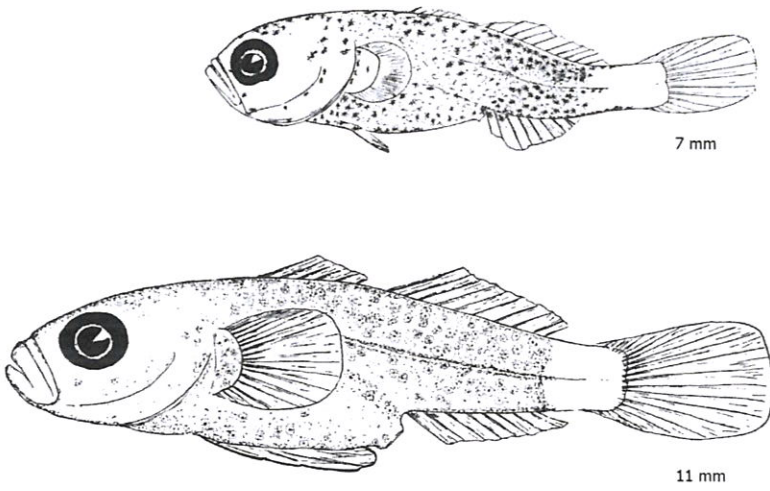


Plate 76- Early life history stages of *Lebetus scorpioides*. Fage (1918).

GOBIIDAE

Pomatoschistus microps (Krøyer, 1838)

MERISTICS

Fins:

Dorsal rays - D₁ V-VII, D₂ I+8-11
Anal rays - I+8-9
Pelvic rays - I+5
Pectoral rays - 15-20

Myomeres:

Total number - 30-32

LIFE HISTORY

Range: Eastern Atlantic: Norway to Morocco, including Baltic Sea (to southern Portugal) and western Mediterranean. Also in Mauritania and the Canary Islands.

Habitat: demersal; freshwater; brackish; marine; depth range 0-12 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Lebour, M.V. (1920). The eggs of *Gobius minutus*, *pictus* and *microps*. *J. Mar. Biol. Ass. U.K.*, 12: 253-260.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.
- Petersen, C.G.J. (1892). On the eggs and breeding of our Gobiidae. *Reports of the Danish Biological Station*, 2: 1-9.
- Petersen, C.G.J. (1917). On the development of our common gobies (*Gobius*) from the egg to the adult stages etc.. *Reports of the Danish Biological Station*, 24: 5-16.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.7-1.0x0.65-0.7 mm
No. of oil globules - many oil globules
Shell surface - smooth, pear-shaped with rounded apex
Pigment -
Yolk -
Diameter of oil globules - up to 0.08 mm
Diagnostic features -

LARVAE

Hatching length - 3.0 mm
Yolk-sac absorption - 3.5 mm
Flexion length -
Transformation length -
Pigmentation - Newly hatched larva: melanophores on yolk and along the ventral body contour. One prominent ventral melanophore, mid-way along the tail. One to Two dorsal melanophores. Late larva: melanophores on the otocystic region, on head and lower jaw. Pigmentation intensifies half-way along the tail and medio-lateral region.
Diagnostic features - Pigmentation. Prominent gas bladder. Very large melanophore mid-way along the ventral side of the tail.

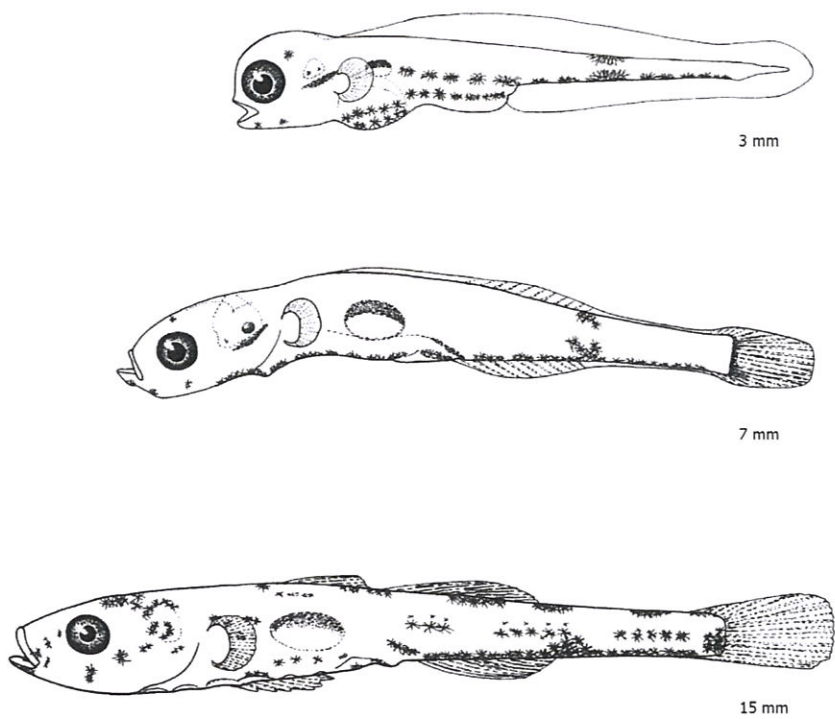


Plate 79- Early life history stages of *Pomatoschistus microps*. Petersen (1919).

GOBIIDAE

Pomatoschistus minutus (Pallas, 1770)

MERISTICS

Fins:

Dorsal rays - D₁ VI-VII, D₂ I+10-12

Anal rays - I+9-12

Pelvic rays - I+5

Pectoral rays - 18-21

Myomeres:

Total number - 32-34

LIFE HISTORY

Range: demersal; brackish; marine; depth range 4-200 m.

Habitat: Eastern Atlantic: from Norway to Spain; also Mediterranean Sea and Black Sea.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Lebour, M.V. (1920). The eggs of *Gobius minutus*, *pictus* and *microps*. *J. Mar. Biol. Ass. U.K.*, 12: 253-260.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Gobiidae. *Uova, larve e stadii Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 648-678.
- Petersen, C.G.J. (1892). On the eggs and breeding of our Gobiidae. *Reports of the Danish Biological Station*, 2: 1-9.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.9-1.4x0.7-0.8 mm

No. of oil globules -

Shell surface - smooth, pear-shaped

Pigment -

Yolk - pigmented embryo

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 3.0 mm

Yolk-sac absorption - 3.5 mm

Flexion length -

Transformation length -

Pigmentation - Newly hatched larva:

pigmentation along the ventral and dorsal body contours. Melanophores develop in the otocystic region, on head and on the lower jaw. Late larva: basically the same pigmentation pattern. Pigmentation intensifies along the tail (dorsal and ventral body contours). In postflexion larvae, melanophores appear on head and on medio-lateral region.

Diagnostic features - Pigmentation. Prominent gas bladder. Melanophores along the ventral side of the tail are of the same size (there is no evidence of a large branched melanophore mid-way along the tail).

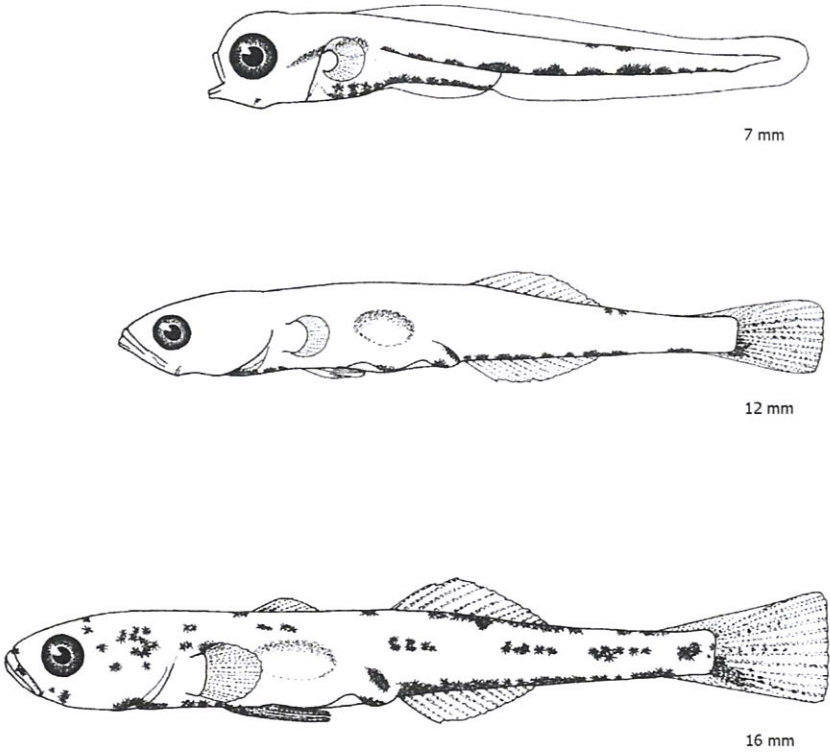


Plate 77- Early life history stages of *Pomatoschistus minutus*. Petersen (1919).

GOBIIDAE

Pomatoschistus pictus (Malm, 1865)

MERISTICS

Fins:

Dorsal rays - D₁ V-VI, D₂ I+7-10

Anal rays - I+8-9

Pelvic rays - I+5

Pectoral rays - 16-20

Myomeres:

Total number - 30-31

LIFE HISTORY

Range: Eastern Atlantic: Norway (Trondheim fjord) to Spain and the Canary Islands.

Habitat: demersal; marine; depth range 1-55 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Lebour, M.V. (1919). The young of the Gobiidae from the neighbourhood of Plymouth. *J. Mar. Biol. Ass. U.K.*, 12: 48-80.
- Lebour, M.V. (1920). The eggs of *Gobius minutus, pictus* and *microps*. *J. Mar. Biol. Ass. U.K.*, 12: 253-260.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Petersen, C.G.J. (1917). On the development of of our common gobies (*Gobius*) from the egg to the adult stages etc.. *Reports of the Danish Biological Station*, 24: 5-16.
- Petersen, C.G.J. (1919). Our gobies (Gobiidae). From the egg to the adult stages. *Reports of the Danish Biological Station*, 26: 45-66.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.75-0.8 mm long

No. of oil globules - many oil globules

Shell surface - smooth, pear-shaped

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - 3.0 mm

Yolk-sac absorption - 3.5 mm

Flexion length -

Transformation length -

Pigmentation - Newly hatched larva: well pigmented. Melanophores on the yolk sac and along the dorsal and ventral body controur. Dorsal melanophores stretch from the neck to the middle of the tail.

Melanophores on head, otocystic region and lower jaw. Late larva: dorsal

pigmentation disappears being dominated by the postanal ventral row, which has large branched melanophores from above the anus to the caudal region. Postflexion larva: dorsal pigmentation reappears.

Three groups of medio-lateral melanophores.

Diagnostic features - Pigmentation.

Prominent gas bladder. Well pigmented newly hatched larvae. Well developed dorsal pigmentation.

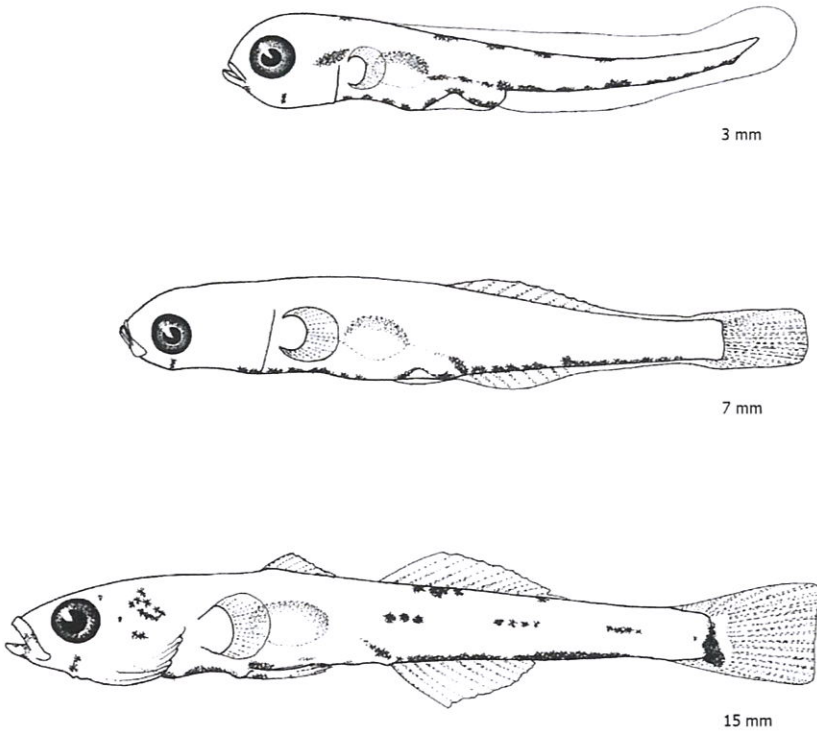


Plate 78- Early life history stages of *Pomatoschistus pictus*. Petersen (1919).

CALLIONYMIDAE

Callionymus lyra Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays - D₁ IV, D₂ 9
Anal rays - 9
Pelvic rays - I+5
Pectoral rays - 18-20

Myomeres:

Total number -

LIFE HISTORY

Range: Gibraltar, and Algeria, western Black Sea, Aegean and Adriatic Sea, Azores and the Canary Islands.

Habitat: demersal; marine; depth range 5-430 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Demir, N. (1972). The abundance and distribution of the eggs and larvae of some teleost fishes off Plymouth in 1969 and 1970. II. The postlarvae of *Callionymus*. *J. Mar. Biol. Ass. U.K.*, 52: 997-1010.
- Demir, N. (1976). Callionymidae of the Northeastern Atlantic. *Fiches d'Identification du Zooplancton*, 148: 5pp.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.81-0.97 mm
No. of oil globules - 0
Shell surface - honeycomb-like sculpturing (4, 6 or 7 sided cells).
Pigment -
Yolk - peripheral segmentation
Diameter of oil globules -
Diagnostic features - Characteristic shell surface.

LARVAE

Hatching length - 1.08 mm
Yolk-sac absorption - 2.3 mm
Flexion length - 4 mm
Transformation length - 10 mm
Pigmentation - very strong pigmentation distributed over most of the larva.
Mediolateral pigmentation prominent.
Diagnostic features - small newly hatched larva (ca. 2 mm). Typical shape and pigmentation. *C. lyra* has a greater concentration of melanophores in the opercular and mid-brain regions compared to *Callionymus maculatus*. The best diagnostic character in late larvae is the form and development of the preopercular spines. Larvae with more than 6 mm develop a characteristic preopercular spine. Larger pelvic fins as compared to *C. maculatus*.

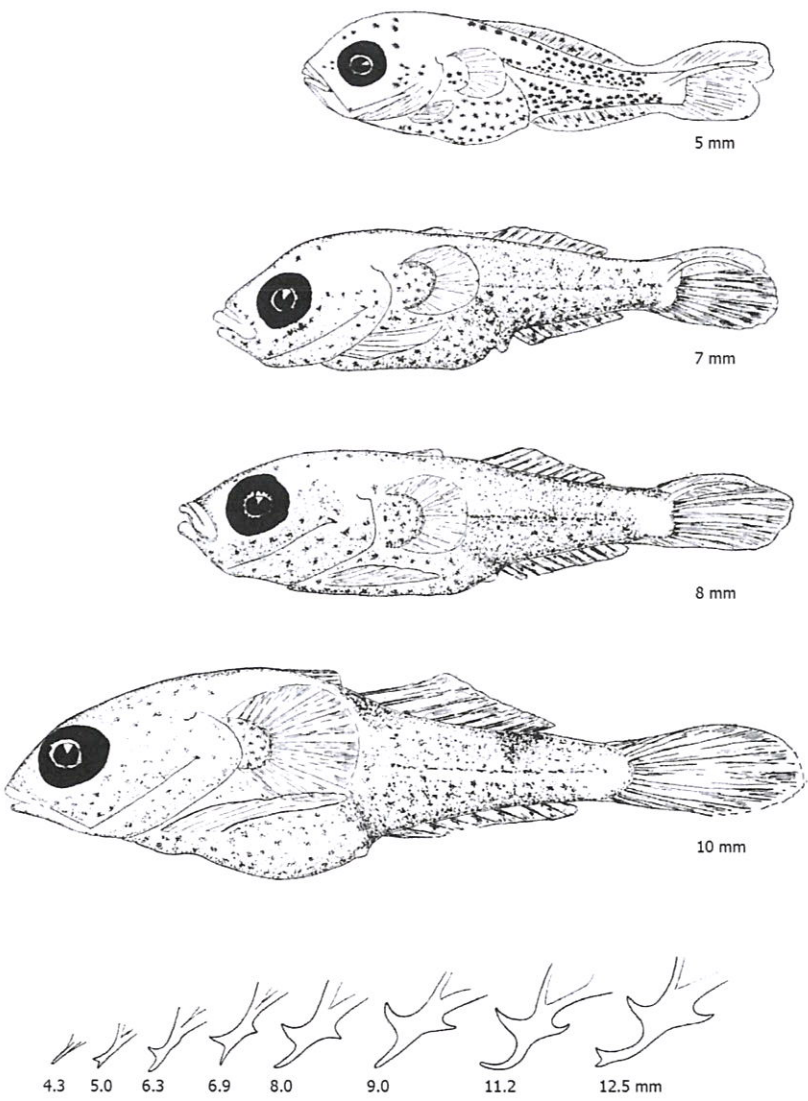


Plate 80- Early life history stages of *Callionymus lyra*. Fage (1918). Preopercular spines, Demir (1972).

CALLIONYMIDAE

Callionymus maculatus Rafinesque, 1810

MERISTICS

Fins:

Dorsal rays - D₁ IV, D₂ 9-10

Anal rays - 8-9

Pelvic rays - I+5

Pectoral rays - 16-20

Myomeres:

Total number -

LIFE HISTORY

Range: Eastern Atlantic: southern and western Iceland and Norway south to Senegal. Also in the Mediterranean, including the Adriatic and Aegean but not in the Black Sea.

Habitat: demersal; marine; depth range 45-650 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Demir, N. (1972). The abundance and distribution of the eggs and larvae of some teleost fishes off Plymouth in 1969 and 1970. II. The postlarvae of *Callionymus*. *J. Mar. Biol. Ass. U.K.*, 52: 997-1010.
- Demir, N. (1976). Callionymidae of the Northeastern Atlantic. *Fiches d'Identification du Zooplancton*, 148: 5pp.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter - 0.66-0.79 mm

No. of oil globules - 0

Shell surface - honeycomb-like sculpturing

Pigment -

Yolk - peripheral segmentation

Diameter of oil globules -

Diagnostic features - Characteristic shell surface.

LARVAE

Hatching length - 2.29 mm (very similar to *C. lyra*)

Yolk-sac absorption -

Flexion length - 4 mm

Transformation length - 10 mm

Pigmentation - heavily pigmented larva (stronger than *C. lyra* in branchiostegal and mandibular regions). Strongly pigmented pectoral fins.

Diagnostic features - Pigmentation, length of pelvic fins and preopercular spine.

Preopercular spine very distinct from that of *C. lyra*. Pelvic fins develop when the larva reaches 3.0 to 3.5 mm. At 6.5 mm they reach a point half way along the base of the pectoral fin. At comparable sizes the pelvic fins are shorter than those of *C. lyra*.

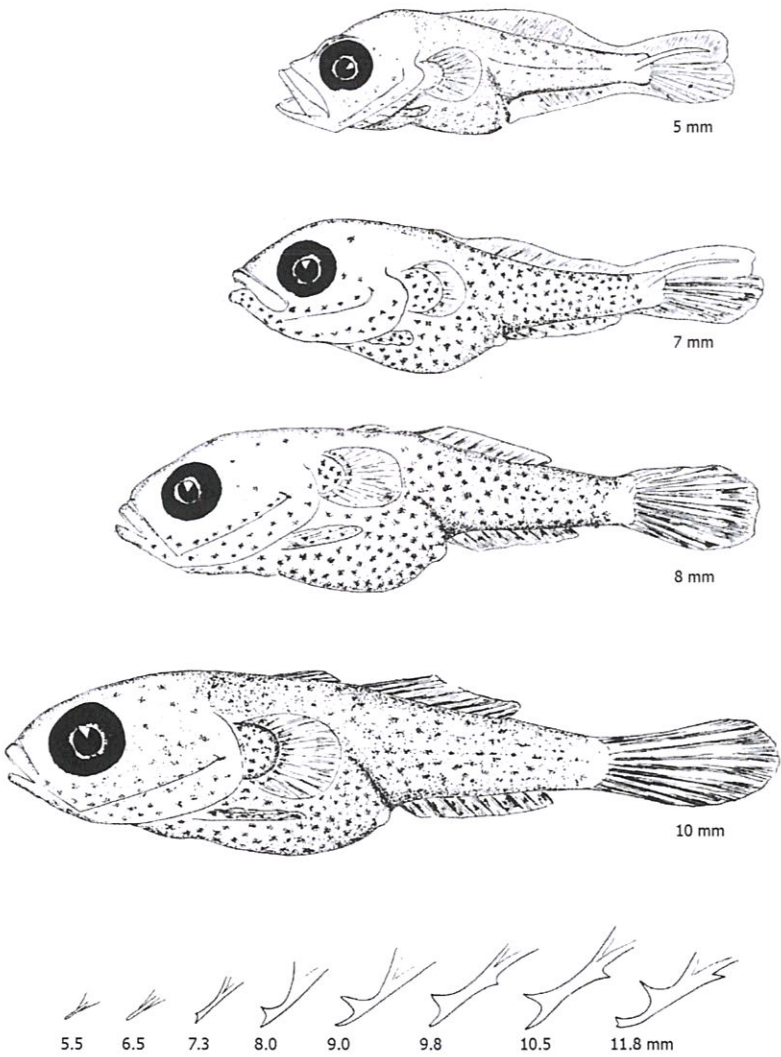


Plate 81- Early life history stages of *Callionymus maculatus*. Fage (1918). Preopercular spines, Demir (1972).

BLENNIIDAE

Blennius ocellaris Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – XI-XII+14-16

Anal rays – II+14-16

Pelvic rays – I+3

Pectoral rays – 12

Myomeres:

Total number –

LIFE HISTORY

Range: Southeast Atlantic: Atlantic coast from Morocco to the English Channel. Also known from the Mediterranean and Black Sea.

Habitat: demersal; marine; depth range 10-400 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Cunningham, J.T. (1889). Studies of the reproduction and development of teleostean fishes occurring in the neighbourhood of Plymouth. *J. mar. bio. Ass. U.K.*, 1: 370-375.
- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Ford, E. (1922a). On the young of *Blennius ocellaris* L., *Blennius pholis* L., and *Blennius gattorugine*. *J. mar. biol. Ass. U.K.*, 12: 688-692.
- Lebour, M.V. (1927). The eggs and newly hatched young of the common blennies from the Plymouth neighbourhood. *J. mar. biol. Ass. U.K.*, 14: 647-650.
- Padoa, E. (1933-1956). *Benniidae. Uova, larve e stadii Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 720-745.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.12-1.20 mm

No. of oil globules – many oil globules

Shell surface – smooth, nearly spherical

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 4.6 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva:

melanophores on snout, head, peritoneal area and a strongly pigmented pectoral fin (arranged in longitudinal rows between the fin rays). Postanal row of pigments along the posterior half of the caudal region.

Late larva: large, rounded in shape and heavily pigmented pectoral fin with rows of large melanophores.

Diagnostic features - Characteristic pigmentation, large, round and heavily pigmented pectoral fins.

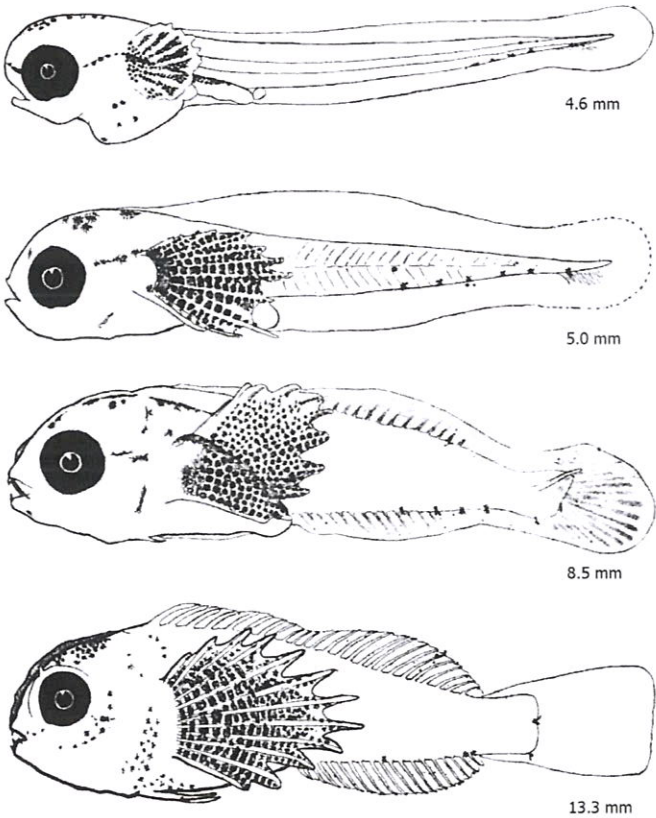


Plate 82- Early life history stages of *Blennius ocellaris*. Ford (1922a).

BLENNIIDAE***Coryphoblennius galerita* (Linnaeus, 1758)****MERISTICS****Fins:**

Dorsal rays – XIII+16-17

Anal rays – II+16-19

Pelvic rays – I+3

Pectoral rays – 12

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: along the coasts of western England and the British Channel, Spain, Portugal, France, Morocco, Madeira, Canary Islands; Mediterranean Sea, Sea of Marmara, and the Black Sea.

Habitat: demersal; marine.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Fives, J.M. (1980). An account of the eggs and developmental stages of Montagu's blenny, *Coryphoblennius galerita* (L.), with notes on the reproductive behaviour of the adults. *J. Mar. Biol. Ass. U.K.*, 60: 749-757.
- Fives, J.M. (1986). Blenniidae of the North Atlantic (revised). *Fich. Ident. Plancton*, 172: 6pp.
- Padoa, E. (1933-1956). Blenniidae. *Uova, larve e stadii giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 720-745.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION**EGGS**

Capsule diameter – ca. 1 mm

No. of oil globules – golden-yellow oil globules

Shell surface – smooth, nearly spherical

Pigment –

Yolk –

Diameter of oil globules –

Diagnostic features –

LARVAE

Hatching length – 3.3 mm

Yolk-sac absorption –

Flexion length –

Transformation length –

Pigmentation – Melanophores on top and back of head and on auditory capsule.

Pigmented pectoral fins. Melanophores on top of gut and a metameric series of 24-25 melanophores along posterior ventral margin from fifth to sixth postanal myomere to urostyle tip.

Diagnostic features – Characteristic pigmentation. Pointed pectoral fins extending to second or third postanal body segment.

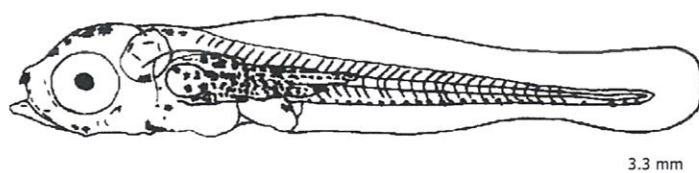


Plate 83- Early life history stages of *Coryphoblennius galerita*. Fives (1986).

BLENNIIDAE

Lipophrys pholis (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XII+18-19

Anal rays – II+19

Pelvic rays – I+3

Pectoral rays – 13

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: southern Norway to Morocco and Madeira, including the Mediterranean and the Balearics.

Habitat: demersal; marine; depth range 0-8 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Ford, E. (1922a). On the young of *Blennius ocellaris* L., *Blennius pholis* L., and *Blennius gattorugine*. *J. mar. biol. Ass. U.K.*, 12: 688-692.
- Faria, C., R. Borges, F. Gil, V.C. Almada, E.J. Gonçalves (2002). Embryonic and larval development of *Lipophrys pholis* (Pisces: Blenniidae). *Scentia Marina*, 66 (1): 21-26.
- Fives, J.M. (1986). Blenniidae of the North Atlantic (revised). *Fich. Ident. Plancton*, 172: 6pp.
- Lebour, M.L. (1927). The eggs and newly hatched young of the common blennies from the Plymouth neighbourhood. *J. mar. biol. Ass. U.K.*, 14: 647-650.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Blenniidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 720-745.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.18-1.6 mm

No. of oil globules – several oil globules

Shell surface – smooth, hemispherical

Pigment –

Yolk – unsegmented

Diameter of oil globules –

Diagnostic features –

LARVAE

Hatching length – 5 mm

Yolk-sac absorption – 5.0-5.5 mm

Flexion length – 10 mm

Transformation length – 17-19 mm

Pigmentation – Newly hatched larvae:

rounded and heavily pigmented pectoral fins (12 radial rows of melanophores).

Peritoneal pigmentation. Late larva:

narrow, pointed and heavily pigmented

pectoral fin. A few postanal ventral

melanophores in the posterior half of the

caudal region and a vertical row at the

base of the caudal fin. Notochordal row of melanophores evident anteriorly.

Diagnostic features – Heavily pigmented pectoral fins. Shape of body and pectoral fins.

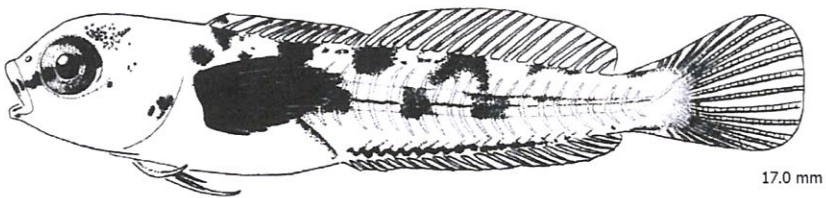
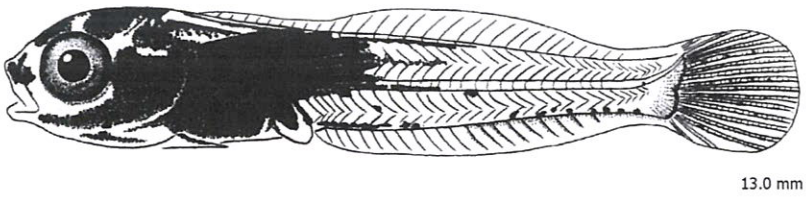
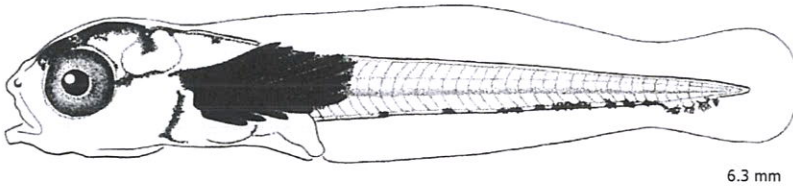
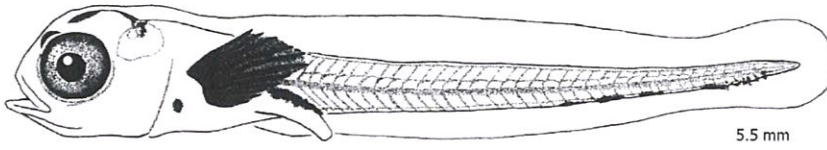


Plate 84- Early life history stages of *Lipophrys pholis*. Faria *et al.* (2002).

BLENNIIDAE***Lipophrys trigloides* (Valenciennes, 1836)****MERISTICS****Fins:**

Dorsal rays – XII-16-17

Anal rays – II+18

Pelvic rays – I+3

Pectoral rays – 13

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: Along the coasts of France (Brittany), the Iberian Peninsula, Morocco, the Mediterranean and the Sea of Marmara southwards to Senegal, the Canary Islands and Madeira.

Habitat: demersal; marine.

Spawning season: winter and spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Faria, C., F. Gil, V.C. Almada (2005). Ontogenic development of *Lipophrys trigloides* (Pisces: Blenniidae), with some notes of the spawning behaviour. *J. Mar. Biol. Ass. U.K.*, 85: 185-188.
- Padoa, E. (1933-1956). Blenniidae. *Uova, larve e stadii Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 720-745.

EARLY LIFE HISTORY DESCRIPTION**EGGS**

Capsule diameter – 1.3x0.86 mm

No. of oil globules -

Shell surface – smooth, hemispherical

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 4.8 mm

Yolk-sac absorption – 4.8 mm

Flexion length –

Transformation length – 16-17 mm

Pigmentation - Newly hatched larva: heavily pigmented pectoral fins. Heavy peritoneal pigmentation (8-10 radial rows of melanophores). One or two melanophores at base of the pectoral fin and 8-14 melanophores on the last myomeres with 1-6 near the caudal tip. Pigmentation on head, upper jaw and otocystic capsule.

Late larva: pigmentation pattern maintained with an increase in the number and intensity of the postanal ventral pigmentation.

Diagnostic features – Pigmentation.

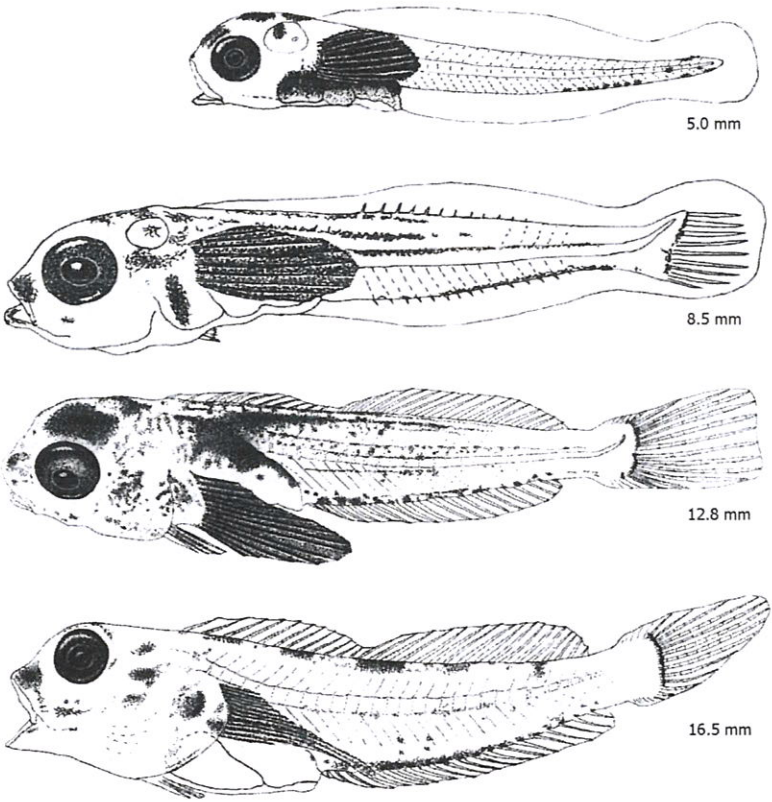


Plate 85- Early life history stages of *Lipophrys trigloides*. Faria *et al.* (2005).

BLENNIIDAE

Parablennius gattorugine (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – XIII+18-19

Anal rays – II+20

Pelvic rays – I+3

Pectoral rays – 20

Myomeres:

Total number –

LIFE HISTORY

Range: Northeast Atlantic: Atlantic coast from Ireland to Morocco; also in the Mediterranean Sea and the Sea of Marmora. This species is present only in mainland Portugal. Although older papers reported this species from the Azores and Madeira, the occurrences were misidentifications of *Parablennius ruber*.

Habitat: demersal; marine; depth range 3-32 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Faria, C., F. Gil, V.C. Almada (submitted). Ontogenetic development of *Parablennius gattorugine* (Pisces: Blenniidae). *J. mar. biol. Ass. U.K.*
- Ford, E. (1922a). On the young of *Blennius ocellaris* L., *Blennius pholis* L., and *Blennius gattorugine*. *J. mar. biol. Ass. U.K.*, 12: 688-692.
- Fives, J.M. (1986). Blenniidae of the North Atlantic (revised). *Fich. Ident. Plancton*, 172: 6pp.
- Lebour, M.L. (1927). The eggs and newly hatched young of the common blennies from the Plymouth neighbourhood. *J. mar. biol. Ass. U.K.*, 14: 647-650.
- Padoa, E. (1933-1956). Blenniidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 720-745.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.6 mm

No. of oil globules - 0

Shell surface – smooth, hemispherical

Pigment -

Yolk - unsegmented

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 4.9-5.2 mm

Yolk-sac absorption -

Flexion length –

Transformation length -

Pigmentation - Newly hatched larva:

peritoneal pigmentation: Melanophores on snout and head. Unpigmented pectoral fin.

Pigmented eyes. Late larva: ventral

postanal row of 19-21 pigments (starting

behind anus, melanophores regularly

spaced due to its metameric distribution).

Black peritoneal pigmentation covering the

dorsal side of gut. Notochordal row of

melanophores starts at 8 mm.

Diagnostic features - Characteristic form

(elongated appearance) – preanal length

only one third or less of the total length. At

18 mm the rudiments of the tentacles may

be seen in front of and over the eye.

Pigmentation.

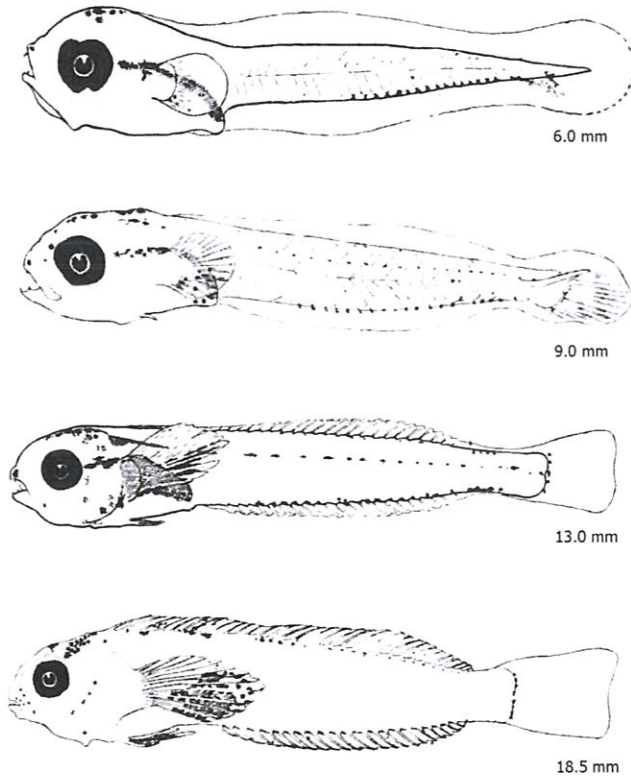


Plate 86- Early life history stages of *Parablennius gattorugine*. Ford (1922a).

BLENNIIDAE

Parablennius pilicornis (Cuvier, 1829)

MERISTICS

Fins:

Dorsal rays – XII+21

Anal rays – II+23

Pelvic rays – I+3

Pectoral rays – 14

Myomeres:

Total number – 38

LIFE HISTORY

Range: Eastern Atlantic: Spain and Portugal to Möwe Bay, Namibia. Also in the Mediterranean along the coast from Morocco, Algeria, Spain. Southwest Atlantic: Brazil and Patagonia, Argentina. Western Indian Ocean: Natal to Knysna in South Africa.

Habitat: demersal; marine; depth range 0–25 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Faria, C., F. Gil, V.C. Almada (2006). Ontogenic development of *Parablennius pilicornis* (Pisces: Blenniidae) in controlled conditions. *Scientia Marina*, 70 (4): 667-671.
- Olivar, P. (1986). Development and distribution of *Parablennius pilicornis* (Cuvier) larvae (Teleostei: Blenniidae) off Namibia. *S. Afr. J. mar. Sci.*, 4: 193-201.
- Olivar, P., J.-M. Fortuño (1991). *Guide to the ichthyoplankton of the Southeast Atlantic (Benguela current region)*. *Scientia Marina*, 55 (1): 1-383.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter -

No. of oil globules -

Shell surface -

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length – 3.0-3.2 mm

Yolk-sac absorption –

Flexion length – 10-11 mm

Transformation length -

Pigmentation – Newly hatched larva: heavy peritoneal pigmentation, pigmented eyes, small and unpigmented pectoral fins. One melanophore close to the anus and a characteristic row of postanal melanophores (ca. 30). Late larva: 6-7 pre-opercular spines visible from a length of 6 mm until metamorphosis.

Pigmentation pattern maintained during development, with an increase in the number and intensity of melanophores at the ventral row, on liver, head and opercula.

Diagnostic features – Characteristic pigmentation. Small preanal length (25-33 % of total length) from the earliest stages to juveniles. Presence of pre-opercular spines from a length of 6 mm until metamorphosis.

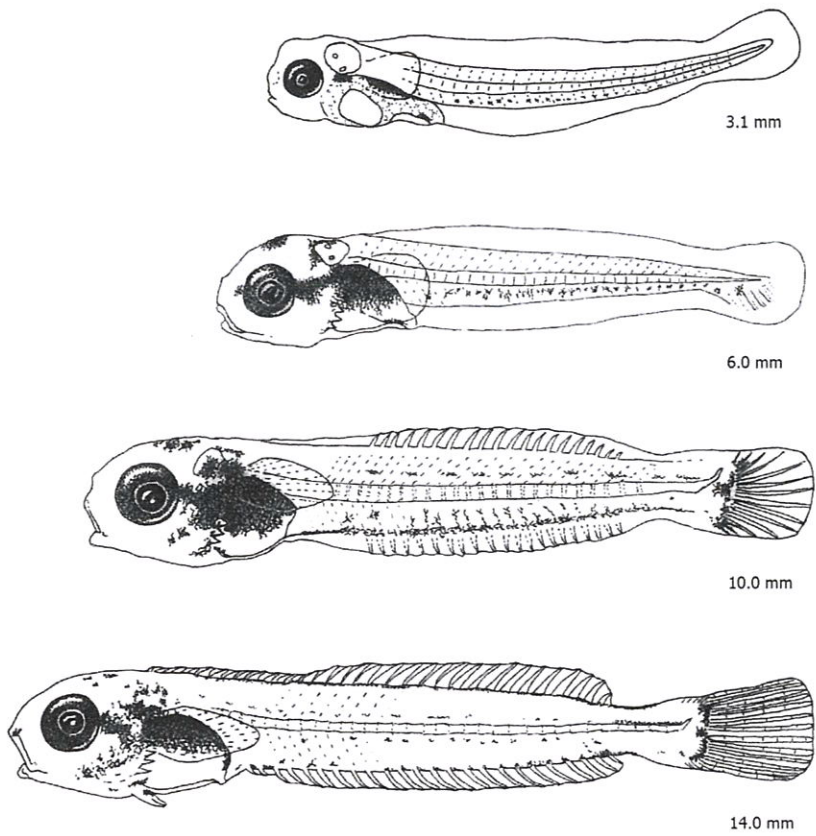


Plate 87- Early life history stages of *Parablennius pilicornis*. Faria *et al.* (2006).

CARAPIDAE

Carapus acus (Brünnich, 1768)

MERISTICS

Fins:

Dorsal rays – 37-39

Anal rays - 58

Pelvic rays -

Pectoral rays –

Myomeres:

Total number – 125-144 (17-18 pre-caudal)

LIFE HISTORY

Range: Eastern Atlantic: including the Mediterranean. Probably south to Ascension Island.

Habitat: demersal; marine; depth range 0-100 m. Adults typically live as commensals in the gut of shallow-water holothurians, *Holothuria tubulosa* and *Stichopus regalis*.

Spawning season: summer, autumn and winter.

ELH pattern: Oviparous, planktonic eggs (in slimy egg masses) and larvae.

MAIN REFERENCES

- Padoa, E. (1933-1956). Carapidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 761-774.
- Raffaele, F. (1888) - Le uova galleggianti e la larve dei Teleostei nel Golfo di Napoli. *Mitt. zool. Str. Neapel*, 8: 1-85.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.75-0.9 mm

No. of oil globules - 1

Shell surface – smooth, ellipsoidal

Pigment -

Yolk - unsegmented

Diameter of oil globules – 0.18-0.20 mm

Diagnostic features -

LARVAE

Hatching length – 2.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva:

abundant pigments on the head and the trunk. Pigmented caudal region.

Diagnostic features – Characteristic larva. A dorsal appendage (vexillum), longer than the trunk, is developed at 4 mm.

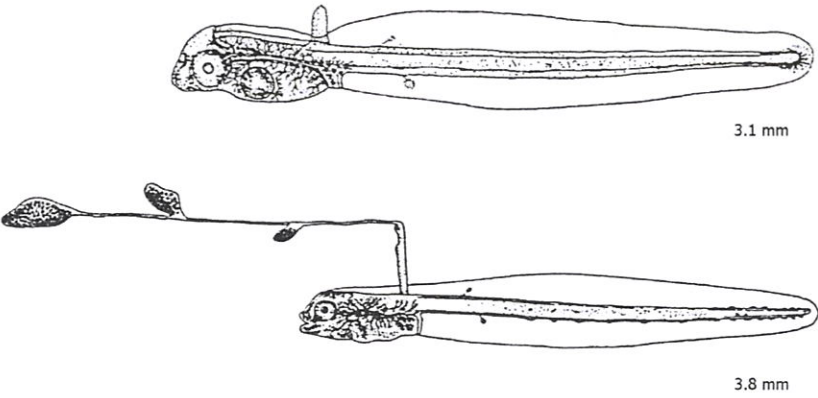


Plate 88- Early life history stages of *Carapus acus*. Emery (1880 in Padoa, 1933-1956).

MUGILIDAE

Mugil cephalus Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – D₁ IV, D₂ I+8-9

Anal rays – III+8

Pelvic rays – I+5

Pectoral rays – 17

Myomeres:

Total number –

LIFE HISTORY

Range: Cosmopolitan in coastal waters of the tropical and subtropical zones of all seas.

Habitat: benthopelagic; catadromous; freshwater; brackish; marine; depth range 0-120 m.

Spawning season: spawns mainly in winter.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.
- Vialli, M. (1933-1956). Mugilidae. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 433-457.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.72 mm

No. of oil globules - 1

Shell surface - smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules – 0.28 mm

Diagnostic features – Large oil globule.

LARVAE

Hatching length – 2.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Melanophores on head and trunk. Tip of tail less pigmented. Anus situated about 50% of total length.

Diagnostic features – Typical pigmentation. Shape of body.

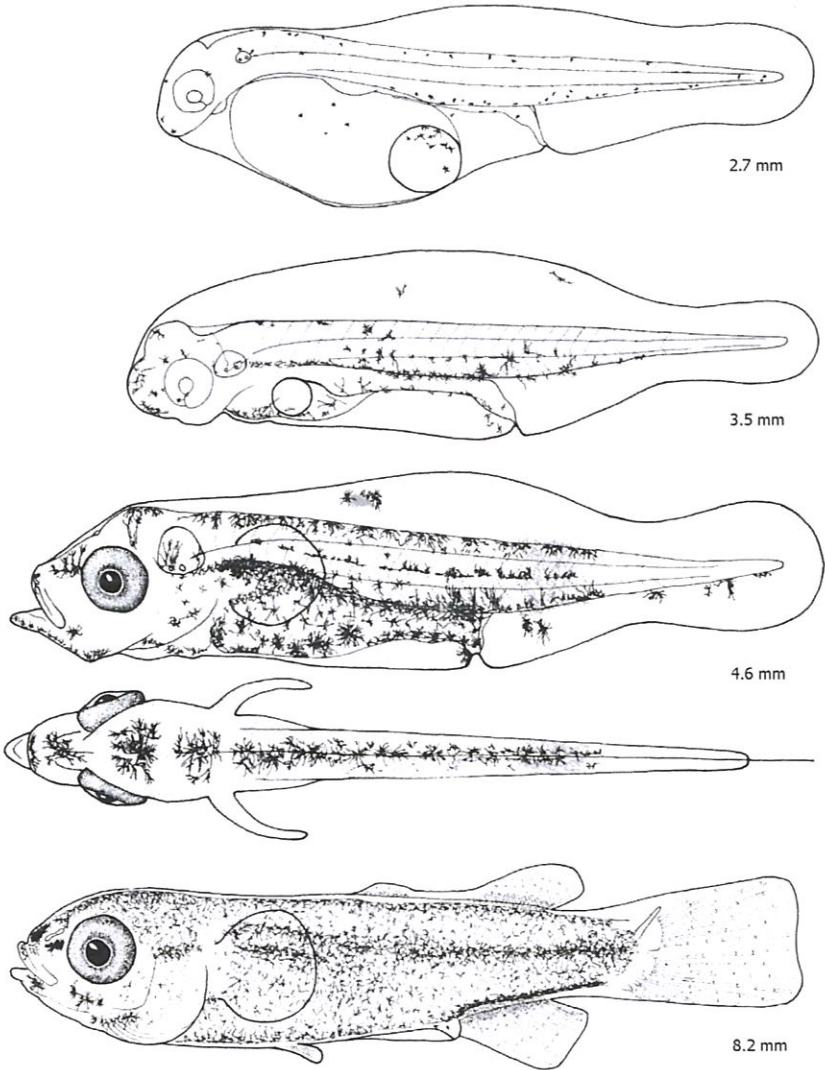


Plate 89- Early life history stages of *Mugil cephalus*. Brownell (1979).

ATHERINIDAE

Atherina presbyter Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – VII-IX+11-14

Anal rays – I+14-17

Pelvic rays – I+5

Pectoral rays – 13-15

Myomeres:

Total number – 46-52

LIFE HISTORY

Range: marine; pelagic; in coastal areas and estuaries.

Habitat: Eastern Atlantic: Kattegat (rare) and British Isles to Canary Islands, Mauritania and Cape Verde, also western Mediterranean.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.85-1.9 mm

No. of oil globules – several oil globules

Shell surface – smooth, long hairy appendages. Attached to plants

Pigment -

Yolk -

Diameter of oil globules -

Diagnostic features -

LARVAE

Hatching length - Unknown

Yolk-sac absorption - Unknown

Flexion length -

Transformation length -

Pigmentation – Three large melanophores on the crown of the head and two smaller ones over the anterior of the eye. Well developed peritoneal pigmentation on dorsal side of abdomen. Characteristic mediolateral line consisting of 10-13 elongated melanophores, in some larvae almost forming a continuous line. Two ventral contour postanal melanophores near tail (6 mm). Continuous row of postanal ventral melanophores from a short distance behind the anus to the tail. Single melanophore near the posterior edge of operculum. Row of internal notochordal melanophores (11 mm).

Diagnostic features – Body long and narrow. Anus well forward. Characteristic pigmentation.

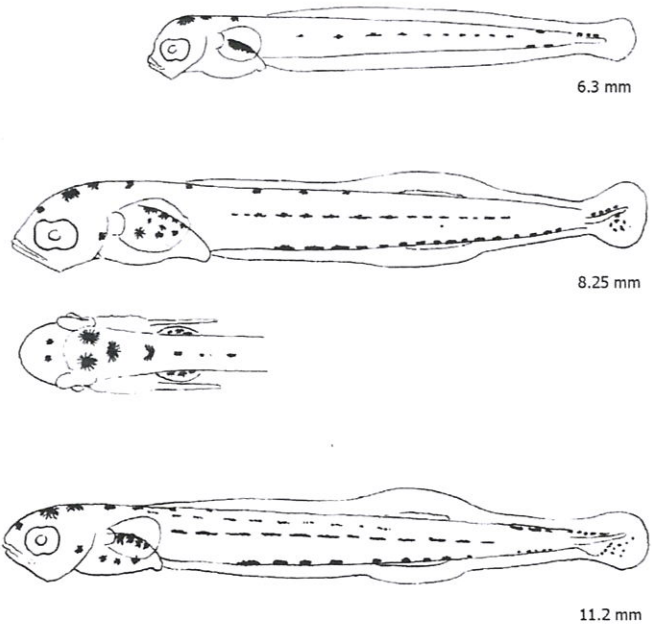


Plate 90- Early life history stages of *Atherina presbyter*. Russell (1976).

TRIGLIDAE

Trigla lucerna Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – D₁ VIII+IX-16-17

Anal rays – 14-16

Pelvic rays – I+5

Pectoral rays – 10-11+3

Myomeres:

Total number – 33-34

LIFE HISTORY

Range: Eastern Atlantic: Norway to Cape Blanc (along the African coast); not recorded at Madeira and the Azores. Also in the Mediterranean and Black seas.

Habitat: demersal; marine; depth range 20-318 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped. 1908-10 Medit. adjac. Seas*, 2, Biology A3: 1-154.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolla, Denmark: 215pp.
- Padoa, E. (1933-1956). Triglidae. *Uova, larve e stadii giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 627-642.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.10-1.54 mm

No. of oil globules - 1

Shell surface - smooth

Pigment -

Yolk -

Diameter of oil globules – 0.22-0.31 mm

Diagnostic features -

LARVAE

Hatching length – 3.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva: large pectoral fin, melanophores distributed on larva and yolk sac. Late larva:

Melanophores on head, upper and lower jaws. Postanal row of melanophores.

Pigmented pectoral fin (radial melanophores).

Diagnostic features – Shape of body. Spines on pre-operculum. Large and rounded pectoral fins reaching the anus. Pelvic fins pigmented at their margins. Occipital ridge, infra-orbital ridge, nasal and mandibular spines. Spines also develop medio-laterally and on the bases of pectoral fins.

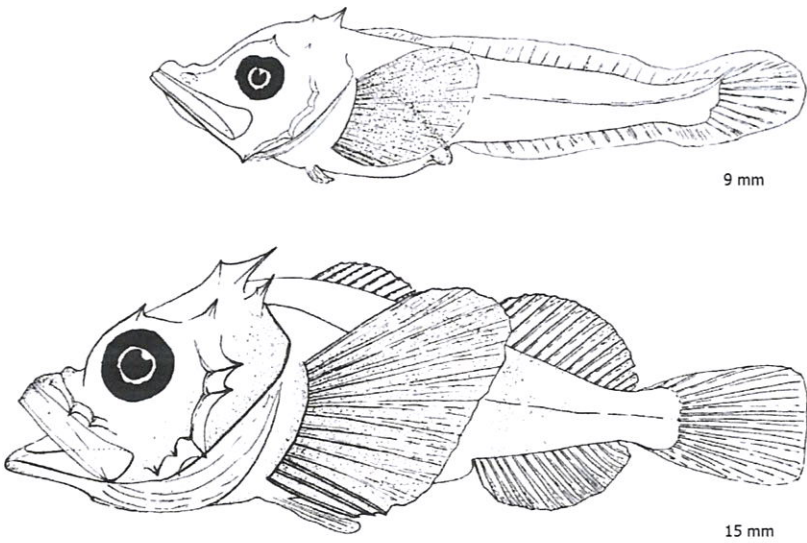


Plate 91- Early life history stages of *Trigla lucerna*. Fage (1918).

COTTIDAE

Taurulus bubalis (Euphrasen, 1786)

MERISTICS

Fins:

Dorsal rays – D₁ VII-X, D₂ 10-14
Anal rays – 8-10
Pelvic rays – I+3
Pectoral rays – 14-16

Myomeres:

Total number – 29-33

LIFE HISTORY

Range: Eastern Atlantic: Iceland, the Shetlands, from Murmansk southward to Portugal, also Baltic Sea northward to Gulf of Finland and northern Mediterranean coasts eastward to Gulf of Genoa.

Habitat: demersal; brackish; marine; depth range 0-100 m.

Spawning season: spring.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
M'Intosh, W.S., A.T. Masterman (1897). *The life-histories of the British marine food-fishes*. C. J. Clay London: 467p.
Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.5-1.8 mm
No. of oil globules – several oil globules
Shell surface – smooth, spherical
Pigment -
Yolk - unsegmented
Diameter of oil globules – 0.25-0.35 mm
Diagnostic features -

LARVAE

Hatching length – 5.5-5.8 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Newly hatched larva: no melanophores on head and base of pectoral fin. Late larva: heavy peritoneal pigmentation. Row of postanal ventral melanophores. Late larva: little change in pigmentation. The black peritoneal pigmentation is the most obvious feature. Usually two melanophores at the base of the caudal fin. Two large melanophores on each side of the throat region, and a few melanophores on the ventral edge of the abdomen.
Diagnostic features – Heavy peritoneal pigmentation. Characteristic shape of body. Spinal armature evident. Single otocystic spine, four preopercular spines and two small protuberances behind the otocyst.

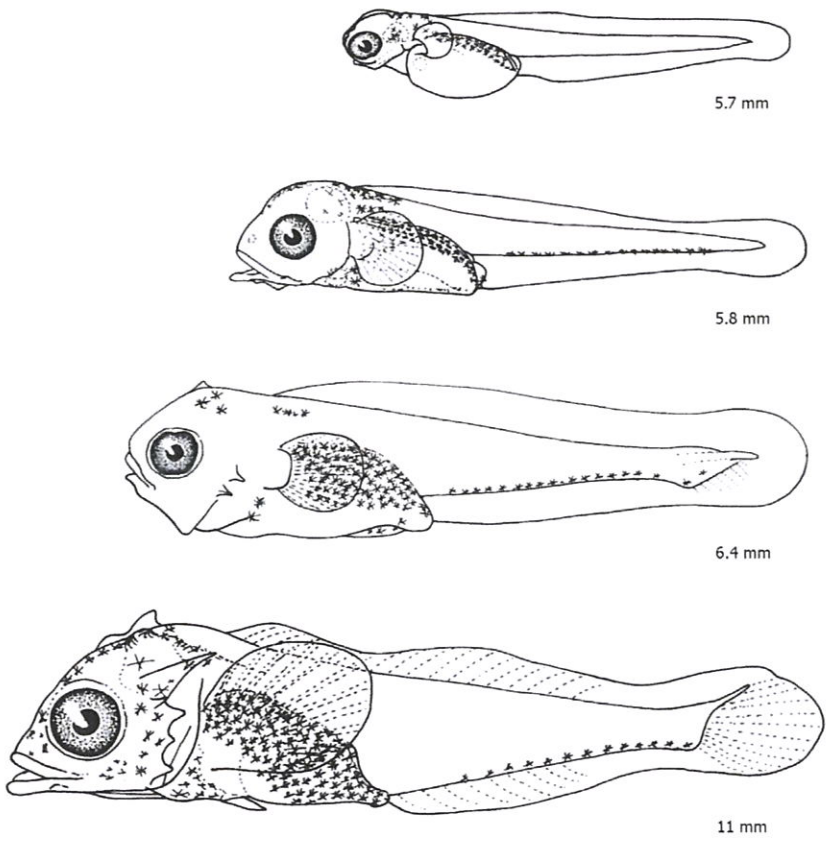


Plate 92- Early life history stages of *Taurulus bubalis*. Ehrenbaum (1905-1909).

LIPARIDAE

Liparis montagui (Donovan, 1804)

MERISTICS

Fins:

Dorsal rays – 28-30

Anal rays – 22-25

Pelvic rays -

Pectoral rays –

Myomeres:

Total number –

LIFE HISTORY

Range: Northeast Atlantic: North Sea, around the British Isles, Norwegian Sea, southwestern Barents Sea and around southern Iceland.

Habitat: demersal; marine; depth range 0-30 m.

Spawning season: winter to summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Fage, L. (1918). Shore-fishes. *Rep. Dan. Oceanogr. Exped . 1908-10 Medit . adjac. Seas*, 2, Biology A3: 1-154.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Ré, P., L. Arruda, P. Salgado, (1985). On the occurrence of *Liparis montagui* (L.) larval and juvenile stages off the portuguese coast. *Cybiu*, 9 (4): 407- 409.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.03-1.19 mm

No. of oil globules - 1

Shell surface – smooth, spherical

Pigment -

Yolk - unsegmented

Diameter of oil globules – 0.25-0.38 mm

Diagnostic features -

LARVAE

Hatching length – 3.5 mm

Yolk-sac absorption – 4.0-4.5 mm

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva: heavy peritoneal pigmentation, row of postanal ventral melanophores, pigment on head and pectoral fins. Late larva: little change in overall pigmentation.

Diagnostic features – Typical boby shape.

Heavy peritoneal pigmentation. Large pectoral fins. Pelvic fin sucker. At 7-8 mm fin rays develop and the small pelvic fin sucker is already apparent. Large pigmented pectoral fins. At 11-12 mm dosal and anal fins rays fully developed. Pectoral fin reaches de anus.

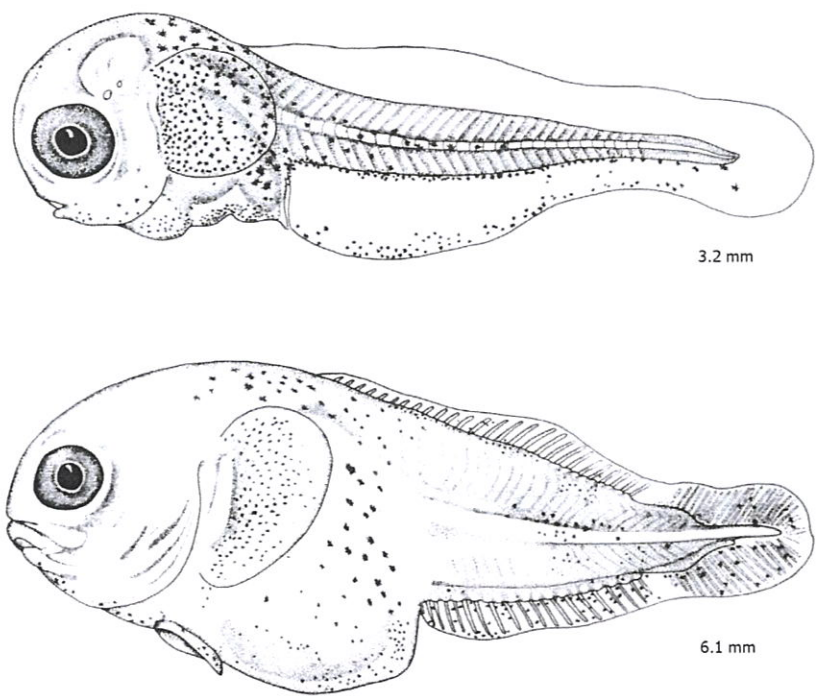


Plate 93- Early life history stages of *Liparis montagui*. Ré *et. al.* (1985).

SCOPHTHALMIDAE

Lepidorhombus boscii (Risso, 1810)

MERISTICS

Fins:

- Dorsal rays – 79-86
- Anal rays – 65-69
- Pelvic rays - 6
- Pectoral rays – 11-12

Myomeres:

- Total number – 10+32

LIFE HISTORY

Range: Northeast Atlantic: British Isles south to Cape Bojador, West Sahara and the Mediterranean.

Habitat: demersal; marine; depth range 7–800 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic larvae.

MAIN REFERENCES

- Petersen, C.G.J. (1909). On the larval and post-larval stages of some Pleuronectidae (*Zeugopterus*, *Arnoglossus*, *Solea*). *Meddr Kommn Havunders., Ser. Fiskeri*, 3, Nr. 1: 1-18.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

- Capsule diameter – Unknown
- No. of oil globules - Unknown
- Shell surface – Unknown
- Pigment - Unknown
- Yolk - Unknown
- Diameter of oil globules - Unknown
- Diagnostic features - Unknown

LARVAE

- Hatching length - Unknown
- Yolk-sac absorption - Unknown
- Flexion length – 9 mm
- Transformation length -
- Pigmentation – Seven groups of melanophores along the margin of the dorsal fin and three along the margin of the anal fin. Three bands of melanophores on the dorsal portion of the body, the most anterior above the anus. Three groups on the ventral postanal region.
- Diagnostic features – Characteristic pigmentation (groups of melanophores on dorsal and anal fins). Preoperculum with many small spines behind the otocystic region (two distinct rows).

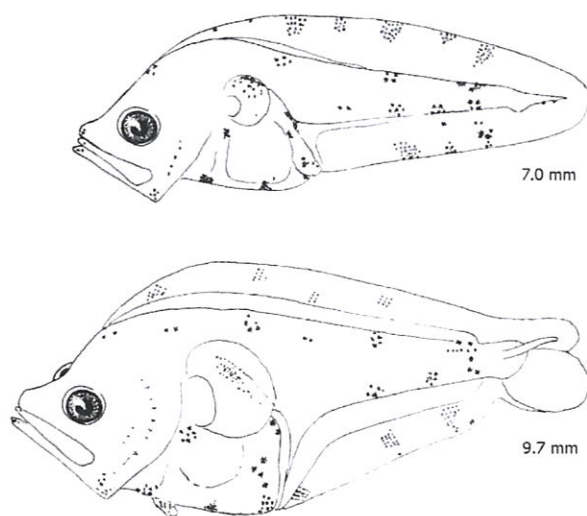


Plate 94- Early life history stages of *Lepidorhombus boscii*. Petersen (1909).

SCOPHTHALMIDAE

Psetta maxima (Linnaeus, 1758)

MERISTICS

Fins:

Dorsal rays – 57-71

Anal rays – 43-52

Pelvic rays - 6

Pectoral rays – 11-12

Myomeres:

Total number – 11+20

LIFE HISTORY

Range: Northeast Atlantic: throughout the Mediterranean and along the European coasts to Arctic Circle; also found in most of the Baltic Sea.

Habitat: demersal; brackish; marine; depth range 20-70 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- M'intosh, W.S., A.T. Masterman (1897) - *The life-histories of the British marine food-fishes*. C. J. Clay London: 467p.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.91-1.20 mm

No. of oil globules - 1

Shell surface – smooth

Pigment - When the embryo is a little over half way around the yolk, chromatophores appear over the head, trunk and oil globule, and black fine pigment on either side of the notochord and a few larger ones over the oil globule. Reddish appearance.

Yolk - unsegmented

Diameter of oil globules – 0.15-0.22 mm

Diagnostic features -

LARVAE

Hatching length – 2.14-2.8 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva: characteristic pigmentation. Melanophores over head and trunk and postanal bar formed by spreading the pigment onto the primordial fin dorsally and ventrally. Late larva: Identical pigmentation pattern. At about 8 mm, melanophores are scattered over most of the dorsal and anal fins giving the larva a much darker appearance than that of other related species.

Diagnostic features – Characteristic pigmentation. Spiny armature appear at 4-5 mm and is very well developed at 10-11, declining in after. Presence of a gas bladder. Spiny armature on head region. Bony toothed crest above the posterior margin of the eye, two rows of spines on the operculum and two small groups on the otocystic region.

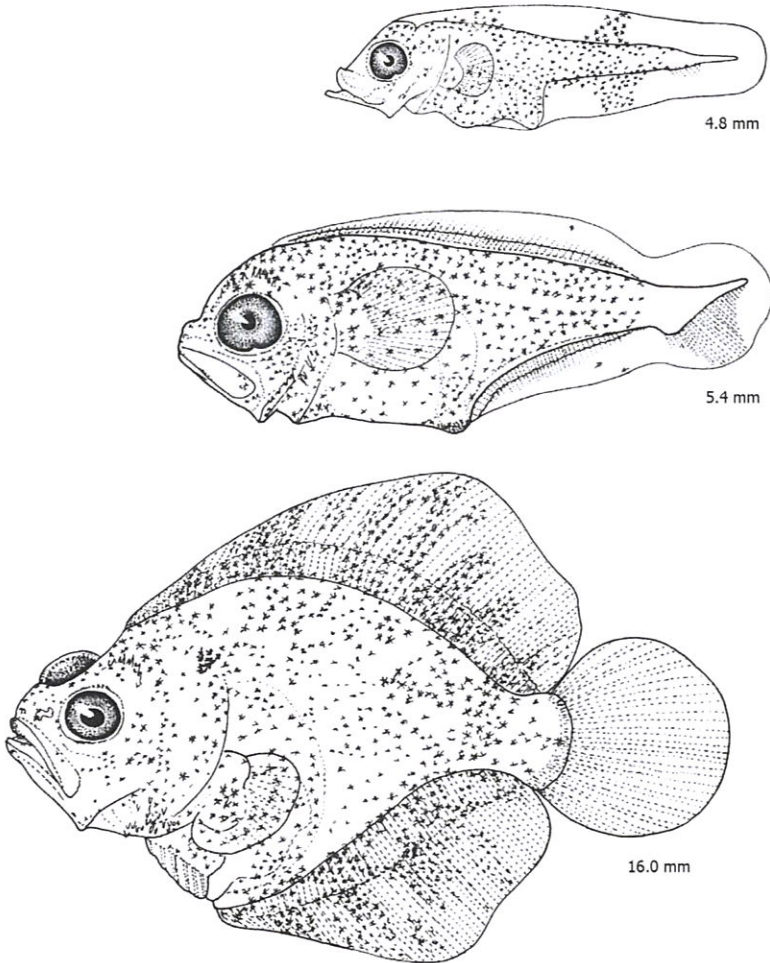


Plate 95- Early life history stages of *Psetta maxima*. Ehrenbaum (1905-1909).

SCOPHTHALMIDAE

Zeugopterus punctatus (Bloch, 1787)

MERISTICS

Fins:

Dorsal rays – 88-102
Anal rays – 67-76
Pelvic rays - 6
Pectoral rays – 11-12

Myomeres:

Total number –

LIFE HISTORY

Range: North Atlantic: Trondheim to the Bay of Biscay; including Newfoundland, Canada.

Habitat: demersal; marine.

Spawning season: winter to summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- M'intosh, W.S., A.T. Masterman (1897) - *The life-histories of the British marine food-fishes*. C. J. Clay London: 467p.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Petersen, C.G.J. (1906). On the larval and post-larval stages of some Pleuronectidae (*Pleuronectes*, *Zeugopterus*). *Meddr Kommn Havunders., Ser. Fiskeri*, 2, Nr. 1: 9pp.
- Petersen, C.G.J. (1909). On the larval and post-larval stages of some Pleuronectidae (*Zeugopterus*, *Arnoglossus*, *Solea*). *Meddr Kommn Havunders., Ser. Fiskeri*, 3, Nr. 1: 1-18.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.92-1.07 mm
No. of oil globules - 1
Shell surface – smooth
Pigment -
Yolk - unsegmented
Diameter of oil globules – 0.17-0.20 mm
Diagnostic features -

LARVAE

Hatching length – 2.5-3.0 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Characteristic pigmentation on the primordial fin – patterns of evenly spaced cone-shaped and latter elongated oblong groups of melanophores. Rows of melanophores also appear on the body contour.
Diagnostic features – Characteristic pigmentation. Two large spines on the otocystic region.

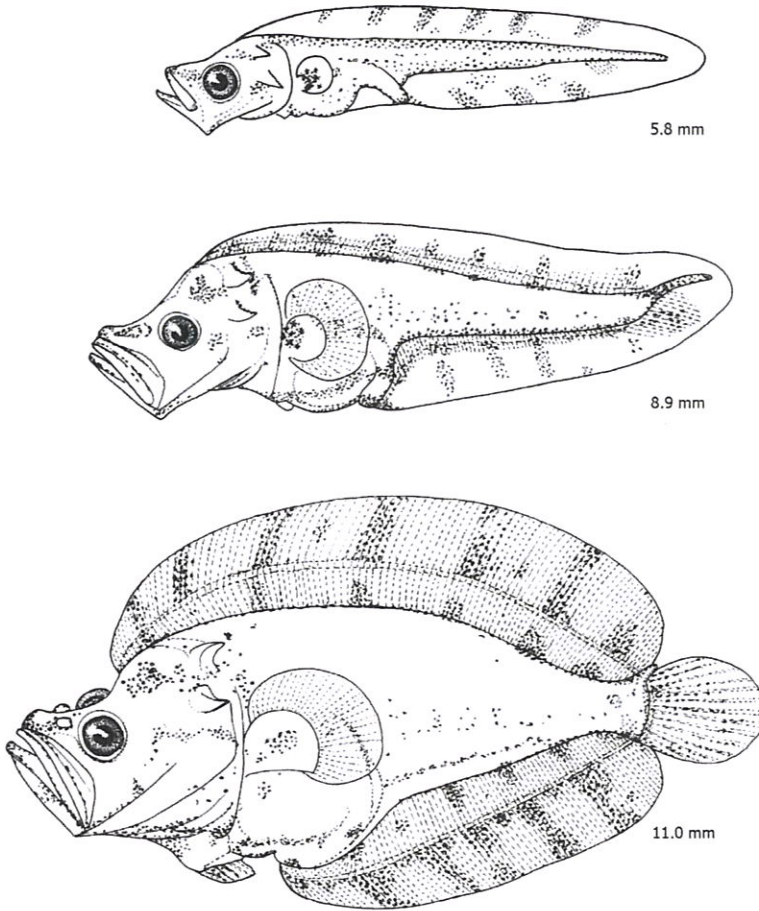


Plate 97- Early life history stages of *Zeugopterus punctatus*. Ehrenbaum (1905-1909), Petersen (1909).

SCOPHTHALMIDAE

Zeugopterus regius (Bonnaterre, 1788)

MERISTICS

Fins:

Dorsal rays – 73-80

Anal rays – 60-68

Pelvic rays - 6

Pectoral rays – 9-10

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: British Isles to Morocco; also in the western Mediterranean and the Adriatic Sea.

Habitat: demersal; brackish; marine; depth range 10-180 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Petersen, C.G.J. (1909). On the larval and post-larval stages of some Pleuronectidae (*Zeugopterus*, *Arnoglossus*, *Solea*). *Meddr Kommn Havunders., Ser. Fiskeri*, 3, Nr. 1: 1-18.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.90-0.99 mm

No. of oil globules - 1

Shell surface – smooth

Pigment -

Yolk - unsegmented

Diameter of oil globules – 0.16-0.18

Diagnostic features -

LARVAE

Hatching length – 2.4 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Body and fins covered with many uniformly distributed small melanophores. Similar in appearance with *Phrynorhombus norvegicus*.

Diagnostic features – Typical pigmentation. Two large otocystic spines (not present in *P. norvegicus* larvae).

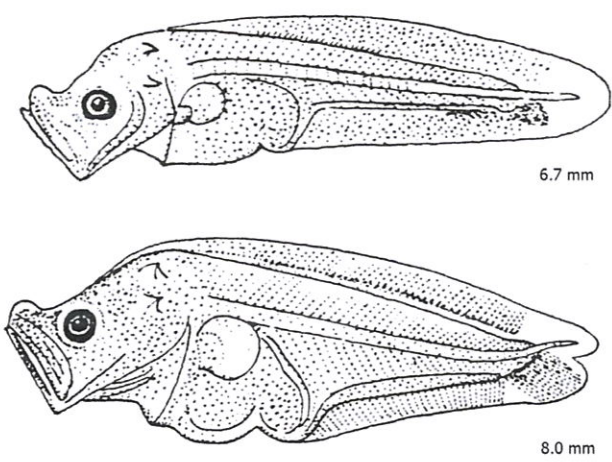


Plate 96- Early life history stages of *Phrynorhombus regius*. Petersen (1909).

BOTHIDAE

Arnoglossus laterna (Walbaum, 1792)

MERISTICS

Fins:

- Dorsal rays – 87-93
- Anal rays – 65-74
- Pelvic rays - 6
- Pectoral rays – 11-12

Myomeres:

- Total number –

LIFE HISTORY

Range: Eastern Atlantic: Norway to Angola.
Also known from the Mediterranean and Black Sea.

Habitat: demersal; marine; depth range 10-200 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Holt, E.W.L. (1899). Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Kyle, H.M. (1913). Flat-fishes (Heterosomata). *Rep. Dan. Oceanogr. Exped.*, 1908-1910. Vol. II, Biology, A.1: 150pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Heterosomata. *Uova, larve e stadii giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 783-877.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 0.60-0.76 mm
- No. of oil globules - 1
- Shell surface – smooth, spherical
- Pigment -
- Yolk -
- Diameter of oil globules – 0.11-0.15 mm
- Diagnostic features – small dimensions.

LARVAE

- Hatching length – 2.5 mm
- Yolk-sac absorption – 2.9 mm
- Flexion length -
- Transformation length -
- Pigmentation - Few melanophores in dorsal contour. Evenly spaced small melanophores in ventral row. Some melanophores in the otocystic region.
- Head and abdomen heavily pigmented. At 5 mm the gas bladder is apparent and there is a large tentacle on the head.
- Pigmentation can vary (pale form with little or no pigment, and well pigmented form).
- Diagnostic features – Shape of body. Large tentacle on head. Spines on head near the base of tentacle (5-6).

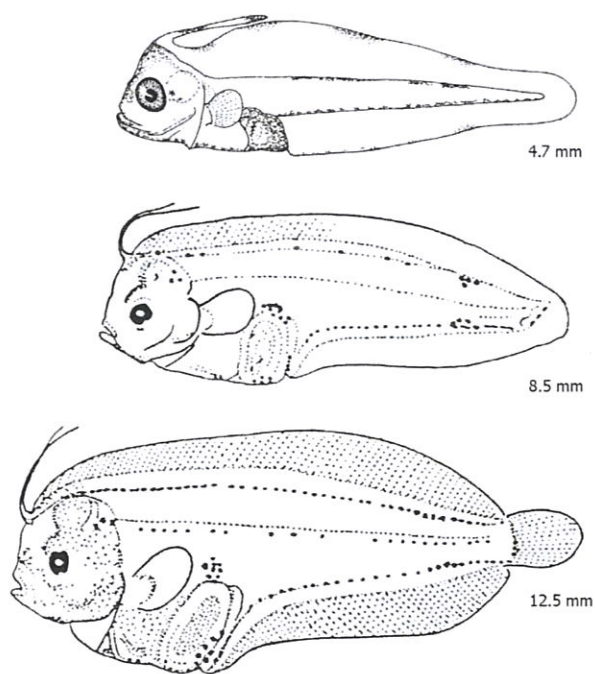


Plate 98- Early life history stages of *Arnoglossus laterna*. Ehrenbaum (1905-1909), Kyle (1913).

PLEURONECTIDAE

Platichthys flesus (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays – 52-67
- Anal rays – 36-46
- Pelvic rays - 6
- Pectoral rays – 9-12

Myomeres:

- Total number –

LIFE HISTORY

Range: Eastern Atlantic: coastal and brackish waters of western Europe and from the White Sea to the Mediterranean and the Black Sea.

Habitat: demersal; brackish; marine; depth range 1-100 m.

Spawning season: winter and spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Nichols, J.H. (1971). Pleuronectidae. *Fiches d'Identification des oeufs et larves de poissons*, 4/6: 18pp.
- Padoa, E. (1933-1956). Heterosomata. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 783-877.
- Petersen, C.G.J. (1906). On the larval and post-larval stages of some Pleuronectidae (*Pleuronectes*, *Zeugopterus*). *Meddr Kommn Havunders., Ser. Fiskeri*, 2, Nr. 1: 9pp.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 0.8-1-13 mm
- No. of oil globules - 0
- Shell surface – smooth
- Pigment -
- Yolk - unsegmented
- Diameter of oil globules –
- Diagnostic features -

LARVAE

- Hatching length – 2.3-3.3 mm
- Yolk-sac absorption – 4 mm
- Flexion length -
- Transformation length – 10-12 mm
- Pigmentation – Newly hatched larva: pigmentation all over the marginal fins, forming regular rows of small spots along the ventral fin rays. Late larva: There are no obvious rows of melanophores on either side of the body. Many scattered melanophores along the ventral sides of the body and spreading out over the anal fin (pigment aligned with fin rays).
- Diagnostic features – Typical pigmentation. Small head. Assymetry begins at 9-10 mm. Distinct yellow appearance of the larvae in fresh specimens.

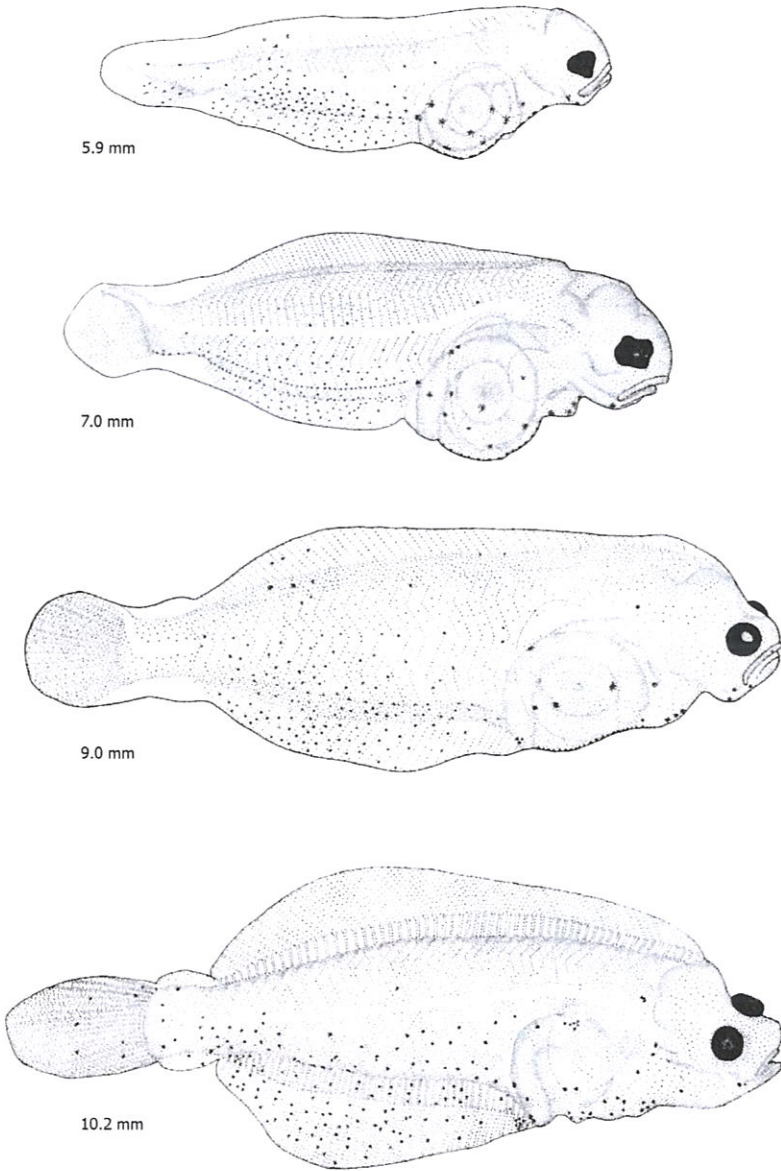


Plate 99- Early life history stages of *Platichthys flesus*. Nichols (1971).

SOLEIDAE

Buglossidium luteum (Risso, 1810)

MERISTICS

Fins:

Dorsal rays – 65-77

Anal rays – 49-63

Pelvic rays – 5

Pectoral rays – 3-5

Myomeres:

Total number – 9-10+27-29

LIFE HISTORY

Range: Eastern Atlantic: Iceland and Scotland southward, also North Sea, Kattegat and Baltic. Mediterranean Sea: including Adriatic, Sea of Marmara, Bosphorus.

Habitat: demersal; marine; depth range 5-450 m.

Spawning season: spring to autumn.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Kyle, H.M. (1913). Flat-fishes (Heterosomata). *Rep. Dan. Oceanogr. Exped.*, 1908-1910. Vol. II, Biology, A.1: 150pp.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Nichols, J.H. (1976). Soleidae of the Eastern North Atlantic. *Fiches d'Identification du Zooplancton*, 150/151: 10pp.
- Padoa, E. (1933-1956). Heterosomata. *Uova, larve e stadii Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.* 38: 783-877.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 0.64-0.94 mm

No. of oil globules – 12-15 small scattered oil globules

Shell surface – smooth

Pigment – pigment on embryo

Yolk – peripheral segmentation

Diameter of oil globules –

Diagnostic features –

LARVAE

Hatching length – 1.83-2.29 mm

Yolk-sac absorption – 3.5 mm

Flexion length –

Transformation length – 10 mm

Pigmentation – Fairly evenly spaced large melanophores along the dorsal and ventral body contours.

Diagnostic features – Characteristic pigmentation. Large gas bladder.

Assymetry begins around 6 mm. When the larva reaches 8 mm both eyes are on the same side of the body.

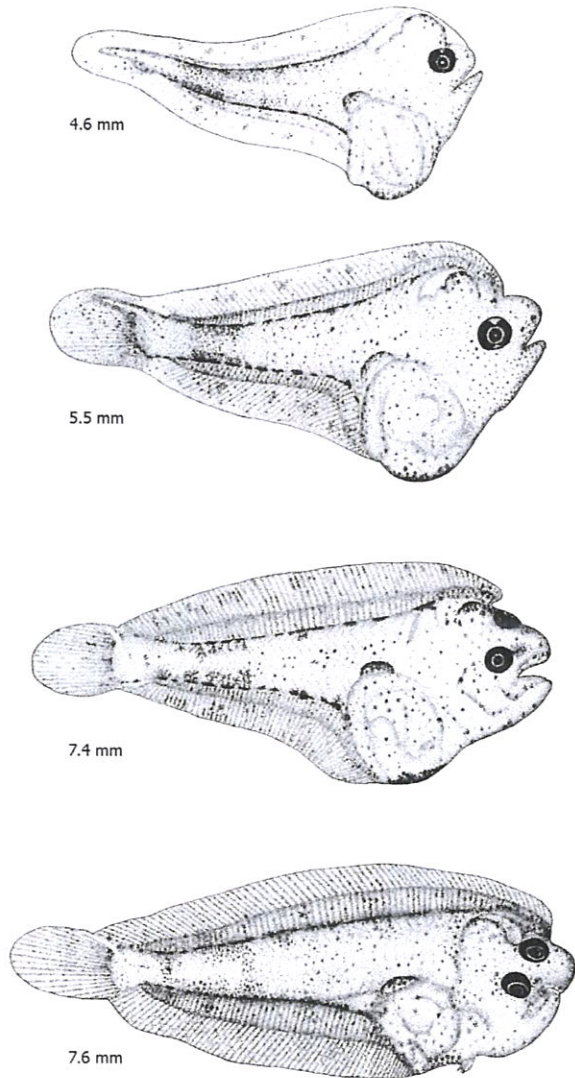


Plate 100- Early life history stages of *Buglossidium luteum*. Nichols (1976).

SOLEIDAE

Microchirus variegatus (Donovan, 1808)

MERISTICS

Fins:

Dorsal rays – 63-77

Anal rays – 46-64

Pelvic rays - 5

Pectoral rays – 4-5

Myomeres:

Total number – 10+30-32

LIFE HISTORY

Range: Northeast Atlantic: British Isles south to Senegal and the Mediterranean.

Habitat: demersal; marine; depth range 20-400 m.

Spawning season: winter to summer.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Clark, R. S. (1920) . The pelagic young and early bottom stages of Teleosteans. *J. mar. biol. Ass. U. K.*, 12: 159-240.
- Cunningham, J.T. (1889). Studies of the reproduction and development of teleostean fishes occurring in the neighbourhood of Plymouth. *J. mar. bio. Ass. U.K.*, 1: 370-375.
- Munk, P., J.G. Nielsen (2005). *Eggs and larvae of North Sea fishes*. Biofolia, Denmark: 215pp.
- Padoa, E. (1933-1956). Heterosomata. *Uova, larve e stadii Giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.*38: 783-877.
- Petersen, C.G.J. (1909). On the larval and post-larval stages of some Pleuronectidae (*Zeugopterus*, *Arnoglossus*, *Solea*). *Meddr Kommn Havunders., Ser. Fiskeri*, 3, Nr. 1: 1-18.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.28-1.42 mm

No. of oil globules – 50 or more scattered oil globules

Shell surface – smooth

Pigment -

Yolk – peripheral segmentation

Diameter of oil globules –

Diagnostic features -

LARVAE

Hatching length – 2.4-2.9 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva: rows of large stellate melanophores along the dorsal and ventral margins of the primordial fin. Late larva: similar pigmentation. The body is uniformly covered with small stellate or simple melanophores less numerous on the suborbital and on the posterior parts of the dorsal, anal and caudal fins. Longitudinal rows along the dorsal and ventral contours (slightly less larger than those on the body).

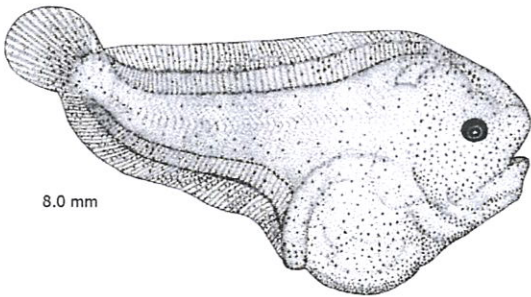
Diagnostic features – Characteristic pigmentation: small evenly spaced melanophores over most of the body. Gas bladder not evident. Head very distinctive with a definite snout.



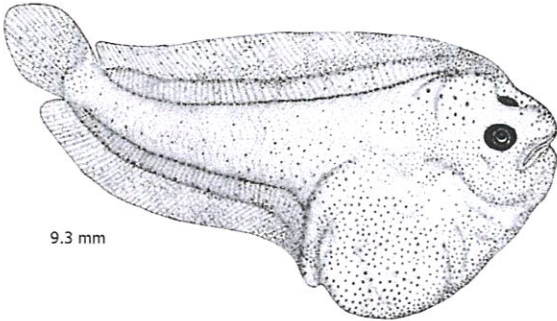
4.8 mm



5.8 mm



8.0 mm



9.3 mm

Plate 101- Early life history stages of *Microchirus variegatus*. Nichols (1976).

SOLEIDAE

Pegusa lascaris (Risso, 1810)

MERISTICS

Fins:

Dorsal rays – 71-90

Anal rays – 55-75

Pelvic rays - 5

Pectoral rays – 7-10

Myomeres:

Total number – 9-10+37-38

LIFE HISTORY

Range: Eastern Atlantic: northeastern to southeastern Atlantic; Gulf of Guinea; the Mediterranean Sea and Black Sea.

Habitat: demersal; brackish; marine; depth range 5-350 m.

Spawning season:

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Ehrenbaum, E. (1905-1909). *Eier und Larven von Fischen. Nordisches Plankton*, 1: 413pp.
- Holt, E.W.L. (1899) - Recherches sur la reproduction des poissons osseux principalement dans le Golfe de Marseille. *Annls Mus. Hist. nat. Marseille*, 5 Mém.2: 128p.
- Kyle, H.M. (1913). Flat-fishes (Heterosomata). *Rep. Dan. Oceanogr. Exped.*, 1908-1910. Vol. II, Biology, A.1: 150pp.
- Padoa, E. (1933-1956). Heterosomata. *Uova, larve e stadi giovanili di Teleostei: monografia elaborata con l'uso del materiale raccolto e sveriato da Salvatore Lo Bianco. Fauna e Flora Golfo Napoli Monogr.*38: 783-877.
- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 1.28-1.38 mm

No. of oil globules – 50 or more scattered oil globules

Shell surface – smooth

Pigment -

Yolk – peripheral segmentation

Diameter of oil globules –

Diagnostic features -

LARVAE

Hatching length – 3.5 mm

Yolk-sac absorption -

Flexion length -

Transformation length -

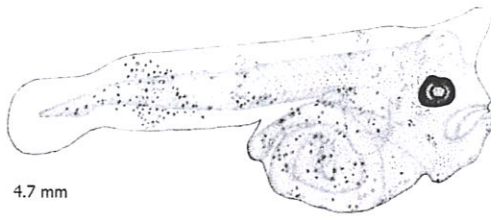
Pigmentation – Distinct pigmentation pattern. Large finely branched

melanophores on the head, trunk and abdomen (largest on the gut region).

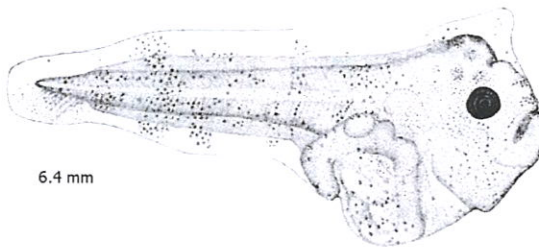
Aggregations of pigment on the dorsal and anal fin membranes towards the posterior end of the body forming a distinct anal bar. As development proceeds the

pigmentation becomes more pronounced. Pigmented gas bladder.

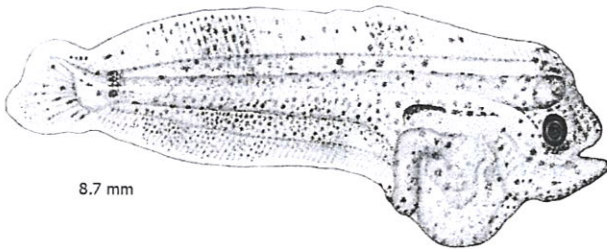
Diagnostic features – Abnormal large anterior prolongation of the dorsal primordial fin during first stages of development. Pigmentation pattern. Pigmented gas bladder.



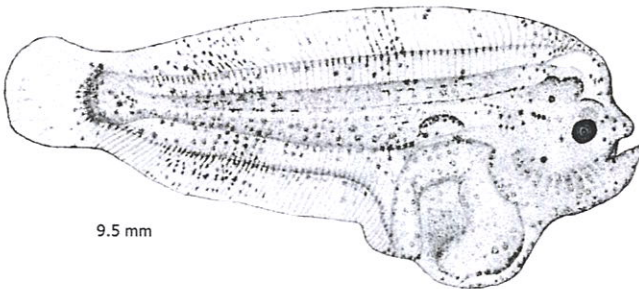
4.7 mm



6.4 mm



8.7 mm



9.5 mm

Plate 102- Early life history stages of *Pegusa lascaris*. Nichols (1976).

SOLEIDAE

Solea senegalensis Kaup, 1858

MERISTICS

Fins:

Dorsal rays – 75-95

Anal rays – 61-75

Pelvic rays - 5

Pectoral rays – 8-10

Myomeres:

Total number – 9+36-37

LIFE HISTORY

Range: Eastern Atlantic: North to southern Atlantic.

Habitat: demersal; brackish; marine; depth range 12–65 m.

Spawning season: spawns throughout the whole year.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

- Dinis, M.T. (1986). Quatre Soleidae de l'estuaire du Tage. Reproduction et croissance. Essai d'élevage de *Solea senegalensis* Kaup. Tese, Université de Bretagne Occidentale: 348 pp.
- Ré, P. (1999). *Ictioplâncton estuarino da Península Ibérica (Guia de identificação dos ovos e estados larvares planctónicos)*, 163pp, 51 fig. Prémio do Mar, 1996. Câmara Municipal de Cascais. ISBN 972-637-065-5.

EARLY LIFE HISTORY DESCRIPTION

EGGS: Undescribed

Capsule diameter – Unknown

No. of oil globules - Unknown

Shell surface – Unknown

Pigment - Unknown

Yolk - Unknown

Diameter of oil globules – Unknown

Diagnostic features - Unknown

LARVAE

Hatching length - Unknown

Yolk-sac absorption -

Flexion length -

Transformation length -

Pigmentation – Newly hatched larva: heavy pigmentation on the primordial fin, over the body and yolk sac. Late larva: similar pigmentation pattern. Bands of pigment on the dorsal and anal fins. Body heavily pigmented.

Diagnostic features – Protruding otocystic capsules. Overall pigmentation.

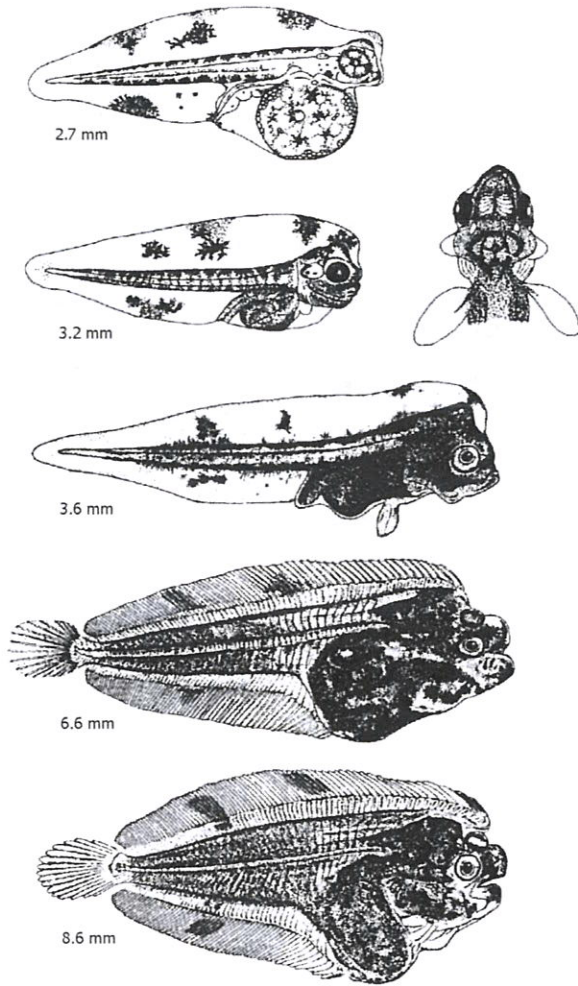


Plate 103- Early life history stages of *Solea senegalensis*. Dinis (1986).

SOLEIDAE

Solea solea (Linnaeus, 1758)

MERISTICS

Fins:

- Dorsal rays – 69-97
- Anal rays – 53-79
- Pelvic rays – 5-6
- Pectoral rays – 7-10

Myomeres:

- Total number – 9-10+40-42

LIFE HISTORY

Range: Eastern Atlantic: southward from Trondheim Fjord (including North Sea and western Baltic) and Mediterranean Sea (including Sea of Marmara, Bosphorus and southwestern Black Sea).

Habitat: demersal; brackish; marine; depth range 0-150 m.

Spawning season:

ELH pattern: Oviparous, planktonic eggs and larvae.

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EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 1.0-1.6 mm
- No. of oil globules – many small aggregated oil globules
- Shell surface – smooth
- Pigment -
- Yolk – peripheral segmentation
- Diameter of oil globules –
- Diagnostic features -

LARVAE

- Hatching length – 2.5-3.75 mm
- Yolk-sac absorption -
- Flexion length -
- Transformation length -
- Pigmentation – Newly hatched larva: heavy pigmentation. Rows of melanophores over the body, yolk and primordial fin forming a complete network, except for the extreme caudal end of the tail. Late larva: same overall pigmentation pattern. The number of melanophores increase with development, eventually covering the whole body.
- Diagnostic features – Characteristic pigmentation. In early larvae the primordial fin have a hood-like projection over the head. Gas bladder not clearly visible. Pigment not in the form of bands, but evenly spread over the whole larva.

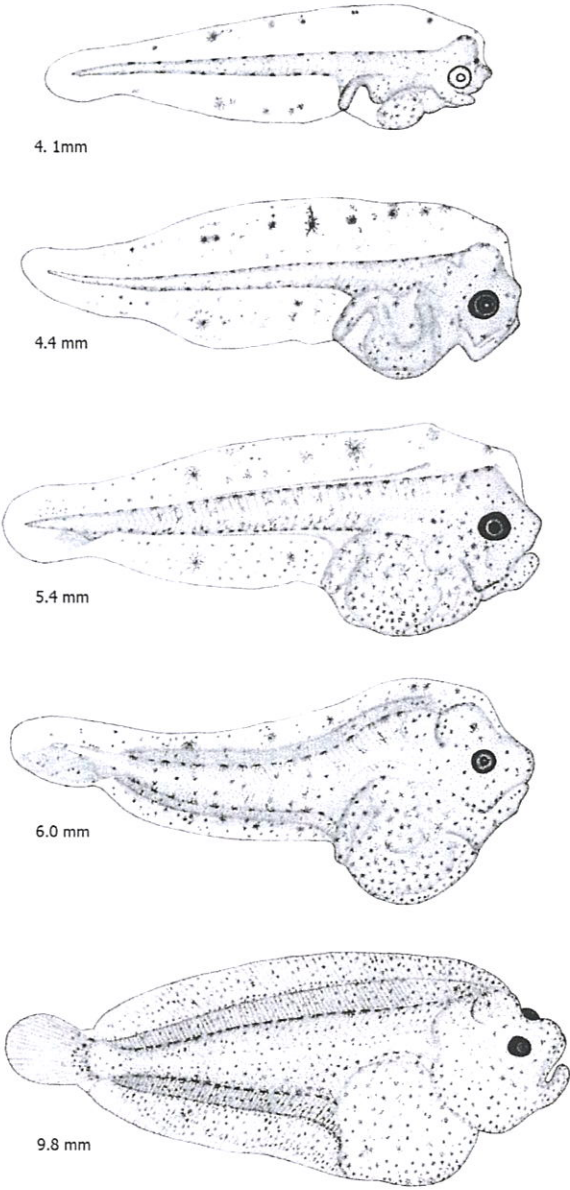


Plate 104- Early life history stages of *Solea solea*. Nichols (1976).

GOBIESOCIDAE

Diplecogaster bimaculata (Bonnaterre, 1788)

MERISTICS

Fins:

- Dorsal rays – 4-7
- Anal rays – 4-6
- Pelvic rays – I+4
- Pectoral rays – 18-26

Myomeres:

- Total number – 30-31

LIFE HISTORY

Range: Eastern Atlantic: Norway and the Faroes to Gibraltar including western Mediterranean and Adriatic Sea.

Habitat: demersal; marine; depth range 18-36 m.

Spawning season: spring and summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

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- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 1.37-1.54 mm
- No. of oil globules - 1
- Shell surface – smooth, flattened, oval
- Pigment – Yellow oil globule, colourless yolk
- Yolk - unsegmented
- Diameter of oil globules – 0.24-0.28 mm
- Diagnostic features -

LARVAE

- Hatching length – 3-4.3 mm
- Yolk-sac absorption – 4.8 mm
- Flexion length -
- Transformation length -
- Pigmentation - At 5.5 mm, pigment begins to develop on top of the head. In specimens 7.5-10 mm long, the melanophores arranged in four more or less regular longitudinal rows on the body.
- Diagnostic features - About 4.8-4.9 mm long (soon after the yolk has been reabsorbed), early larvae similar to the newly hatched larva. At 7.0 mm, the head is noticeably flattened dorsoventrally. Sucker appears at 8 mm and is well developed at 10 mm length. Late larvae can be easily distinguished from *L. lepadogaster* (wide unpigmented dorsal area and different pigmentation of the anal fin).

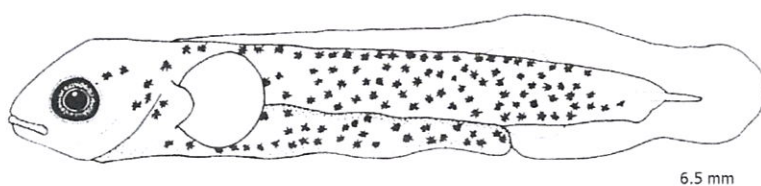


Plate 105- Early life history stages of *Diplecogaster bimaculata*. Russell (1976)

GOBIESOCIDAE***Lepadogaster lepadogaster* (Bonnaterre, 1788)****MERISTICS****Fins:**

Dorsal rays – 15-20
Anal rays – 9-12
Pelvic rays – I+4
Pectoral rays – 20-22

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: eastern and central Mediterranean westward to Monaco, possibly in the Black Sea.

Habitat: demersal; marine.

Spawning season: summer.

ELH pattern: Oviparous, demersal eggs and planktonic larvae.

MAIN REFERENCES

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- Russell, F.S. (1976). *The eggs and planktonic stages of British marine fishes*. Academic Press, London: 524pp.

EARLY LIFE HISTORY DESCRIPTION**EGGS**

Capsule diameter – 1.85-1.90 mm
No. of oil globules - 1
Shell surface – smooth, flattened, oval
Pigment –
Yolk - unsegmented
Diameter of oil globules – 0.36-0.28 mm
Diagnostic features -

LARVAE

Hatching length – 5 mm
Yolk-sac absorption -
Flexion length -
Transformation length -
Pigmentation – Larva heavily pigmented. The top of the head and the sides of the body are intensively pigmented. Melanophores arranged regularly along longitudinal rows. Body pigmentation continuous down to the ventral side of the abdomen. Snout and operculum appear to be without melanophores. Tail and pectoral fins without pigment. Row of melanophores on the base of the anal fin. Diagnostic features – Characteristic pigmentation. Gas bladder invisible due to the heavy pigmentation.

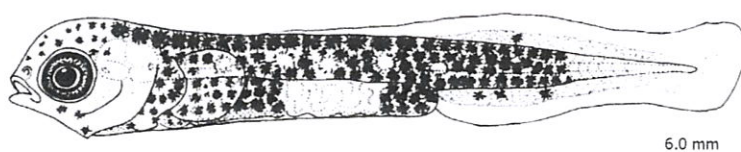


Plate 106- Early life history stages of *Lepadogaster lepadogaster*. Russell (1976).

LOPHIIDAE

Lophius piscatorius Linnaeus, 1758

MERISTICS

Fins:

Dorsal rays – D₁ II+I+III D₂ 10-12

Anal rays – 10-11

Pelvic rays – I+5

Pectoral rays – 23-28

Myomeres:

Total number –

LIFE HISTORY

Range: Eastern Atlantic: south-western Barents Sea to Strait of Gibraltar including the Mediterranean and Black Sea. Reported from Iceland and Mauritania. North Atlantic specimens attain larger sizes than those collected off West Africa and they also occur in shallower depths.

Habitat: demersal; marine; depth range 20-1000 m.

Spawning season: spring.

ELH pattern: Oviparous, planktonic eggs and larvae.

MAIN REFERENCES

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EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – 2.3-3.1 mm

No. of oil globules – one or more (up to nine)

Shell surface – ovoid in jelly matrix

Pigment – yellow, orange, amber

Yolk - unsegmented

Diameter of oil globules – 0.51-0.88 mm

Diagnostic features – Eggs embedded in a gelatinous ribbon ca. 11 m long and 30 cm wide.

LARVAE

Hatching length – 4.5 mm

Yolk-sac absorption – 6.5 mm

Flexion length -

Transformation length -

Pigmentation – Pigmented eyes before hatching. Pigmentation does not seem to change during development. Black pigmentation over the head and shoulder region (large ramified melanophores).

Melanophores are also present along the gut. Late larva: two bars of melanophores, one situated behind the anus and the other near the tail end.

Diagnostic features – Characteristic shape.

Newly hatched larva: hump-like projection into the dorsal primordial fin corresponding to the third ray of the fully-formed fin.

Pelvic fins are very elongated.

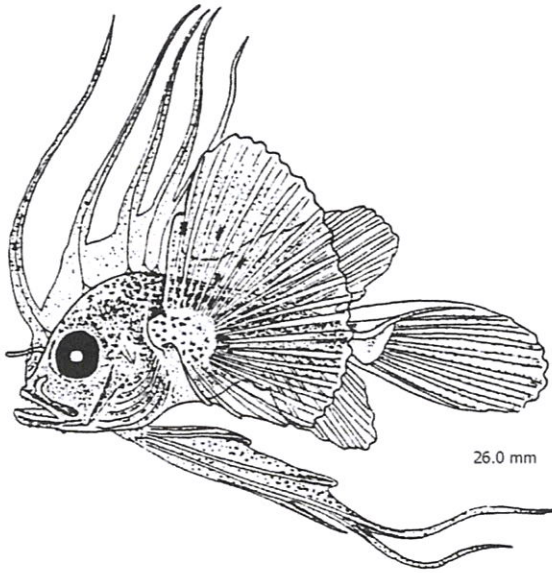
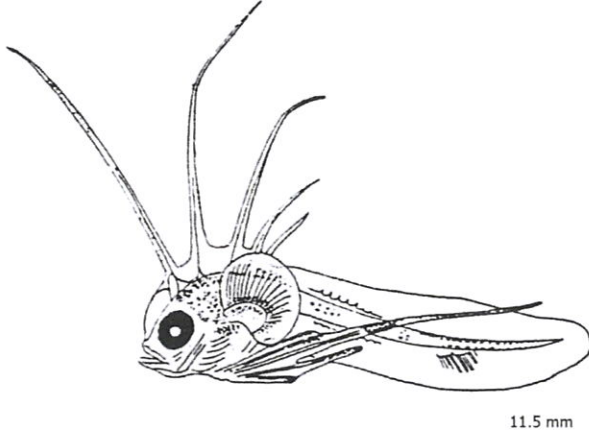


Plate 107- Early life history stages of *Lophius piscatorius*. Tåning (1923).

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ANNEX

COMPARATIVE APPROACH OF EARLY LIFE HISTORY STAGES OF SOME FISHES

In this Annex, we will include comparisons between the early life stages of some fish species, which are difficult to distinguish and of some species rarely seen or overlooked off the Iberian Peninsula. We considered important to include these comparisons to warn researchers for possible occurrences due to potential influx from the surrounding areas.

Great variation is observed in biometric data depending on habitat (Fage, 1920) so we advise to pay attention mainly to relative meristic values. Size at stage of development can be modified by environmental factors such as temperature or food availability (Moser *et al.*, 1984).

Detailed descriptions of reported species in our samples can be seen on the identification sheets in the main part of this guide.

The species to compare are in three groups:

A. Clupeiformes

Sardina pilchardus (Walbaum, 1792)
Sardinella aurita Valenciennes, 1847
Sardinella maderensis (Lowe, 1838)
Sprattus sprattus (Linnaeus, 1758)
Engraulis encrasicolus (Linnaeus, 1758)

B. Perciformes vs Gasterosteiformes

Macroramphosus scolopax (Linnaeus, 1758)
Dicentrarchus labrax (Linnaeus, 1758)
Trachurus mediterraneus (Steindachner, 1868)
Trachurus picturatus (Bowdich, 1825)
Trachurus trachurus (Linnaeus, 1758)

C. Perciformes

C.1. *Trachurus mediterraneus* (Steindachner, 1868)
Trachurus picturatus (Bowdich, 1825)
Trachurus trachurus (Linnaeus, 1758)
Scomber japonicus Houttuyn, 1782
Scomber scombrus Linnaeus, 1758

C.2. *Trachurus mediterraneus* (Steindachner, 1868)
Trachurus picturatus (Bowdich, 1825)
Trachurus trachurus (Linnaeus, 1758)
Pomatomus saltatrix (Linnaeus, 1766)
Boops boops (Linnaeus, 1758)
Pagrus pagrus (Linnaeus, 1758)

EGGS

It is difficult to identify most fish eggs with certainty. Except for late stages, few eggs can be identified to the species level (Moser *et al.*, 1984).

The following features will be considered:

1. shape – spherical, ellipsoidal
2. size – vary
3. oil globule/s – presence or absence, number, size, color, position, pigmentation
4. perivitelline space – size
5. yolk – segmented or unsegmented, colour and pigmentation
6. embryo characteristics – morphologic, pigmentation patterns, body shape.

LARVAE

Larval anatomy is dynamic and, for this reason, it's identification can be difficult and frequently must be based on a combination of characters (Moser *et al.*, 1984).

Meristic characters are important, as counts usually do not change once established. Vertebrae/myomere counts and fin element counts are particularly important. Nevertheless, one must be cautious because in the literature some doubts can emerge due to differences of methodology and variable attention to detail (Moser *et al.*, 1984).

A second set of characters includes:

1. pigmentation
2. shapes
3. spination
4. fin development patterns
5. fin placement
6. fin element development
7. eye shape (Moser *et al.*, 1984)

A. Clupeiformes

Clupeid and Engraulid larvae have characteristic elongated bodies, which makes identification easy in relation to other families. On the other hand, they have many features that are similar between them besides the elongated trunk, such as numerous myomeres and rectilinear elongated gut with the position of the anus near the tail (Fage, 1920).

Off the Iberian Peninsula, the more frequent species are *Sardina pilchardus* and *Engraulis encrasicolus* with one main spawning season (Ré *et al.*, 1990 and Uriarte *et al.*, 1996).

See Figure A1 to Figure A4 for comparison of different Early Life History stages.

EGGS

- 1) Shape
 - a) Spherical
 - i) With one oil globule and large perivitelline space - *Sardina pilchardus* and *Sardinella aurita* (referred sometimes as "with additional smaller oil droplets", Jones *et al.*, 1978)
 - ii) Without oil globule and large perivitelline space - *Sprattus sprattus*
 - b) Ellipsoidal, without oil globule - *Engraulis encrasicolus*
- 2) Capsule diameter
 - a) 0.8–1.3 mm (Russell, 1976) - *Sprattus sprattus*
 - b) 1.2–1.4 mm (D'Ancona, 1931) - *Sardinella aurita*
 - c) 1.5–1.7 mm (D'Ancona, 1931) - *Sardina pilchardus*
 - d) 1.2–1.9 mm x 0.5–1.2 mm (Russell, 1976) - *Engraulis encrasicolus*
- 3) Oil globule diameter
 - a) 0.16 mm (D'Ancona, 1931) - *Sardina pilchardus*
 - b) 0.12 mm; smaller oil droplets, when present, 0.08–0.94 mm (Jones *et al.*, 1978) - *Sardinella aurita*

Sardinella maderensis eggs are not described in the literature.

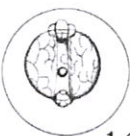
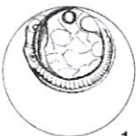
Species	Eggs	Newly hatched larvae
<i>Sardina pilchardus</i>	 1.4–1.8 mm	 3.5 mm
<i>Sprattus sprattus</i>	 0.8–1.3 mm	 2.25 mm
<i>Sardinella aurita</i>	 1.2–1.4 mm	 3.5 mm
<i>Sardinella maderensis</i>	Not described	Not described
<i>Engraulis encrasicolus</i>	 1.2–1.9 mm x 0.5–1.2 mm	 2 mm

Figure A1– Early life history stages of Clupeidae and Engraulidae. Figures redrawn from D'Ancona (1931); and Conand and Fagetti (1971).

LARVAE

Newly hatched

- 1) Hatching length
 - a) 2–3 mm (Russell, 1976 and D'Ancona, 1931) – *Sprattus sprattus*, *Sardinella aurita* and *Engraulis encrasicolus*
 - b) >3 mm (Russell, 1976) – *Sardina pilchardus*
- 2) Spherical yolk-sac
 - a) With oil globule
 - i) Situated in the ventral posterior part of the yolk (Russell, 1976) – *Sardina pilchardus*
 - ii) Situated in the ventral central part of the yolk (D'Ancona, 1931) – *Sardinella aurita*
 - b) Without oil globule (Russell, 1976) – *Sprattus sprattus*
- 3) Oblong yolk-sac without oil globule (Russell, 1976) – *Engraulis encrasicolus*

Early and Late larvae

(See Figure A2)

The number of myotomes is relevant to distinguish these species in stages between yolk-sac absorption and the appearance of the pelvic fins (Russell, 1976). The number of trunk myotomes (trunk is considered to be the part between the cleithrum and the anus) decreases slightly with age (Russell, 1976). This is a consequence of changes in body proportions, during development, and movement of anus relative to the vertebrae.

Taking into account the changes that take place during development, a single key cannot be used to cover the whole planktonic phase. For this reason (Fage, 1920 and Saville, 1964), we first considered two diagnostic characters: relative head length and relative position of dorsal and anal fins (three size groups).

- 1) Head length
 - a) <6 times total length of body (Fage, 1920, Saville, 1964, Conand and Fagetti, 1971) – *Sardinella aurita* and *Engraulis encrasicolus*
 - b) >6 times total length of body (Fage, 1920, Saville, 1964) – *Sardina pilchardus* and *Sprattus sprattus*
 - c) >6 times standard length to 15 mm and <6 times above 15 mm (Conand and Fagetti, 1971) – *Sardinella maderensis*
- 2) Relative position of dorsal fin to anal fin
Engraulis encrasicolus soon becomes identifiable by the early development of dorsal and anal fins, which overlap (Fage, 1920 and Russell, 1976).
 - a) Overlapping fins (Russell, 1976) – *Engraulis encrasicolus*
 - b) Non-overlapping fins (Russell, 1976, Fage, 1920, Conand and Fagetti, 1971, Conand, 1978) – *Sardina pilchardus*, *Sardinella aurita*, *Sardinella maderensis* and *Sprattus sprattus*.

Grouped by size

Larvae less than 10 mm in total length

Number of myomeres:

- 1) 40-43 myomeres, 35-38 in trunk (Conand and Fagetti, 1971, Conand, 1978) – *Sardinella maderensis*
- 2) 45-47 myomeres, 31-35 in trunk (Fage, 1920) – *Engraulis encrasicolus*
- 3) 46-48 myomeres, 37 in trunk (Saville, 1964) – *Sprattus sprattus*
- 4) 47-48 myomeres, 39-41 in trunk (Conand and Fagetti, 1971, Conand, 1978) – *Sardinella aurita*
- 5) 51-52 myomeres, 36-41 in trunk (Saville, 1964, Russell, 1976) – *Sardina pilchardus*

Larvae 10-20 mm in total length

Head size in relation to tail (from anus to base of caudal fin), and anus position in relation to dorsal fin:

- 1) Head shorter than tail, anus below dorsal fin (Fage, 1920, Saville, 1964, Russell, 1976) – *Engraulis encrasicolus*
- 2) Head and tail of same length, anus behind dorsal fin (Saville, 1967, Conand and Fagetti, 1971) – *S. pilchardus*, *S. aurita*, *S. maderensis* and *S. sprattus*

Pelvic fins position in relation to pylorus and larva length at the appearance of the fins:

- 1) At level of pylorus – *S. pilchardus*, *E. encrasicolus* and *S. maderensis*
 - a) Appears at 13-14 mm (Conand and Fagetti, 1971) – *S. maderensis*
 - b) Appears at 15 mm (Fage, 1920) – *E. encrasicolus*
 - c) Appears at 18 mm (Fage, 1920) – *S. pilchardus*
- 2) Behind pylorus – *S. aurita* and *S. sprattus*
 - a) Appears at 13-14 mm (Conand and Fagetti, 1971) – *S. aurita*
 - b) Appears at 18 mm (Russell, 1976) – *S. sprattus*

Larvae 20-40 mm

Pelvic fins position in relation to pylorus:

- 1) At level of pylorus (Saville, 1964) – *S. pilchardus* and *E. encrasicolus*
 - a) Head and tail of same length (Saville, 1964) – *S. pilchardus*
 - b) Tail at least 1 ½ times length of head and 2/7 of total length (Saville, 1964) – *E. encrasicolus*
- 2) Behind pylorus (Saville, 1964, Russell, 1976) – *S. sprattus*
Sardinella spp. not described in the available literature (larvae between 20 and 40 mm)

Characteristic to each species are the different levels of development in relation to their length:

- *Sardinella maderensis* is very precocious. At 7 mm of standard length, dorsal fin is already present and pelvic fins initiate their appearance at about 13-14 mm (Conand and Fagetti, 1971).
- *Sardinella aurita* is also very precocious in comparison to the other species considered here. Fage (1920) stated that pelvic fins begin to appear at about 11 mm. On the other hand, Conand and Fagetti (1971) referred their appearance at about 13-14 mm. At 11 mm total length, dorsal fin is already present and caudal fin is symmetric (Fage, 1920, Conand and Fagetti, 1971).
- *Engraulis encrasicolus* develops pelvic fins at about 15 mm (Fage, 1920). In *Sardina pilchardus* and *Sprattus sprattus*, appearance of the pelvic fins starts at 18 mm (Fage, 1920).

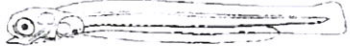
Species	Larvae	
<i>Sardina pilchardus</i>		
	7.2mm	11.1mm
<i>Sprattus sprattus</i>		
	4.7mm	10 mm
<i>Sardinella aurita</i>		
	6.5 mm	11 mm
<i>Sardinella maderensis</i>		
	6.9 mm	10.1 mm
<i>Engraulis encrasicolus</i>		
	4 mm	11 mm

Figure A2– Early life history stages of Clupeidae and Engraulidae. Figures redrawn from Fage (1920); D`Ancona (1931); and Conand and Fagetti (1971).

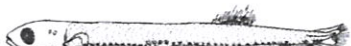
Species	Larvae
<i>Sardina pilchardus</i>	 16mm
<i>Sprattus sprattus</i>	 16.4mm
<i>Sardinella aurita</i>	 16.5mm
<i>Sardinella maderensis</i>	 16mm
<i>Engraulis encrasicolus</i>	 19mm

Figure A3– Early life history stages of Clupeidae and Engraulidae. Figures redrawn from Fage (1920); Conand and Fagetii (1971)

***Sardinella aurita* and *Sardinella maderensis* features**

Identification of the Early Life History stages of *Sardinella aurita* and *Sardinella maderensis* before the appearance of the pelvic fins is very difficult. Conand and Fagetti (1971) and Conand (1978) compared the larval stages of the two species. One of the main features considered was the pigmentation of the head, ventral pigmentation, and the position of the pylorus in relation to the ventral pigments.

Larvae less than 12 mm in standard length

Presence of continuous double row of pre-pyloric melanophores; caudal pigmentation in inferior position; snout longer or similar to eye diameter; anus position after the 32nd myomere; eye diameter more than 4% of standard length

- 1) Pylorus at level of third-to-last pre-pyloric melanophore; anus position at the 39th – 40th myomere – *Sardinella aurita* (Figure A4a)
- 2) Pylorus slightly posterior in relation to the last pre-pyloric melanophore; anus position at the 34th – 38th myomere – *Sardinella maderensis* (Figure A4b)

Larvae of 12-18 mm in standard length

Anal fin with less than 25 rays; one double range of pre-pyloric melanophores; anus in posterior position in relation to the 30th myomere; anal fin behind the dorsal fin extremity; presence of head pigments

- 1) Head pigmentation in dome; in advanced larval stages one tiny otocystic melanophore; absence of shoulder or occipital melanophores; pelvic fins level with the pylorus – *Sardinella maderensis* (Figure A5a, and c)
- 2) Head pigments but not in dome; pelvic fins behind the pylorus – *Sardinella aurita* (Figure A5b and d)

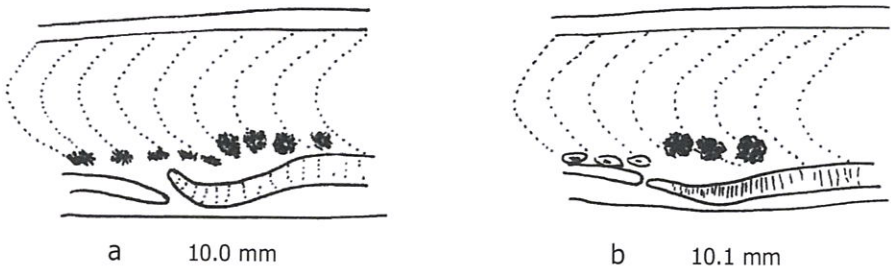


Figure A4— Ventral pigmentation at level of the pylorus of *Sardinella aurita* (a); and *Sardinella maderensis* (b) larvae. Redrawn from Conand (1978).

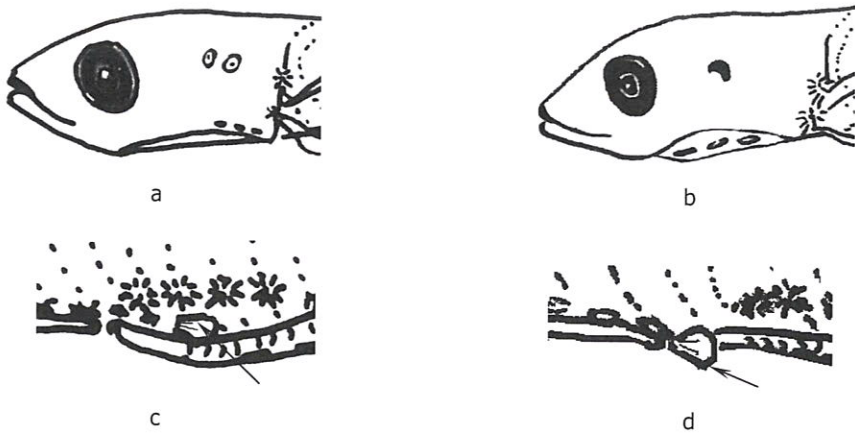


Figure A5— Head pigmentation and pelvic fins (arrows) position of *Sardinella aurita*, 16.5 mm (a) and (c); and *Sardinella maderensis*, 16.0 mm (b) and (d). Redrawn from Conand and Fagetti (1971).

B. Perciformes and Gasterosteiformes

The families Macroramphosidae, Moronidae and Carangidae are not phylogenetically related, but their Early Life History stages have similar morphological characteristics. Carangid eggs, for instance, are similar to those of many other marine fishes (Laroche *et al.*, 1984). Their only diagnostic characteristic is the position of the oil globule in the yolk-sac (Aboussouan, 1975).

We will now compare the following species:

Macroramphosus scolopax, *Dicentrarchus labrax*, *Trachurus mediterraneus*, *Trachurus picturatus* and *Trachurus trachurus* (see Figure B1 and Figure B2).

Some of these species are poorly described in the literature, such as *Trachurus picturatus* and *Trachurus mediterraneus*.

EGGS

Inconsistencies in the literature must be taken into account while studying the Early Life History stages of fishes. Aboussouan (1975) refers Carangidae eggs with unsegmented yolk. However, yolk of Carangidae eggs is segmented (Padoa, 1956, Marinaro, 1971, Russell, 1976 and Laroche *et al.*, 1984).

Demir (1961) refers *Trachurus trachurus* eggs being larger (0.789-0.947 mm) than *Trachurus mediterraneus* eggs (0.71-0.895 mm) and suggests that environmental conditions, such as salinity and temperature, are the causes of these differences. These measurements are based on eggs from the Sea of Marmara and the Black Sea and we will not consider them here. We will consider the diameters of *Trachurus* spp. eggs from Mediterranean Sea and Atlantic Ocean.

- 1) Spherical with small perivitelline space and one pigmented oil globule
 - a) Segmented yolk
 - i) With oil globule in anterior position in relation to ventral part of the yolk-sac
 - (1) Capsule diameter 0.81-1.04 mm, oil globule diameter 0.19-0.27 mm and yolk with no pigmentation (Laroche *et al.*, 1984, Marinaro, 1971, Padoa, 1956 and Russell, 1976) – *Trachurus trachurus*
 - (2) Capsule diameter 1.0-1.04 mm and oil globule diameter 0.24 mm (Padoa, 1956) – *Trachurus mediterraneus*
 - (3) *Trachurus picturatus* – not described
 - b) Unsegmented yolk
 - i) With oil globule in central position in relation to ventral part of the yolk-sac
 - (1) Capsule diameter 1.10-1.52 mm and oil globule diameter 0.31-0.46 mm – *Dicentrarchus labrax* (Marinaro, 1971 and Russell, 1976).
 - ii) With oil globule in posterior position in relation to ventral part of the yolk-sac
 - (1) Capsule diameter 1.0 mm and oil globule diameter 0.20 mm – *Macroramphosus scolopax* (Spartà, 1936).

Macroramphosus scolopax yolk pigmentation is described as light amber (Spartà, 1936) and light amber with grainy reflections (Hardy, 1978). Pigmentation of oil globule of *M. scolopax* eggs is described in literature (Spartà, 1936 and Hardy, 1978) as amber-rose although in the figures oil globules are displayed with slightly stellate black spots. Our own observations of *M. scolopax* eggs off the Iberian coast confirm the existence of stellate black spots.

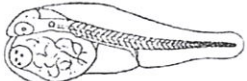
Species	Eggs	Newly hatched larvae
<i>Macroramphosus scolopax</i>	 1 mm	 3 mm
<i>Dicentrarchus labrax</i>	 1.10-1.52 mm	 3.5 mm  4.5 mm
<i>Trachurus mediterraneus</i>	1.0 – 1.04 mm	 2.1 mm
<i>Trachurus picturatus</i>	Not described	Not described
<i>Trachurus trachurus</i>	 0.81-1.04 mm	 2.7 mm  3.2 mm

Figure B1– Early life history stages of different species of Macroramphosidae, Moronidae and Carangidae. Figures redrawn from Spartà (1936); Bertolini (1933); Padoa (1956); and Demir (1961).

LARVAE

Newly hatched

- 1) Oil globule position
 - a) Posterior – *Macroramphosus scolopax* (Spartà, 1936)
 - b) Midway – *Dicentrarchus labrax* (Russell, 1976)
 - c) Anterior – *Trachurus trachurus* (well pigmented on its posterior half, Russell, 1976); *Trachurus mediterraneus* (pigmented on its posterior half, Demir, 1961); and *Trachurus picturatus* (Aboussouan, 1975).
- 2) Pigmentation (melanophores)
 - a) Dorsal and ventral groups of melanophores
 - i) Primordial finfold with melanophores – *Macroramphosus scolopax* (Spartà, 1936).
 - ii) Primordial finfold without melanophores – *Dicentrarchus labrax* (Russell, 1976).
 - b) Melanophores irregularly distributed over the body but tending to form dorsal and ventral rows as development proceeds
 - i) Primordial finfold with melanophores – *Trachurus trachurus* (Demir, 1961 and Russell, 1976).
 - ii) Primordial finfold without melanophores – *Trachurus mediterraneus* (Demir, 1961 and Aboussouan, 1975).
Trachurus picturatus not described.

Early and Late larvae

After yolk absorption, *Trachurus* spp. larvae are very characteristic and can be distinguished from other fish larvae due to the height of the anterior half of the body (Russell, 1976).

Macroramphosus scolopax also have a very characteristic larva from about 4 mm onwards, with the presence of spinous scales along the lateral line (Spartà, 1936 and Hardy, 1978).

- 1) Number of myomeres – are not important characters since the five species have a total number of myomeres varying from 24 to 26, 10 to 12 pre-anal (Laroche *et al.*, 1984).
- 2) Pigmentation (melanophores)
 - a) Melanophores in dorsal groups
 - i) More than 8 regularly distributed between myomeres 18–20 (Aboussouan, 1975)
 - (1) Melanophores on the jaw and on the primordial fin – *Trachurus trachurus*
 - (2) Melanophores absent on the jaw and present on the primordial fin – *Trachurus picturatus*.
 - ii) Few groups irregularly distributed on the jaw and absent on the primordial fin – *Trachurus mediterraneus* (Demir, 1961 and Aboussouan, 1975).
 - iii) One group between myomeres 13–23 and several spots on the primordial fin – *Macroramphosus scolopax* (Spartà, 1936)
 - b) Melanophores in ventral continuous line from the snout to the base of the caudal fin and absent on the primordial fin – *Dicentrarchus labrax* (Russell, 1976).

Species	Larvae	
<i>Macroramphosus scolopax</i>		
	3.4 mm	2.8 mm
		
	2.84 mm	3.55 mm
<i>Dicentrarchus labrax</i>		
	5.0 mm (8 days old)	5.0 mm (12 days old)
<i>Trachurus mediterraneus</i>		
	4.5 mm	7.0 mm
<i>Trachurus picturatus</i>		
	4.0 mm	5.0 mm
<i>Trachurus trachurus</i>		
	6.0 mm	~6.1 mm wild larva

Figure B2– Early life history stages of different species of Macroramphosidae, Moronidae and Carangidae. Figures redrawn from Spartà (1936); Bertolini (1933); Padoa (1956); Aboussouan (1975); and Demir (1961). *Trachurus trachurus* wild larva with ~6.1 mm of standard length was sampled in 1998 off Portuguese coast.

3) Crests

Occipital crests are important larval features of *Tarchurus* spp. These crests develop on the head during the preflexion stage (Laroche *et al.*, 1984). Aboussouan (1975) describes these features and compares their characteristics in *Trachurus trachurus* and *Trachurus picturatus* (Figure B3).

Macroramphosus scolopax develops one supraorbital crest during the preflexion stage, as well as occipital and supraorbital crests at flexion stage (Spartà, 1936 and Hardy, 1978).

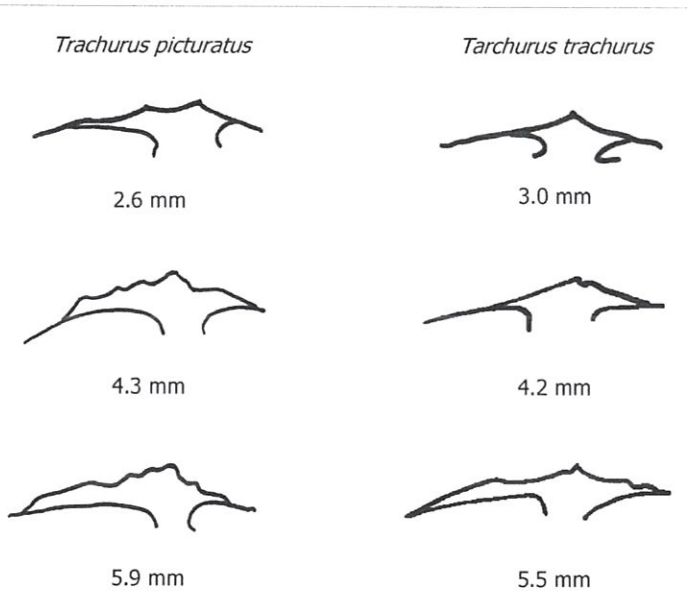


Figure B3— Occipital crests of *Trachurus picturatus* and *Trachurus trachurus* larvae of different lengths. Redrawn from Aboussouan (1975).

C. Perciformes

C.1. Carangidae and Scombridae

The following species will be compared: *Trachurus mediterraneus*, *Trachurus picturatus*, *Trachurus trachurus*, *Scomber japonicus* and *Scomber scombrus* (See Figure C1 and Figure C2).

EGGS

- 1) Spherical with small perivitelline space and with one oil globule
 - a) Segmented yolk and several melanophores rounding the oil globule
 - i) Oil globule in anterior position in relation to ventral part of the yolk-sac
 - (1) Capsule diameter 0.81–1.04 mm; oil globule diameter 0.19–0.27 mm; (Laroche *et al.*, 1984, Marinaro, 1971, Padoa, 1956 and Russell, 1976) yolk-sac with no pigmentation – *Trachurus trachurus*
 - (2) Capsule diameter 1.0–1.04 mm; oil globule diameter 0.24 mm (Padoa, 1956); yolk-sac with no pigmentation – *Trachurus mediterraneus*
 - (3) *Trachurus picturatus*. – not described
 - Aboussouan (1975) refers that the capsule diameter of Carangid eggs varies between 0.7–1.30 mm. We consider egg diameters of *Trachurus picturatus* within this range although not described specifically in the literature. As already mentioned in Section B of this Appendix, we have not considered the results of Demir (1961) for *Trachurus trachurus* and *Trachurus mediterraneus* as far as egg diameters are concerned. We assume no pigmentation in the yolk-sac of *Trachurus* spp. eggs although *Trachurus mediterraneus* and *Trachurus picturatus* are not described in the literature.
 - b) Unsegmented yolk
 - i) Oil globule in posterior/central position in relation to ventral part of the yolk-sac
 - (1) Capsule diameter 1.0–1.38mm; oil globule diameter 0.28–0.35 mm; no pigmentation on yolk; oil globule with melanophores in its anterior half before the caudal extremity is free from yolk (Russell, 1976 and Fritzsche, 1978) – *Scomber scombrus*
 - (2) Capsule diameter 1.06–1.14mm; oil globule diameter 0.26 mm (Olivar and Fortuño, 1991); pigments on the yolk after embryo tail reaches the head; these melanophores migrate ventrally and spread from sides of body forward onto the yolk-sac near the head (Fritzsche, 1978); oil globule with melanophores in its anterior half after the caudal extremity is free from yolk (Fritzsche, 1978) – *Scomber japonicus*

The range of oil globules diameters described for *Scomber japonicus* from Pacific Ocean varies between 0.25 and 0.32 mm (Fritzsche, 1978).

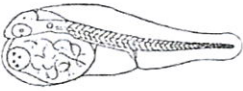
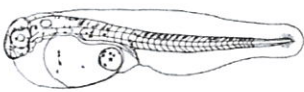
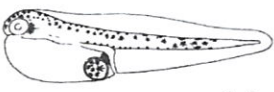
Species	Eggs	Newly hatched larvae
<i>Trachurus mediterraneus</i>	1.0 – 1.04 mm	 2.1 mm
<i>Trachurus picturatus</i>	Not described	Not described
<i>Trachurus trachurus</i>	 0.81-1.04 mm	 2.7 mm  3.2 mm
<i>Scomber japonicus</i>	 0.8-1.35 mm	 3 mm
<i>Scomber scombrus</i>	 1.2 mm	 2.4 mm

Figure C1– Early life history stages of Carangidae and Scombridae. Figures redrawn from Padoa (1956); Demir (1961); Russel (1976); Olivar and Fortuño (1991); and Fritzsche (1978).

LARVAE

Newly hatched

- 1) Oil globule in posterior position in the yolk-sac; position of the anus immediately behind the yolk-sac; melanophores forming one ring surrounding the optic region (Russell, 1976 and Fritzsche, 1978)
 - a) Melanophores over the body
 - i) Double dorsal and ventral rows; no pigmentation on the primordial finfold – *Scomber scombrus* (Russell, 1976)
 - ii) Double dorsal row migrating to ventral row; no pigmentation on the primordial finfold – *Scomber japonicus* (Fritzsche, 1978)

Scombridae suffer strong migratory processes of pigments during development
- 2) Oil globule in anterior position in the yolk-sac; position of the anus well behind the yolk-sac (Aboussouan, 1975, Demir, 1961 and Russell, 1976)
 - a) Melanophores irregularly distributed over the body but tending to form dorsal and ventral rows as development proceeds
 - i) Melanophores on the primordial finfold
 - (1) Yes – *Trachurus trachurus* (Demir, 1961 and Russell, 1976)
 - (2) No – *Trachurus mediterraneus* (Demir, 1961)

Trachurus picturatus pigmentation on primordial finfold is not described.
Melanophores over the head are absent in *Trachurus trachurus* (Russell, 1976) and not described for *Trachurus mediterraneus* and *Trachurus picturatus*.

Early and Late larvae

- 1) Number of myomeres:
 - a) 24-26, 10-12 preanal – *Trachurus* spp. (Laroche, *et al.*, 1984)
 - b) 30-31 – *Scomber scombrus* (Fritzsche, 1978)
 - c) 30-32, 13-15 preanal – *Scomber japonicus* (Fritzsche, 1978, Olivar and Fortuño, 1991)
- 2) Pigmentation (melanophores)
 - a) Preflexion stages
 - i) Dorsal and ventral melanophores in one single row
 - (1) More than 8 melanophores between myomeres 18-20 (Aboussouan, 1975) – *Trachurus trachurus* and *Trachurus picturatus*.
 - (2) *Trachurus mediterraneus* not described although referred as being less pigmented than *Trachurus trachurus* (Demir, 1961).
 - ii) Ventral melanophores in double row
 - (1) Dorsal melanophores in double row (Fritzsche, 1978 and Russell, 1976) – *Scomber scombrus*
 - (2) Dorsal row of melanophores absent (Fritzsche, 1978, Olivar and Fortuño, 1991) – *Scomber japonicus*

- b) Flexion and postflexion stages
- i) Dorsal and ventral melanophores in one single row
 - (1) More than 8 melanophores between myomeres 18–20 and presence of one lateral line of melanophores (Aboussouan, 1975).
 - (a) *Trachurus picturatus* – although not described, Aboussouan (1975) drawings show one lateral line in larvae with 6 mm.
 - (b) *Trachurus trachurus* – lateral line of melanophores begins in preflexion stages at about 3.5–4 mm (Russell, 1976).
 - (2) Less than 8 dorsal melanophores – *Trachurus mediterraneus**
 - **Trachurus mediterraneus* – not described although referred as being less pigmented than *T. trachurus* (Demir, 1961). Although not described, drawings in Demir (1961) show one lateral line on larvae after 4.5 mm.
 - ii) Dorsal and ventral melanophores in double row
 - (1) Starting at some distance behind the anus (Russell, 1976); absence of lateral line of melanophores (Fritzsche, 1978 and Russell, 1976) – *Scomber scombrus* (flexion begins at ~6 mm standard length, Russell, 1976).
 - (2) Dorsal row, at about 8.0 mm of total length, in two groups: the first group between the 7th and 8th myomeres and the second group between the 16th and 27th myomeres (Fritzsche, 1978); at about 7.5 mm the ventral double row of melanophores fuses into one (Olivar and Fortuño, 1991); with one lateral line of melanophores appearing at about 7.4 mm of total length – *Scomber japonicus* (flexion begins at about 4.7 mm, Fritzsche, 1978).

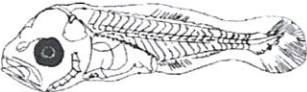
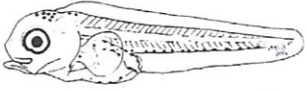
Species	Larvae	
<i>Tachurus mediterraneus</i>	 4.5 mm	 7.0 mm
<i>Trachurus picturatus</i>	 4.0 mm	 6.0 mm
<i>Trachurus trachurus</i>	 5 mm	 ~6.1 mm wild larva
<i>Scomber japonicus</i>	 5 mm	 7.8 mm
<i>Scomber scombrus</i>	 4.5 mm	 6 mm

Figure C2– Early life history stages of Carangidae and Scombridae. Figures redrawn from Padoa (1956); Aboussouan (1975); Demir (1961); Fritzsche (1978); and Russel (1976). *Trachurus trachurus* wild larva with ~6.1 mm of standard length was sampled in 1998 off Portuguese coast.

C.2. Carangidae, Pomatomidae and Sparidae

The following species will be compared: *Trachurus mediterraneus*, *Trachurus picturatus*, *Trachurus trachurus*, *Pomatomus saltatrix*, *Boops boops* and *Pagrus pagrus*.

Pomatomus saltatrix is economically important, with circumglobal distribution in tropical to subtropical waters, except the eastern Pacific. Maybe due to the wide distribution, its phylogeny varies and Early Life History stages have different ontogenetic features turning comparisons difficult. Hardy (1978) present descriptions of different authors. According to this author, the stages described for the Mediterranean Sea by Spartà in 1962, belong to another species. We will use descriptions of eggs and larvae of *Pomatomus saltatrix* from the Western Atlantic and the Black Sea, and will exclude those from Mediterranean Sea (see Figure C3 and Figure C4).

EGGS

- 1) Spherical with small perivitelline space and one small oil globule
 - a) Segmented and unpigmented yolk
 - i) Oil globule in central position before blastopore closure and in anterior position after blastopore closure; oil globule with melanophores after blastopore closure
 - (1) Capsule diameter 0.76–1.04 mm; oil globule diameter 0.19–0.27 mm; yolk unpigmented (Laroche *et al.*, 1984, Marinaro, 1971, Padoa, 1956 and Russell, 1976) – *Trachurus trachurus*
 - (2) Capsule diameter 1.0–1.04 mm; oil globule diameter 0.24 mm (Padoa, 1956) – *Trachurus mediterraneus*
 - (3) *Trachurus picturatus* – not described
 - Trachurus mediterraneus* and *Trachurus picturatus* yolk-sac pigmentation is not described in the available literature.
- b) Unsegmented yolk
 - i) Oil globule in central position in relation to the ventral part of yolk-sac
 - (1) With pigmented yolk
 - (a) Yolk is pale amber and with melanophores appearing after blastopore closure and migrating with development; oil globule deep amber and with melanophores after blastopore closure; capsule diameter 0.80–1.20 mm; oil globule diameter 0.22–0.30 mm (Hardy, 1978) – *Pomatomus saltatrix**
 - *Eggs sometimes described with granulous yolk (Marinaro, 1971).
 - (2) With unpigmented yolk
 - (a) Oil globule with melanophores irregularly distributed; capsule diameter 0.77–0.98 mm; oil globule diameter 0.21–0.23 mm (Radonić *et al.*, 2005 and Saka *et al.*, 2005) – *Pagrus pagrus*
 - (b) Oil globule with melanophores; capsule diameter 0.89 mm; oil globule diameter 0.29 mm (Gaetani, 1937) – *Boops boops***
 - **Although not described in the available literature, Gaetani (1937) drawings of *B. boops* egg show unpigmented yolk and some melanophores over the oil globule hemisphere facing the embryo body.

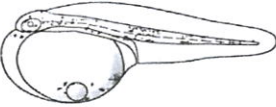
Species	Eggs	Newly hatched larvae
<i>Trachurus trachurus</i>	 0.81-1.04 mm	 2.7 mm  3.2 mm
<i>Pomatomus saltatrix</i>	  0.8-1.20 mm	 Size unknown
<i>Pagrus pagrus</i>	 1.00 mm	 2.64 mm  3.44 mm
<i>Boops boops</i>	 0.89 mm  0.82 mm wild egg	 3.2 mm

Figure C3– Early life history stages of Carangidae, Pomatomidae and Sparidae. Figures redrawn from Padoa (1956); Fritzsche (1978); Gaetani (1936); and Gaetani (1937). *Boops boops* egg in advanced staged was sampled in the year 2007 off Portuguese coast.

LARVAE

Newly hatched

- 1) Position of the anus well behind the yolk-sac and oil globule in anterior position; melanophores irregularly distributed over the body
 - a) Melanophores on the primordial dorsal finfold (Demir, 1961 and Russell, 1976) – *Trachurus trachurus*
 - b) Absence of melanophores on the primordial dorsal finfold (Aboussouan, 1975 and Demir, 1961) – *Trachurus mediterraneus* and *Trachurus picturatus*
- 2) Position of the anus immediately behind the yolk-sac
 - a) Oil globule in central position (Hardy, 1976) – *Pomatomus saltatrix* from the Black Sea*
**P. saltatrix*, during yolk-sac stage, develops melanophores on the anterior outer edge of dorsal finfold; *P. saltatrix* of NW Atlantic is described as having the oil globule in a posterior position (Hardy, 1978).
 - b) Oil globule in posterior position
 - i) With melanophores over the head
 - (1) Double dorsal row of melanophores; as larva develops melanophores spread out onto the finfold; melanophores on the primordial finfold (Hardy, 1978) – *Pomatomus saltatrix* of NW Atlantic.
 - (2) Single dorsal and ventral rows of melanophores; dorsal row disappear during the yolk-sac stage; primordial finfold without melanophores (Gaetani, 1937) – *Boops boops***.
 - ***B. boops* larvae have two single and big stellate contour chromatophores situated at about midway of the postanal part of the body. They are referred in literature as xanthophores but, from our own observations, seem to be melanophores.
 - ii) Without melanophores over the head; melanophores are irregularly distributed over the body, disappearing as development progress; one single ventral row of irregularly distributed melanophores after the former vanished; primordial finfold without melanophores (Gaetani, 1936) – *Pagrus pagrus*.

Early and Late larvae

- 1) Number of myomeres:
 - a) 24, 9 preanal in early larvae and about 12 in late larvae (Hardy, 1978) – *Pomatomus saltatrix*
 - b) 24-26, 10-12 preanal (Laroche, *et al.*, 1984) – *Trachurus* spp.
 - c) 23, 6 preanal (Gaetani, 1936) – *Pagrus pagrus*
 - d) 24, 6 preanal (Gaetani, 1937) – *Boops boops*
- 2) Preflexion stage
 - a) Ventral postanal melanophores
 - i) In double row
 - (1) Dorsal postanal melanophores in double row with its origin at about the 6th myomere; a conspicuous stellate melanophore at the base of pectoral fin (Hardy, 1978) – *Pomatomus saltatrix*
 - ii) In one single row
 - (1) Dorsal single row of melanophores; lateral line of melanophores
 - (a) More than 8 melanophores on dorsal ridge regularly distributed between myomeres 18 and 20; head spination consisting of one occipital crest (see Figure C3) which develops during preflexion stage and preopercular spines increasing in number during development (Aboussouan, 1975, Russell, 1976 and Laroche *et al.*, 1984) – *Trachurus picturatus* and *Trachurus trachurus*
 - (b) Less melanophores on dorsal ridge than *Trachurus trachurus* (Demir, 1961); melanophores on dorsal ridge are irregularly distributed; head spination consisting of one occipital crest (see Figure C3) and preopercular spines increasing in number through development (Aboussouan, 1975) – *Trachurus mediterraneus*

- (2) One single and large dorsal melanophore; one melanophore on the caudal ventral margin which will remain during further stages of development; absence of lateral line of melanophores (Gaetani, 1937) – *Boops boops*
 - (3) Absence of dorsal melanophores; caudal ventral margin with one small melanophore after about 4.00 mm total length which persists till postflexion stage; absence of lateral line of melanophores; head spination consisting of one occipital crest and very early preopercular spines (Gaetani, 1936) – *Pagrus pagrus*.
- 3) Flexion and postflexion stage
 - a) Ventral melanophores in one single row
 - i) Dorsal melanophores in one single row
 - (1) More than 8 dorsal melanophores between myomeres 18 and 20; lateral line of melanophores; head spination consisting of occipital crest and opercular spines (Aboussouan, 1975, Russell, 1976) – *Trachurus picturatus** and *Trachurus trachurus*
 *Although not described, Aboussouan (1975) drawings show one lateral line on *T. picturatus* larvae with 6 mm length.
 - (2) Less than 8 dorsal melanophores; head spination consisting of occipital crest and opercular spines (Demir, 1961) – *Trachurus mediterraneus***
 **Although not described, Demir (1961) drawings show one lateral line on *T. mediterraneus* larvae after 4.5 mm.
 - ii) One single dorsal melanophore in flexion stage, two in postflexion stage (Gaetani, 1937) – *Boops boops****
 ****Boops boops* – is depicted in the literature (Gaetani, 1937) in postflexion stages with about 14.08 mm of total length, with one row of melanophores along the lateral line between myomeres 14 and 25, one per myomere.
 - iii) Absence of dorsal melanophores and very scarce ventral postanal melanophores in one single row; absence of lateral line of melanophores (Gaetani, 1936); head spination consisting of occipital crest and opercular spines – *Pagrus pagrus*
 - b) Ventral and dorsal melanophores in double row forming relatively solid lines; origin of dorsal and ventral pigment rows at about the 9th myomere (Hardy, 1978); lateral pigment band first as single melanophores, sometimes arranged as short dashes, about one per myomere, between the 16th and 20th myomeres; flexion begins at about 5 mm standard length; during flexion 8-9 dorsal and 6-7 preopercular spines develops (Hardy, 1978); few small spines along the posterior margin of preopercle (Johnson, 1984) – *Pomatomus saltatrix*.

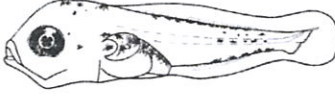
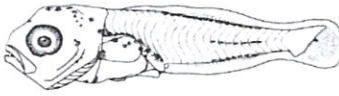
Species	Larvae	
<i>Trachurus trachurus</i>	 5 mm	 ~6.1 mm wild larva
<i>Pomatomus saltatrix</i>	 5 mm	 6 mm
<i>Pagrus pagrus</i>	 2.7 mm	 4.64 mm
	 3.56 mm	 5.28 mm
<i>Boops boops</i>	 5.2 mm	 6 mm

Figure C4— Early life history stages of Carangidae, Pomatomidae and Sparidae. Figures redrawn from Padoa (1956); Fritzsche (1978); and Gaetani (1937). *Trachurus trachurus* wild larva with ~6.1 mm of standard length was sampled in 1998 off Portuguese coast.

EGGS AND LARVAE OF TWO TROPICAL FISHES OCCURING IN PORTUGUESE WATERS

The distribution, ecology and spawning seasons of fish species are normally used by planktonologists as characteristics to aid in the difficult identification of early life stages. Environmental changes are presently globally reported (e.g. Reid *et al.*, 2001, Stenseth *et al.*, 2002) and must be recognised as potential causes for possible alterations to the distribution of adult fish and of their spawning products.

Already in last decade, typically tropical species have been shown to occur in more northerly latitudes than was previously recognised. Among these we will consider here the Red cornetfish *Fistularia petimba*, Lacépède 1803 (Syngnathiformes: Fistulariidae) and monrovia doctorfish *Acanthurus monroviae*, Steindachner, 1876 (Perciformes: Acanthuridae) recently reported off the Iberian waters (Cardénas *et al.*, 1997, Bañón and Sande, 2008 and Martins, pers. comm.).

Although the Early Life History stages of these species cannot be mistaken for any other here described, we considered their inclusion in the following pages of special interest, due to the high possibility of their occurrence in plankton samples.

Fistulariidae

Red cornetfish (*Fistularia petimba*, Lacépède, 1803) is found in its adult stage, in deeper waters along continental margins and was found off Portuguese continental waters in 2008 (Martins pers. comm.) and Azores waters in 2004 (Azevedo *et al.*, 2004).

FISTULARIIDAE

Fistularia petimba Lacépède, 1803

MERISTICS

Fins:

- Dorsal rays – 13-15
- Anal rays – 14-15
- Pelvic rays – 5-6 (for the Family)
- Pectoral rays – 13-18

Myomeres:

- Total number – 82-86
- Preanal number – 53
- Postanal – 33

LIFE HISTORY

Range: Throughout tropical Atlantic, Indo-West Pacific and Hawaii.

Habitat: Inhabits soft-bottomed inshore waters, usually at depths over 10 meters.

Spawning season: February in Pacific Ocean.

ELH pattern: oviparous, planktonic eggs and larvae.

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EARLY LIFE HISTORY DESCRIPTION

EGGS

- Capsule diameter – 1.50-2.10 mm
- No. of oil globules – 0
- Shell surface – smooth
- Pigment –
- Yolk – unsegmented
- Diameter of oil globules –
- Diagnostic features – spherical, no oil globule, small perivitelline space.

LARVAE

- Hatching length – 7.08 mm
- Yolk-sac absorption –
- Flexion length –
- Transformation length –
- Pigmentation – Light pigmentation. Newly hatched larvae are pigmented along dorsal and ventral body contours, on yolk, along ventral wall of gut near anus, and extended into ventral finfold on posterior half of tail.
- Diagnostic features – Develops small spines on body ("villosa-stage").

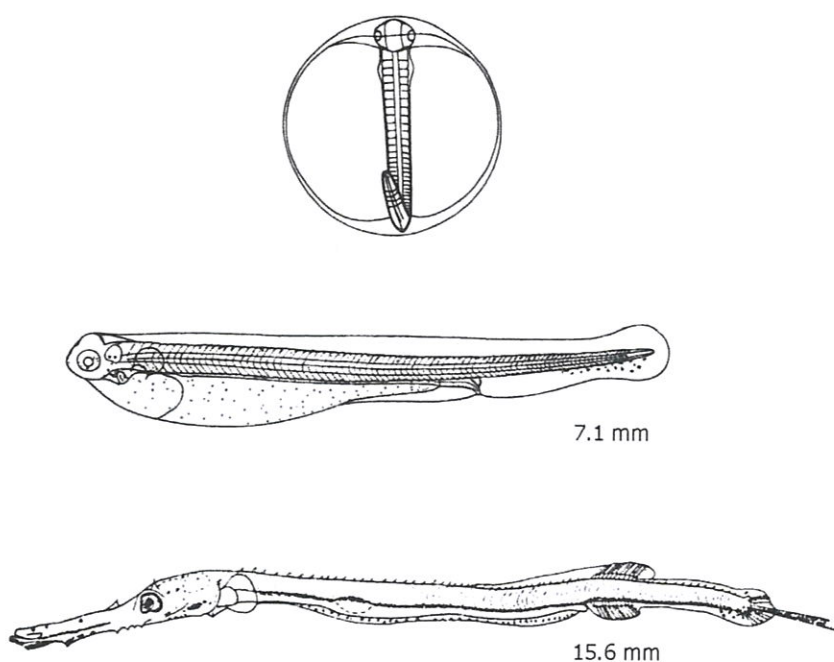


Figure D— Early life history stages of *Fistularia petimba*. Redrawn from Moser, *et al.* (1984).

Acanthuridae

Monrovia doctorfish (*Acanthurus monroviae*, Steindachner, 1876) is a coastal demersal species found in the mouth of rivers and coastal lagoons, on rocky and coral bottoms (Leis and Richards, 1984). Depth distribution 5-200 m. The reported range of distribution at Eastern Atlantic tropical latitudes, varies between 30° N and 15° S (water temperatures between 20 and 25 °C). In recent years, Scuba divers reported the presence of this species off the Portuguese coast. Early life stages of this species are poorly described in literature.

ACANTHURIDAE

Acanthurus monroviae Steindachner, 1876

MERISTICS

Fins:

Dorsal rays – 24-26 (adults)

Anal rays – 24-26(adults)

Pelvic rays –

Pectoral rays –

Myomeres:

Total number – 22

Preanal number – 3-4

Postanal – 18

LIFE HISTORY

Range: Eastern Atlantic from 30° N to 15° N

Habitat: Inhabits inshore waters on rocky and coral bottoms, in the mouth of rivers and lagoons.

Spawning season:

ELH pattern: oviparous, pelagic eggs and planktonic larvae.

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EARLY LIFE HISTORY DESCRIPTION

EGGS

Capsule diameter – < 1mm

No. of oil globules – 1

Shell surface –

Pigment –

Yolk - unsegmented

Diameter of oil globules –

Diagnostic features –

LARVAE

Hatching length – 2.5 mm

Yolk-sac absorption – unknown

Flexion length – ~4.7 mm; with scales shortly after flexion

Transformation length – ~6.0 - 7 mm

Pigmentation – Gut dorsal wall heavily pigmented. Ventral postanal body contour with small chromatophores until caudal region. Occipital region and supraorbital region of the head with several small chromatophores and few large branched chromatophores.

Diagnostic features – Head and trunk remarkably deepened. Develop big ventral and dorsal spines, early stages (1.9–2.1 mm). Develops one anal spine ~3.1 mm. Tubular snout with a little mouth and spines on its mandible. Strong backward bending spines on superior ridge of the head.

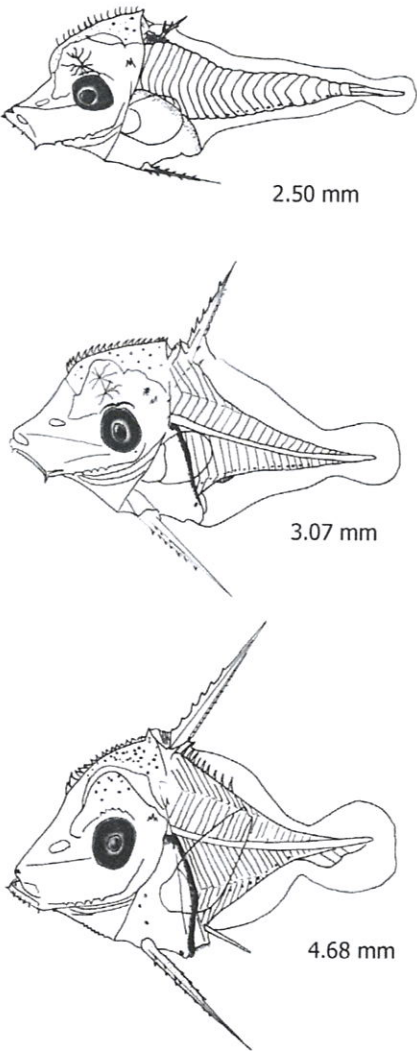


Figure E– Early life history stages of *Acanthurus monroviae*. Redrawn from Aboussouan (1965).

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