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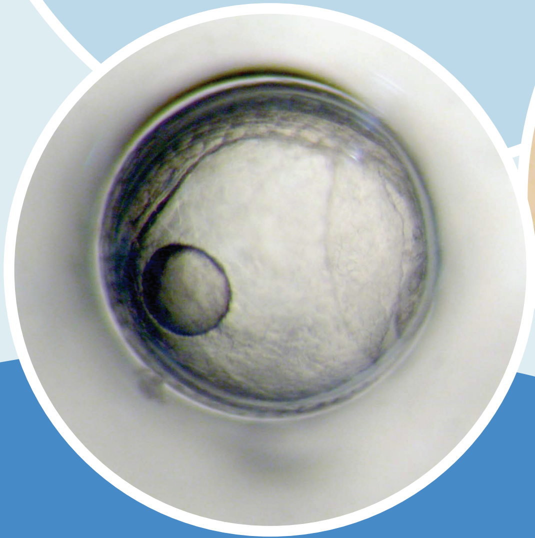

A guide to the eggs and larvae of 100 common Western Mediterranean Sea bony fish species

Cover photographs (clockwise from top left):
Larva of *Trisopterus luscus*, © J.M. Rodríguez
Yolk-sac-larva and egg of *Xiphias gladius,* © A. García

A guide to the eggs and larvae of 100 common Western Mediterranean Sea bony fish species

by

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PREPARATION OF THIS DOCUMENT

The study of ichthyoplankton is crucial in understanding the dynamics of fish populations. The knowledge of the distribution and abundance of fish eggs and larvae, obtained through plankton surveys can, among other things, help scientists improve the understanding of the spatial distribution of fisheries resources and the processes affecting the fluctuations in recruitment; two important underpinnings of fish stocks assessment and management. The FAO Regional Project "CopeMed Phase II": Coordination to Support Fisheries Management in the Western and Central Mediterranean" has among its priorities the strengthening of research capabilities in its member countries in support of sustainable management of fishery resources. In February 2016, the Project organized a course on ichthyoplankton identification at the Spanish Institute of Oceanography, in Fuengirola (Málaga). For this course, the lecturer and co-author of this guide, J.M. Rodríguez, prepared a collection of technical sheets for several larval fish species with their corresponding description and illustrations. During the course, the scarcity of identification guides for the Mediterranean Sea was noticed. Participants asked the organizers to expand the number of sheets of the species used at the course and requested that CopeMed II publish a FAO Guide including the most common species occurring in the Mediterranean Sea. The present guide is the outcome of this process. It presents the egg and larval descriptions of 100 species of fishes belonging to 55 families, which are most likely to be present in the plankton samples collected in the continental shelf and oceanic waters of the Western Mediterranean Sea. The document is not meant to be a complete guide for ichthyoplankton of the Western Mediterranean Sea but a comprehensive tool with which to support students and researchers new to the field of ichthyoplankton identification.

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ABSTRACT

This guide presents the egg and larval descriptions of 100 species of fishes belonging to 55 families, which are most likely to be present in plankton samples collected in the continental shelf and oceanic waters of the Western Mediterranean Sea. The guide is structured in two parts. The first introductory part describes the different applications of ichthyoplankton studies in fisheries research, the main sampling strategies, methods and gears, the early life history of fishes and how to identify them. A brief historical account of ichthyoplankton identification studies in the Mediterranean Sea is also provided. The second part of the guide contains the identification sheets of the species. Each species sheet includes the following information: illustration of the adult fish and information on its habitat and spawning season; description of the main features useful towards identifying the egg, yolk sac and larval stage of each fish species; illustrations and (when available) photos of the different life stages.

CONTENTS

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1. INTRODUCTION

1.1 What is ichthyoplankton?

The early life stages (eggs and larvae) of marine fishes are referred to as ichthyoplankton (Fig. 1). Some species of marine fishes produce demersal eggs that lay on the sea bottom, or are even deposited in nests. Demersal eggs of a number of species are under parental care, extended in some exceptional cases, such as in sea horses, to the larval stage. However, most marine fish species spawn pelagic eggs. Larvae hatched from pelagic and from most demersal eggs are pelagic. Due to their null (eggs) or limited (larvae) swimming abilities, they are both integrated within the plankton community as part of the meroplankton (organisms that only spend part of their life cycle within the plankton community). Ichthyoplankton is mainly found in the upper layers (from 200 m depth to the surface) of the water column, where it is subject to spatial dispersion, mainly by marine currents. The planktonic stage of fishes usually lasts from a couple of weeks to a few months (Victor, 1986; Brothers *et al.*, 1983).

During the larval stage, larvae develop specializations for the planktonic life and other important changes occur. For example, most fishes increase their weight by five orders of magnitude throughout their life and three of them occur during the planktonic stage (Werner and Gilliam, 1984; Houde, 1987; Miller *et al.*, 1988). The end of the larval stage is marked by a metamorphosis or transformation process, more or less abrupt depending on the species, during which the larva becomes a juvenile

Figure 1. Ichthyoplankton sample

that is morphologically similar to the adult and has the meristic characters of the species. Juveniles of pelagic species are integrated in the nekton community and those of most demersal species migrate directly to the bottom, after the metamorphosis. However, in several demersal species, where the transformation is prolonged, there is an intermediate stage (called the pre–juvenile stage) where the fish develops specializations that are distinct from both larvae and juveniles. These pelagic pre–juveniles eventually transform into demersal juveniles (Kendall *et al.*, 1984). Pelagic pre–juveniles of demersal species and the early juveniles of the pelagic ones maintain an intense relationship, mainly trophic, with the plankton community, but because of their behaviour and swimming abilities, they cannot be considered ichthyoplankton, they become part of the micronekton.

1.2 Why study ichthyoplankton?

There are several reasons for studying ichthyoplankton. For example, information regarding the distribution and abundance of fish eggs and larvae can provide clues to spawning locations and environmental requirements of important fish species. Moreover, the knowledge of ichthyoplankton is necessary because, as one of the components of the pelagic food web (Raymont, 1983), it can represent an important link between smaller planktonic and larger nektonic organisms. In addition, as most fishes inhabit the upper water column during their early life history and have limited avoidance capability, ichthyoplankton surveys provide a relatively low–cost efficient means to monitor marine fish populations and communities (Koslow and Wright, 2016). Finally, survival of fish larvae may directly influence future abundances of adult fish stocks. The latter has been and it still is the most important reason for studying ichthyoplankton, as most processes determining the recruitment strength and the spatial distribution of fish populations occur during the planktonic stage of fishes, resulting in important interannual fluctuations in fish stock biomasses. Such fluctuations have been known for centuries, but they started to worry scientists and fishery managers only at the end of the nineteenth century (Petersen, 1894; Garstang, 1900). Initially, it was thought that fishing pressure itself or fish migrations were responsible for such fluctuations, but at the beginning of the twentieth century, Hjort (1914, 1926), after analysing the causes of the successful herring year–class of 1904, suggested that the variability in "year–class success" was determined during the early life stages of fishes. He proposed two hypotheses to explain those fish stock fluctuations resulting from interannual recruitment variability, the *Critical Period Hypothesis* and the *Aberrant Drift Hypothesis*, or larval transport to unfavourable areas (due to interannual variability in ocean circulation), from which juveniles could not recruit to the exploited stock.

According to the *Critical Period Hypothesis*, the strength of a year–class is determined shortly after yolk–sac absorption, at the beginning of exogenous feeding, when larvae must find suitable prey and in sufficient amounts (Fig. 2). Failing to find adequate feeding conditions would lead to massive larval mortality, in a short period of time. Hjort's hypotheses laid the groundwork for future research on recruitment variability, mainly focused on the *Critical Period Hypothesis* (Cowan and Shaw, 2002; Houde, 2008), fostering the development of "recruitment fisheries oceanography" as a multidisciplinary science to investigate the spectrum of oceanographic processes controlling recruitment (Kendall and Duker, 1998).

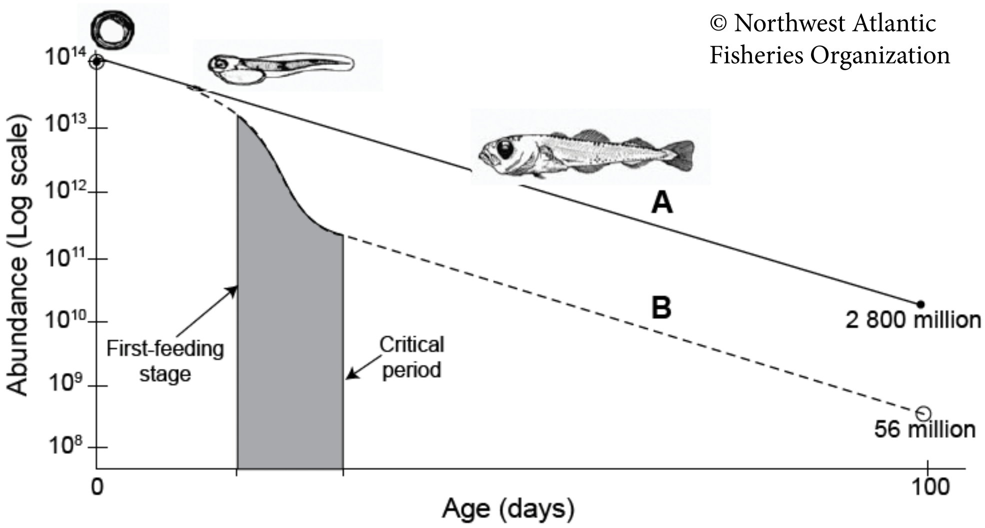


Figure 2. Illustration showing the Hjort's Critical Period Hypothesis (1914, 1926). From Houde (2008).

Cushing (1974, 1990) merged both Hjort's hypotheses into the *Match/Mismatch Hypothesis*. He hypothesized that a fixed time of spawning coupled with a variable time of plankton blooms generates a variability in larval fish survival and, hence, variable recruitment. In this hypothesis, food limitation at any time of the larval period, rather than mortality being concentrated at a specific larval stage, could be a major contributor to the recruitment variability. In addition, abiotic factors that regulate water–column mixing and the timing and intensity of seasonal production cycles may be involved.

Lasker (1981), in the *Stable Ocean Hypothesis*, proposed that the occurrence and frequency of calm periods in upwelling ecosystems (named Lasker events) lead to stratification of the water column and, hence, the aggregation of fish larvae and their prey, supporting high larval feeding, survival and recruitment. A further extension of Lasker's *Stable Ocean Hypothesis* was the *Optimal Environmental Window* (OEW) *Hypothesis* by Cury and Roy (1989). These authors hypothesized that, in upwelling ecosystems, the relationship between annual recruitment of small pelagic fish species (sardines and anchovies) and upwelling intensity is dome shaped, confirming the existence of an optimal environmental window for recruitment, with recruitment most successful under moderate (roughly 5–6 m*s–1) wind stress that controls both ichthyoplankton advective losses and food availability for fish larvae. On the contrary, weak winds, if prolonged, disrupt the upwelling process and the renewal of nutrients in the surface layer, inducing nutrient limitation, which reduces primary productivity (Huntsman and Barber, 1977) and food availability for fish larvae. Finally, strong winds generate strong turbulence that also limits primary productivity (Huntsman and Barber, 1977) and increases the offshore transport of fish egg and larvae (Bakun and Parrish, 1982)

Based on the Hjort's *Aberrant Drift Hypothesis*, Iles and Sinclair (1982) and Sinclair (1988) proposed the *Larval Retention or Member/Vagrant Hypothesis*. In this hypothesis, larval retention, not levels of available prey, is critical in the recruitment process.

For tropical reef fish species, Sale (1978, 1991) proposed the *Lottery Hypothesis*, which states that recruitment in tropical reef fishes is strongly dependent on delivery potential to the reef of settlers and that post–settlement processes could control recruitment levels. However, nowadays, both pre– and post–settlements processes are acknowledged to influence recruitment (Jones, 1991; Doherty, 2002).

The above hypotheses consider starvation and physical processes as the main drivers of recruitment variability; however, there is strong evidence that predation is the main source of ichthyoplankton mortality and, consequently, the main factor influencing recruitment (Hunter, 1981; Bailey and Houde, 1989). Mortality from nutritional deficiencies and predation may not act independently. Slow–growing and small fish larvae remain relatively vulnerable to predation for longer periods of time. This is the foundation of the *Stage–Duration Hypothesis*, which implies that large size ("bigger is better") and fast growth improves survival potential (Houde, 1987; Anderson, 1988; Houde, 2008).

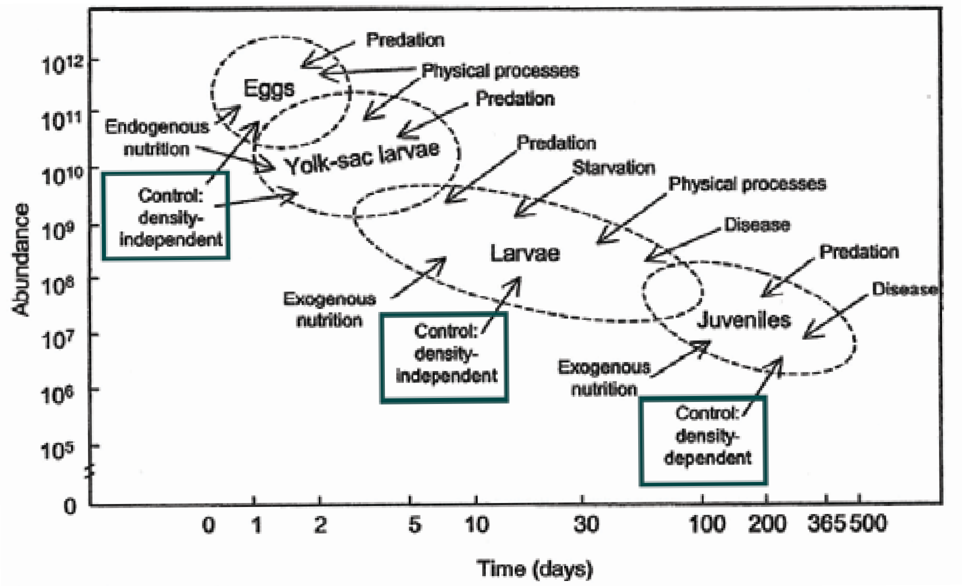


Figure 3. Schematic diagram of different processes acting on the early stages of a marine fish (eggs, yolk–sac larvae, larvae and juveniles). From Houde (1987).

In summary, although Hjort focused on starvation of first–feeding larvae as the main driver of larval mortality, he already envisaged that recruitment variability was the result of complex, interacting factors, stating that "*the simultaneous investigation of meteorology, hydrography and biology seems the only way to a deeper understanding of the conditions in which the destiny of the spawned ova is being decided*" (Hjort, 1926). In this line, nowadays it is widely agreed that recruitment variability is the outcome of complex trophodynamic and physical processes, operating on different temporal and spatial scales and throughout the pre–recruit life stages of fishes (Fig. 3). That is to say, recruitment success is not determined during a particular ontogenetic stage and it depends on the species, populations and environmental conditions (Houde, 2008). In this way, the knowledge of the ecology of the early life stages of fishes is crucial to understanding the population dynamics of fish stocks, but also, the functioning of marine ecosystems.

New discoveries, technological advances and new analytical techniques, developed in the last decades, have allowed for significant advances in the knowledge of the causes of mortality of the early life fish stages. One of the major findings was the discovery by Pannella (1971) that growth rings in fish otoliths are deposited daily. Brothers *et al.* (1976) confirmed the presence of daily growth rings in otoliths of fish larvae (Fig. 4). This finding allowed for the estimation of growth and mortality rates during the larval stage, and for the cohort contributions to recruitment (Methot, 1983; Miller *et al.*, 1988; Houde, 1997). The analysis of the otolith's microstructure also allows for assessing the environmental influence on larval survival, dating, with high precision, early life events and relating them to environmental conditions.

Other indicators useful for determining the nutritional status and recent growth rate in fish larvae are the RNA/DNA ratio (Buckley, 1979, 1980, 1984) and the nitrogen (N) and carbon (C) stable

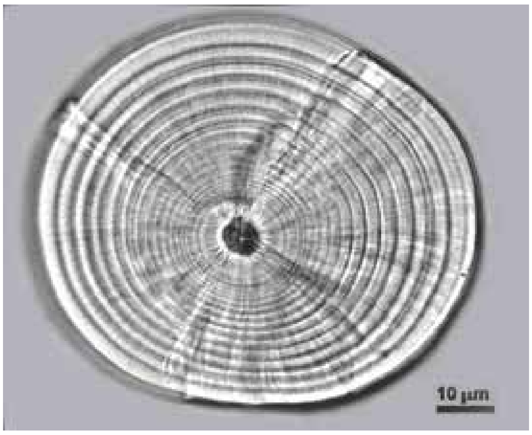


Figure 4. Otolith of a sardine (*Sardina pilchardus*) larva

isotope analysis (SIA). The latter is used to assess the trophic position and C flow to consumers in food webs (Minagawa and Wada, 1984, Peterson and Fry 1987, Post, 2002). Specifically, 15N provides an estimate of the trophic level, and 13C can be used to assess the sources of C for an organism when the isotopic nature of the sources is different, since C isotope ratios undergo small changes within the food web (Peterson and Fry, 1987, France and Peters, 1997). The SIA analysis has also been used recently to assess the trophic ecology of fish larvae (e.g. Laiz–Carrión *et al.*, 2013, Laiz–Carrión *et al.*, 2015). Finally, advances in telemetry have allowed synoptic sampling of environmental variables over large areas and advances in computer power the development of biophysical models, simulating larval drift and survival under real or hypothetical environmental scenarios.

1.3 Applications of ichthyoplankton studies in fisheries research

One of the main objectives of ichthyoplankton field studies is the direct assessment of the number or biomass of exploitable populations (Heath, 1992). This is based on the fact that for some fish populations there may be a relationship between the number of eggs and/or larvae in a given area and the number or biomass of spawning adult fish, and this can be used to estimate the size of the adult population (Heath, 1992). There are six direct methods that use ichthyoplankton production for estimating the abundance of fish stocks, three based on eggs and three on larvae, with the latter used for demersal spawners (Stratoudakis *et al.*, 2006). The underlying principle of the ichthyoplankton–based methods is that the abundance of an early life stage of a fish species can be used to estimate the reproductive outcome of the population over a time period (Stratoudakis *et al.*, 2006).

Of the three methods based on eggs production, the *Daily Egg Production Method* (DEPM), the most widely used, was developed for small pelagic fishes (such as anchovies and sardines) that exhibit indeterminate fecundity (Lasker, 1985; Parker, 1980). Fecundity is indeterminate when the potential annual fecundity of a female is not fixed prior to the onset of spawning and unyolked oocytes continue to be matured and spawned during the spawning season (Hunter *et al.*, 1992). The advantage of the DEPM is that it only requires a single survey to estimate the daily egg production at sea and the daily specific fecundity at the peak of the spawning period (Parker, 1980). In addition, the application of this method provides information about the reproductive biology and reproductive behaviour of a population and about the distribution, mortality and development of the early life fish stages, which are of particular importance for studying the underlying mechanisms of recruitment (Murua *et al.*, 2010). The other two methods based on eggs, the *Annual Egg Production Method* (AEPM) (Lockwood *et al.*, 1981) and the *Daily Fecundity Reduction Method* (DFRM) (Lo *et al.*, 1992) were developed for species with determinate fecundity, for which the potential annual fecundity becomes fixed prior to the onset of spawning (Hunter *et al.*, 1992). Where egg production methods are impractical, a larval census has been employed to obtain a relative index of the spawning biomass (Heath, 1992).

Larval survey data can be used to obtain estimates of recruitment. The estimation or forecasting of recruitment strength, under variable environmental scenarios, is essential for the proper management of fish stocks, particularly in a context of relatively rapid climate change. Moreover, the implementation of the *Ecosystem Approach to Fisheries* (EAF), where fisheries management recognizes the full range of interactions within a marine ecosystem (Katsanevakis *et al.*, 2011), has led to an increase of studies aimed at understanding recruitment and its underlying processes. In addition, a holistic understanding of ecosystems, of the environmental influence on fish population, especially on their highly vulnerable early life stages, is required to implement the EAF. This knowledge is also essential towards implementing the *Ecosystem–Based Management of Fisheries* (EBMF), in which the order of management priorities is inverse to the customary norm, addressing the status of ecosystems, rather than that of the fishery resources (Pikitch *et al.*, 2004; Cogan *et al.,* 2009).

Furthermore, ichthyoplankton studies can provide a lot of information on the ecology and structure of fish populations, in a cheaper and simpler way than information obtained studying juvenile or adult populations. Thus, a single collection of plankton hauls can give information about most fish species spawning in a given area, both pelagic and demersal, whereas sampling of adults would require larger vessels and a variety of sampling gears and methodologies. Ichthyoplankton surveys can also be used for the prospection of new resources, determining the timing and location of spawning areas and their variations or estimating the relative abundance of different stocks and monitoring their abundance trends over time.

1.4 Ichthyoplankton sampling strategies, methods and gears

Any study on ichthyoplankton communities is based on two pillars: an adequate sampling strategy for the specific objectives to be achieved and a correct taxonomic identification of the target taxa. There is a great variety of sampling strategies, from large–scale surveys to intensive sampling of a single patch of larvae tracked by means of a Lagrangian buoy (a free–floating buoy that moves with a parcel of water). The sampling methodology to be followed and the sampling gear to be used will depend on the objectives of the study, on the target species and/or the early life stages to be sampled.

It is out of the scope of this guide to explain in detail all possible sampling strategies or describe the different types of ichthyoplankton sampling devices and sampling methods. However, it is worth illustrating those that are most frequently used and the potential sources of bias affecting sample representativeness.

As already explained, many ichthyoplankton studies are aimed at estimating the biomass of adult fish stocks, either by using eggs or larvae. When using eggs for e.g. applying the *Daily Egg Production Method* (DEPM), the gear employed is the CalVET net in vertical hauls, and the sampling strategy

Figure 5. Left, CalVET net and right, Bongo net

consists of sampling stations arranged in a regular grid, with a short distance between stations, covering the whole spawning area of the fish stock to be studied. When the objective is to estimate the biomass of an adult fish stock using larvae, to study the horizontal distribution of fish eggs and larvae of specific species or, in general, the ichthyoplankton community of an area, the most adequate sampling gear to be used is the Bongo net (Fig. 5). Hauls are oblique and the sampling strategy consists of sampling a regular grid of stations. Ichthyoplankton hauls must cover the depth distribution range of the target species or, if the goal is to sample the entire ichthyoplankton community, at least the upper 200 m of the water column, where most fish eggs and larvae are concentrated.

When the aim of ichthyoplankton studies is to investigate the vertical distribution of fish eggs and larvae and/or the vertical (diel and/or ontogenetic) migrations of fish larvae, a multiple net system, capable of sampling successive water layers during the same tow, is required (Fig. 6). Hauls are also oblique.

Figure 6. Multiple net systems. Left, MultiNet sampler and right, MOCNESS net

Neuston nets are used to sample the very most surface water layer (Fig. 7). Large micronekton nets, fitted with meshes of the size of 1 mm or larger, may also be necessary for effectively sampling larger larvae. Light traps are used for capturing advanced post–larvae in pre–settlement stages.

Figure 7. Neuston net

Ichthyoplankton samples can also be obtained with continuous sampling systems, such as the *Continuous Underway Fish Egg Sampler* (CUFES), capable of collecting plankton as the research vessel is sailing. It consists essentially of a pump that draws seawater at a given depth and sends it through a plankton collector, where plankton is retained (Fig. 8). The collector is changed and plankton collected after a fixed period of time. While CUFES is running, a data logger records the date, time, and position of each sample, as well as other environmental data from the ship's sensors.

In the last decades, new and more sophisticated sampling systems are being implemented. In situ ichthyoplankton imaging systems or plankton acoustics, despite not providing biological samples for other types of analyses, can produce impressive amounts of data on larval abundance or biomass, over large areas in relatively shorts periods of time (Cowen and Guigand, 2008; Garcia–Seoane *et al.*, 2016)

Any sampling aimed at obtaining quantitative data on ichthyoplankton requires knowing the exact volume of water filtered by the net during each haul. This is done by using flowmeters attached to the mouth of the net. Flowmeters measure the length of the haul path, which, multiplied by the surface

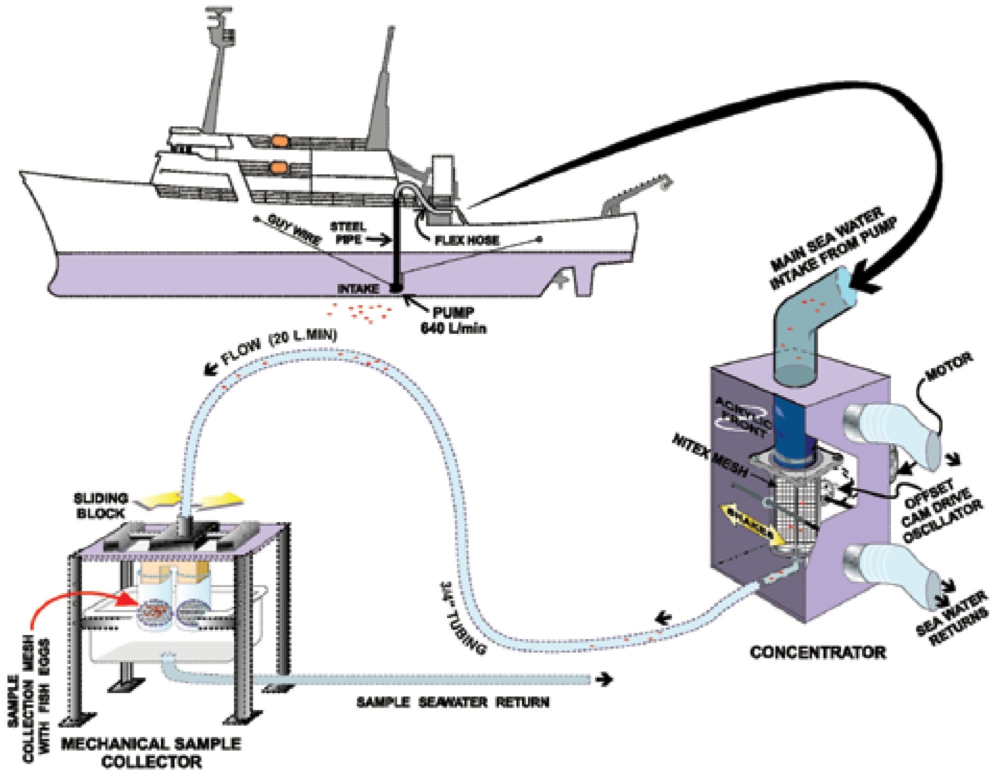


Figure 8. Continuous underway fish egg sampler (CUFES) (http://cufes.ucsd.edu/text/descr.htm)

of the mouth of the net, gives the volume of water filtered by the net during the haul. This allows standardization of fish eggs and larvae captured in each haul to number of individuals per cubic meter, or densities. Ichthyoplankton counts can be also standardised to number of individuals beneath a unit of sea surface (square meter), by multiplying densities by the maximum depth of tow in meters (Smith and Richardson, 1977). Haul depth can be determined by using any device equipped with pressure sensors, such as a conductivity–temperature depth instrument (CTD) of small size or simple depth gauges, such as those used for scuba diving, attached to the sampling gear structure. If flowmeters or depth gauges are not available, the volume of water filtered can be estimated from the duration of the tow and the vessel's speed, which allows for estimating the distance covered by the net's path. Haul depth can be estimated by multiplying the maximum length of wire led out by the cosine of the wire angle at the moment when the maximum amount of wire has been let out. Finally, to get a reliable estimation of ichthyoplankton densities or abundances, it is necessary to homogeneously sample the water column over the whole haul depth range.

Once the haul is finished, plankton must be concentrated into the cod ends by gently washing the nets (Fig. 5). After that, plankton is transferred into jars and fixed for long–term preservation. The most commonly used preservatives are a 5% solution of buffered formalin and seawater, or ethanol at different concentrations. Formalin is more adequate for preserving samples to be used in taxonomic studies, since the egg and larval morphology is better preserved, but presents the problem that formalin is carcinogenic. Ethanol dehydrates both eggs and larvae. Eggs lose their shape, and larvae tend to curl making them difficult to measure. However, it has the advantage that specimens can be used for genetic and for larval growth studies. Other fixatives are liquid nitrogen, used to preserve larvae in biochemical and daily growth analyses, and RNAlater, when it is necessary to stabilize and protect cellular RNA. For some specific studies, larvae must be quickly sorted and identified on board, prior to fixation.

1.5 Sample representativeness

There are several papers dealing with problems associated to ichthyoplankton sampling (Hempel, 1974; Smith and Richardson, 1977; Lasker, 1981; Heath, 1992). Specifically, difficulties in obtaining representative samples of ichthyoplankton communities derive from the spatial and temporal heterogeneity in ichthyoplankton distribution and from the interaction of fish eggs and larvae with sampling gears (Ahlstrom *et al.*, 1973). Fish eggs and larvae are not distributed randomly, but they tend to be concentrated in patches that become part of the plankton during specific periods of the year. This is the result of the distribution of adult fishes, their spawning strategies, hydrodynamic processes, egg and larval density, and larval behaviour, which varies throughout ontogeny. The only way to deal with non-random distribution of ichthyoplankton is through an adequate sampling design.

The main sources of sampling bias, related to the direct interactions between fish eggs and larvae with the plankton nets, are escapement and avoidance. Escapement is the passage of smaller ichthyoplankton organisms through the meshes of the net. It may be active or passive and it is a function of the size, shape and behaviour of the organisms in relation to mesh size (Vannucci, 1968). Active escapement is the process by which fish larvae caught in the net may squeeze through the meshes. This involves behavioural patterns that vary with species and with the developmental stage (Vannucci, 1968). Passive escapement or extrusion is the forced passage of eggs or larvae through the net's meshes. When the organisms are larger than the meshes, extrusion is aided by the compressibility of the organisms and the flexibility of the meshes (Saville, 1958). This source of sampling bias is easily overcome by using net meshes of size adequate to retain smaller fish eggs and larvae. Considering the fact that most fish eggs have a diameter of over 0.5 mm and that most newly hatched larvae are more than 2.0 mm long, the adequate mesh size for sampling ichthyoplankton is between 300 and 500 microns. However, mesh size should not be too small for avoiding, or at least reducing, mesh clogging produced by plankton. Net clogging reduces the filtration efficiency of the net.

Avoidance is the process by which larger fish larvae avoid capture, swimming out of the path of the approaching net or migrating below the net's maximum sampling depth (Morse, 1989). This is probably the most important source of sampling bias (Clutter and Ankaru, 1968). Evidence of this phenomenon is the observed difference in larval fish abundances between night and day samples (Russell, 1976; Bridger, 1956; Ahlstrom, 1954, 1959). However, it seems that avoidance occurs both day and night (Murphy and Clutter, 1972). Larvae are not only able to see the approaching nets (visual avoidance), but they are capable of detecting the water vibrations produced by the towing wires and also the wave pressure produced by the net ahead of it (Smith and Clutter, 1965; Mahnken and Jossi, 1967; Tranter and Smith, 1968). Thus, to reduce or minimize net avoidance, it is useful to use nets without bridles in front of the net mouth, such as Bongo type nets (McGowan and Brown, 1966).

1.6 Ichthyoplankton sorting

For the taxonomic identification of ichthyoplankton or for other analyses, fish eggs and larvae are usually sorted from the plankton samples. The first step in ichthyoplankton sorting is to eliminate formalin from plankton samples. To do this, samples must be sieved through meshes (of smaller sizes than those used for sampling at sea), washed with seawater and placed into jars with seawater. This task must be carried out under a fume hood to avoid breathing the carcinogenic formalin vapours. Then, the sample can be placed in Petri dishes and analysed under a stereoscopic microscope, at low magnification (10x is adequate), to detect and sort fish eggs and larvae. Considering the low abundances of larvae of some species, it is recommendable, for studies on ichthyoplankton communities, to analyse the whole sample. However, for specific studies focusing on eggs or larvae of more abundant species, it is acceptable to analyse 50 or 25% of the sample or even less, depending on the abundance of the target species. Fish eggs and larvae must be handled very carefully, with soft tweezers, thin brushes or pipettes, to separate and keep them in vials with the appropriate preservative medium.

1.7 Taxonomic identification of fish eggs and larvae

The taxonomic identification of fish eggs and larvae is not an easy task. It is more difficult than identifying the juvenile and adult stages of fishes. This is due to several reasons. First, because of the small size of fish eggs and larvae, characters useful for their identification can only be visualized under a stereoscopic microscope. Then, in the case of fish larvae, the main problem is that they undergo continuous and, in some cases, dramatic morphological, meristic, morphometric and pigmentary changes throughout their development. This has prevented the building of dichotomous keys, such as those existing for adult fishes. In addition, other characters, such as pigmentation patterns, can present an important geographical and even individual variability. Despite these difficulties, partial dichotomous keys were developed for the Western Mediterranean Sea by Abossouan (1964) and Marinaro (1971). However, these keys only include some developmental stages of a relatively small number of the species present in the area. Therefore, they easily lead to identification dead ends or to misidentifications. To overcome this problem, the use of intelligent software, capable of managing extensive databases and integrating all the available information on larval stages of different fish species, including ecological information, such as the distribution of adults, reproduction season, etc. has been proposed (Froese and Papasissi, 1989). However, the design and implementation of such information systems is not easy, due to the heterogeneity of the available information, or even the lack of information on the early life stages of many marine fish species. Even in well-studied areas, eggs and larvae of many species are still unknown or, in many cases, early fish stages remain undescribed. More recently, molecular techniques are being used to identify fish eggs and larvae, or for validating previous descriptions of these, but they cannot be routinely applied. Because of all these difficulties, the "look-alike" method remains the method usually used to identify fish eggs and larvae. It consists of comparing the individuals with descriptions made by other authors. This elimination process ultimately results in "assigning" an individual to a species. This is also the method followed in this guide.

However, to properly use the "look-alike" method, it is first necessary to compile and analyse all the available information about the ichthyofauna of the study area. That is to say, faunistic lists and all the available information on the spawning strategies, spawning seasons and known distribution of the fish species inhabiting the study area. Another prerequisite for using this method is being able to accurately determine the developmental stage of the individual under analysis and to compare it with the corresponding developmental stage described in the literature.

The nomenclature of the different early developmental stages of fishes varies by author. In this guide, we follow the nomenclature suggested by Kendall *et al.* (1984)(Fig. 9), one of the most widely accepted. They divided the early life–history of fishes into three stages: egg, from spawning to hatching; larva, from hatching to attainment of complete fin–ray counts and beginning of squamation (juvenile); and juvenile, young fish, fundamentally like the adult in the meristic characters (excluding squamation) but smaller and reproductively inactive. Kendall *et al.* (1984) also divided the larval stage into four sub–stages: yolk–sac larva, from hatching to exhausting of yolk reserves; preflexion larva, from yolk exhausting to the beginning of upward flexion of the notochord; flexion larva, that ends when the urostyle is in its final position, at approximately 45º from the notochord axis and post–flexion larva, that ends when metamorphosis begins. Transformation, or metamorphosis is a transitional stage between larva and juvenile during which the young fish loses larval characters and acquires those of the adult (Kendall *et al.*, 1984; Moser, 1996).

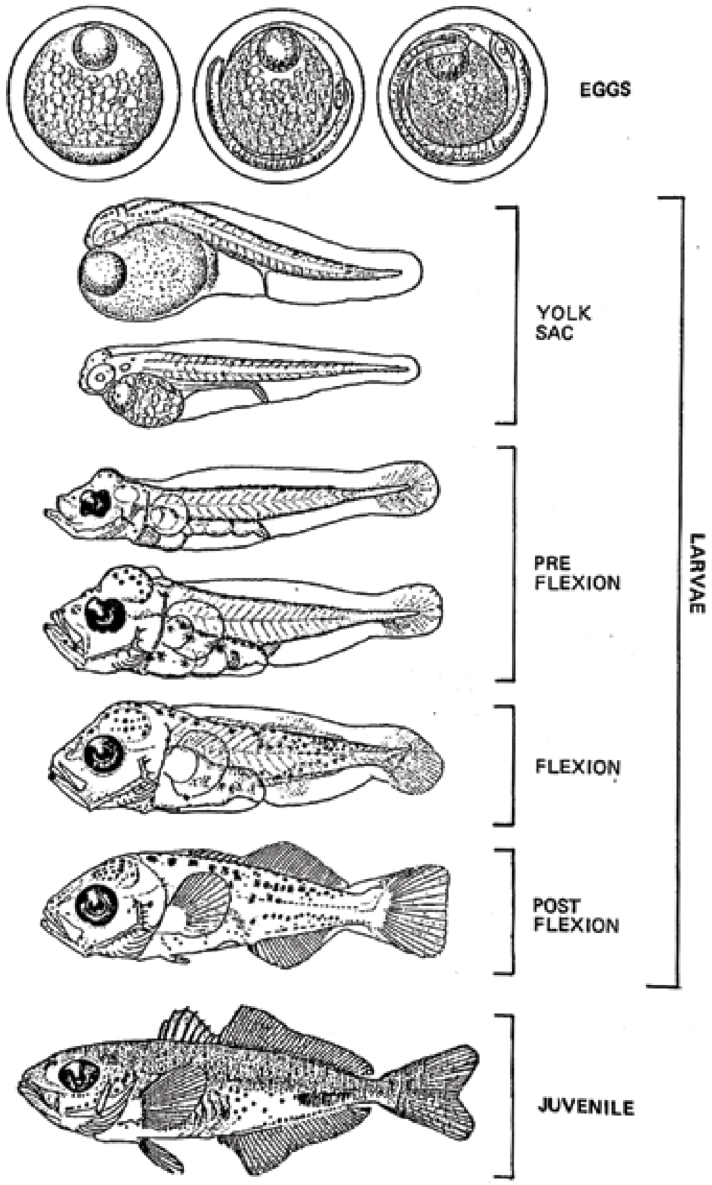


Figure 9. Early life history stages of *Trachurus symmetricus* from Kendall *et al.* (1984)

Most marine fish eggs encountered in plankton samples are spherical and transparent, with a diameter of about 1.0 mm. Eggs are enclosed by a thin membrane or chorion. There is a space between the chorion and the yolk sac, the perivitelline space. Most fish eggs have oil globules (Fig. 10). The main anatomical, morphological and morphometric features used in fish egg identification are: egg shape (spherical or elliptic); egg size (ranges from 0.5 to more than 5.5 mm in diameter); type of surface membrane (smooth, sculptured, with a single protuberance or filaments); presence of a second internal membrane; type of yolk (homogeneous or segmented); size of the perivitelline space; absence/presence, number, position and colour (for live individuals) of oil globules. When the embryo is well developed,

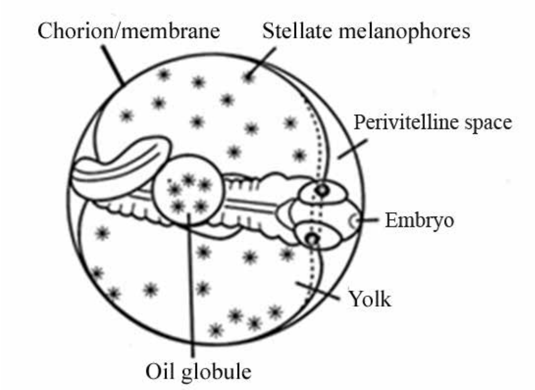


Figure 10. Main anatomic features of a fish egg. Adapted from Munk and Nielsen (2005)

embryonic characters, such as morphological features, pigment patterns and special structures are also used to identify fish eggs (Russell, 1976; Matarese and Sandknop, 1984; Ahlstrom and Moser, 1980). Scanning electron microscopy has proved to be a good tool for the taxonomic identification of fish eggs, but cannot be used in routine analysis (Boehlert, 1984). The identification of fish eggs is usually a more difficult task than larval fish identification. This is reflected by the fact that the number of fish species with the egg stage described is much lower than those with the larval stage described. In the Mediterranean Sea, it is worth mentioning the pioneer identification guide to fish eggs developed by Marinaro (1971), which has been recently revised and extended by Crec'hriou *et al.* (2015).

In most fish species with pelagic eggs, the newly hatched larvae are in general less than 4 mm long (Russell, 1976). The size and state of development at hatching is generally related to yolk–sac diameter. Typically, the body length at hatching is 2.5 to 3.0 times the diameter of the yolk sac (Moser, 1996). In general, yolk–sac larvae hatched from eggs less than 1.5 mm in diameter have an unformed mouth, unpigmented eyes and pectoral–fin buds, while yolk–sac larvae hatched from larger eggs are comparatively well developed, with the mouth formed, eyes pigmented and pectoral fins developed (Moser, 1996). In both cases, the locomotion is aided by a prominent fin–fold that extends from the top of the head, around the caudal region, and ventrally forward to the posterior margin of the yolk sac (Fig. 11).

The identification of yolk–sac larvae is very difficult because some structures, such as fins and most of the specialized larval characters, resulting from the evolutionary adaptation to the plankton realm, are not yet well developed. Consequently, yolk–sac larvae of different species are very similar. The yolk–sac stage is characterized by the migration, coalescence and rearrangement of pigment cells or melanophores (Moser, 1996). Melanophores are amoeboid and capable of migrating from their point of origin in the neural crest to various sites in the larva, to establish the species–specific larval pigmentation pattern, at the end of the yolk–sac stage. Useful characters for the identification of yolk–sac larvae are the shape and relative size of the yolk sac, the presence and the relative position of oil globules in the yolk sac, the position of the anus in relation to the yolk sac and, in some, the species–specific pigmentation pattern.

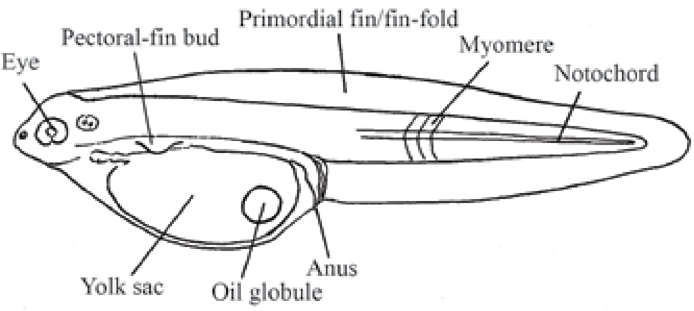


Figure 11. Main anatomic features of a yolk sac larva. From Russell (1976)

The complete utilization of the yolk marks the end of the yolk–sac stage. By this time, most of the organs and the sensory system required to capture prey are functional. The mouth and gut are formed, the anus is open at the margin of the ventral fin–fold, the eyes are pigmented, and the primordial pectoral fins are present. It is now an early larva and during the larval development, the fish gradually acquires the characters of the adult, thus facilitating its identification (Moser, 1996; Russell, 1976). At first, the body is still surrounded by the primordial fin, the urostyle is straight and rudiments of the hypural elements are visible in its ventral side. As the larva grows, the urostyle bends upwards, the hypural elements become defined, caudal rays develop, and the first signs of the formation of the dorsal and anal fins appear as interspinous areas. At this stage, both the meristic characters and pigmentation pattern that are characteristic of the adult of the species, have usually appeared (Russell, 1976). The main anatomical features of a larva are shown in figure 12.

The main characters used in larval fish identification are the body form, the pigmentation pattern and meristic and morphometric characters. The body form allows for separating larvae into several major groups (Russell, 1976). For example, larvae with narrow, elongated bodies (e.g. Families Clupeidae, Engraulidae, Stomiidae, etc.); larvae with laterally compressed bodies (includes all flatfishes, e.g. Families Bothidae, Pleuronectidae, Soleidae, etc.); bodies with the typical fish shape (includes larvae of

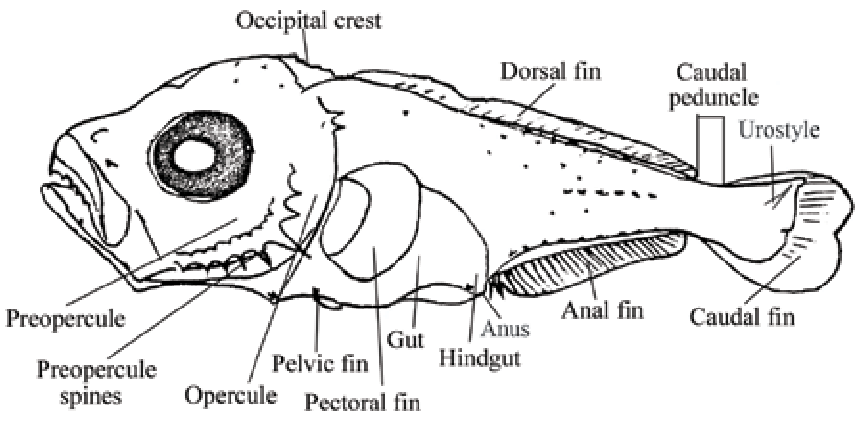


Figure 12. Main anatomic features of a fish larva

most fish species, e.g. Families Gadidae, Triglidae, Gobiidae); bodies with aberrant shapes (e.g. Family Belonidae) or showing specialized larval characters for the plankton life, such as cranial armatures (e.g. Family Scorpaenidae), elongate fin rays (e.g. Families Carapidae, Lophiidae), stalked eyes (e.g. some Myctophidae species) or early developed and large fins (e.g. Family Trachinidae).

Meristic characters are countable structures appearing in series, such as the number of miomeres, vertebrae or fin rays. They have a high diagnostic value (at least the combination of several counts), because they are species–specific. However, they have the disadvantages that some of them, such as fin rays, are completely formed only in older larvae, which are scarce in plankton samples. Others, such as miomeres or vertebrae, are difficult to visualize, even using staining methods, or other techniques, such as X–rays (Pothoff, 1984; Tucker and Laroche, 1984).

Morphometric characters include the different measurements of a larva. The main measurements of a larva, shown in figure 13, are the total length (TL), or the distance from the tip of the snout to the caudal–fin end; the standard length (SL), or the distance between the tip of the snout and the urostyle end; the preanus length, or the distance between the tip of the snout and the anus; the head length, or the distance from the tip of the snout to the border of the cleitrum, and eye diameter, or the maximum diameter of the eye. When measuring the different body regions for identification purposes, the stage of development of the larvae must be taken into account, since larval growth is allometric.

Fish larvae show a variety of pigmentary cells or chromatophores. Those containing black or brown pigments are known as melanophores; those with yellow pigments, xanthophores and those with red pigments, erythrophores (Russell, 1976). However, in formalin–preserved specimens, only black pigmented cells or melanophores remain. For this reason, the latter are usually the only ones used in ichthyoplankton identification. Melanophores are situated in different parts of the body, defining a species–specific pigmentation pattern. This pattern is one of the chief diagnostic characters used for

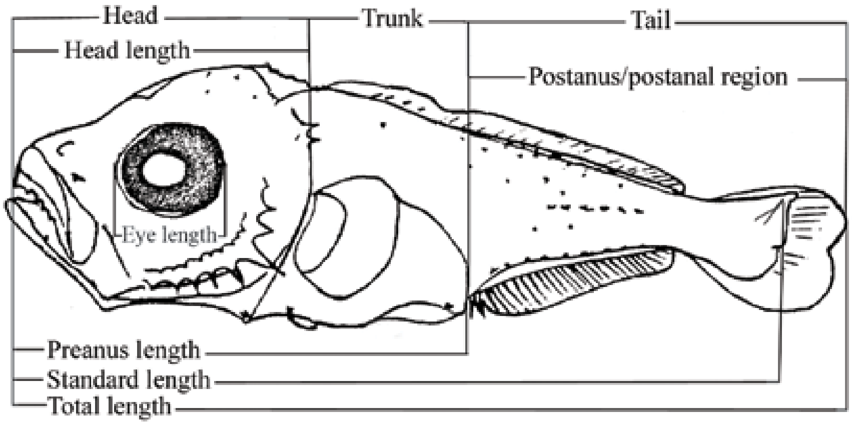


Figure 13. Body regions and the most important measurements of a fish larva

the identification of the larval stage of fish species. Often, the identification of species with similar larvae is made possible thanks to the presence or absence of a single melanophore or by its position (Russell, 1976). The general appearance of preserved specimens will differ very much according to the degree of expansion or contraction of the melanophores. Moreover, in specimens preserved for a long time, the pigmentation will fade, especially if kept in the light (Russell, 1976). Besides, there may be an intraspecific and geographical variability in pigmentation patterns.

1.8 The importance of a proper taxonomic identification of ichthyoplankton

The first step in any ichthyoplankton study is the proper taxonomic classification of eggs and/or larvae since, as Powles and Markle (1984) pointed out, small errors in their identification can result in important misinterpretations about the biology and ecology of fish species. Moreover, there are several examples in the literature showing that wrong identifications of fish eggs or larvae have led to biased stock evaluations and, subsequently, inadequate management measures (Daniel and Graves, 1994; Armstrong *et al.,* 2001; Fox *et al.,* 2005). Unfortunately, these identification errors are probably more frequent and important than desirable. For example, a recent study focusing on the ability of researchers from five different laboratories in Taiwan to identify fish larvae, determined that the average accuracy of identification was 80.1, 41.1 and 13.5 % at the family, genus and species levels, respectively (Ko *et al.,* 2013). Recently, Puncher *et al.* (2015a) revealed that the Atlantic bluefin tuna (*Thunnus thynnus*) larvae have been misidentified in the Mediterranean Sea. These authors demonstrated, through genetic analysis, that more than half of the larvae, submitted by three Mediterranean institutions to a bluefin tuna research project, funded by the International Commission for the Conservation of Atlantic Tunas (ICCAT), were misidentified. Some of these errors are caused by the persistence in literature of wrong descriptions. However, also in species whose larvae are accurately described, the inexperience or lack of training of the people in charge of the taxonomic identification of ichthyoplankton can lead to massive misidentifications (Puncher *et al.*, 2015b). Because of this, it is of paramount importance to produce identification guides with accurate descriptions, taking advantage of molecular genetic techniques, to validate doubtful identifications, as well as to organize courses given by experienced ichthyoplanktologists and aimed at properly training new generations of technicians and researchers in charge of the taxonomic classification of fish eggs and larvae. This book, based on a course on larval fish taxonomy, supported by the FAO COPEMED regional program, intends to be a step in this direction, for the western Mediterranean region.

1.9 History of studies on ichthyoplankton identification in the Mediterranean Sea

The pioneering works on ichthyoplankton identification in the Mediterranean Sea were those of Raffaele (1888) and Marion (1894). These authors described eggs and yolk sac larvae of several fish species from the Gulf of Naples (Raffaele, 1888) and from the Gulf of Marseille (Marion, 1894). Some years later, Fage (1910) published the results of ichthyoplankton surveys carried out off the city of Nice and in the Gulf of Lion including descriptions of larvae of several fish species. Roule and Angel (1930), summarized the results of the oceanographic surveys supported by the Prince of Monaco, Albert I, carried out between 1895 and 1915. Outstanding papers on ichthyoplankton identification are the reports on the "Danish Oceanographic Expeditions in the Mediterranean and Adjacent Seas" (Dana–Reports) by e.g. Kyle (1913), Jespersen (1915), Ege (1918, 1930), Fage (1918, 1920), Schmidt (1918), Schmidt and Strubberg (1918), Täning (1918, 1923), Jespersen and Täning (1926), Guitel (1920), Ehrembaum (1924), and Schnakenbeck (1931). However, the most important publication on ichthyoplankton identification from the Mediterranean Sea is the monography "Uova, larve e stadi giovanili di Teleostei", elaborated using material gathered by Lo Bianco and edited by Bertolini *et al.* (1931–1956). This monography compiles the description and illustrations of fish eggs and larvae of many species carried out by several authors. This monography, along with the Dana–Reports, are even nowadays the basic and essential references for any study on ichthyoplankton identification from the Mediterranean Sea. It is also worth mentioning the papers from Aboussouan (1964) and Lee (1966) that include useful keys for the identification of fish eggs and larvae and the paper by Marinaro (1971), which includes a useful key for the identification of fish eggs. In recent years, the PhD Theses of Sabatés (1988) and Alemany (1997) deserve special attention. These include the description and original illustrations of larvae of several fish species. Several illustrations of the Alemany's PhD Thesis are included in this manual.

1.10 Glossary

Anal fin: Fin (usually single but double in some gadiforms) located on the ventral margin of the tail, behind the anus.

Anus: Orifice and surrounding tissue at end of the gut.

Bathypelagic: Pelagic zone between 1 000 and 4 000 m depth. Bathypelagic fish are those inhabiting the bathypelagic region.

Benthic: Referring to the sea bottom. Benthic species are those living on or in the bottom (substrate).

Benthopelagic: Living and feeding near the bottom as well as in midwater or even near the surface.

Caudal fin: Median fin situated at the posterior end of the fish.

Caudal peduncle: Narrow part of the tail located between the posterior end of dorsal or anal fin and the base of the caudal fin.

Chorion/shell: Outer membrane of a fish egg.

Choroid tissue: Mass of vascular tissue on the ventral side of the eye in larvae of some myctophids and other meso– and bathypelagic fishes, usually associated with elliptical eyes.

Cleithrum: Vertical bone in the pectoral girdle, at the junction of head and body of the larva.

Cleithral symphysis: Ventral junction of the cleithral bones.

Chromatophore: Cell containing pigment that reflects the light.

Continental shelf: The flattened edge of the continental land mass, between the coast and the continental slope (generally, the continental subtidal zone to a depth of about 200 m).

Continental slope: The sloping edge of the continental land mass, generally beginning at depth of around 200 m.

Demersal: Living on or near the bottom of the sea.

Dorsal fin: Median fin or fins located on the dorsal margin of the body.

Early life history: The early life stages of fishes spanning from egg to juvenile.

Embryo: Early stage of development, from fertilisation to hatching

Epipelagic: The illuminated, uppermost layer of the ocean (from 0 to 200 m depth).

Eye stalks: Movable peduncles of varying length bearing the eyes.

Finfold/primordial fin: Median fold of skin surrounding the body of young larvae, within which the dorsal, caudal and anal fins are developed.

Flexion: Larval stage during which the urostyle bends dorsally.

Gut: Alimentary tube and associated organs.

Gut loop: Loop, fold, or curve found along the axis of the gut.

Head length: Distance from the tip of the snout to the posterior margin of the cleithrum.

Hindgut: Posterior part of the gut.

Homogeneous: Uniform composition throughout; opposite to segmented in referring to egg yolk.

Ichthyoplankton: Zooplankton fraction including eggs and larval stages of fishes.

Isthmus: Ventral region of the head separating the gill openings of a fish.

Juvenile: A young fish, fundamentally resembling the adult in meristic characters (excluding squamation) but smaller and reproductively inactive.

Larva: Early life–history stage of fishes between the egg and juvenile stages.

Leptocephalus: The flat, transparent, and often large larvae of fishes in the orders Anguilliformes, Elopiformes and Notacanthiformes, characterized by small heads and prominent teeth

Melanophore: A cell containing melanin; a black or brown pigment cell.

Meristic characters: Countable structures occurring in series (e.g. myomeres, vertebrae, fin rays).

Mesopelagic: Occurring in the open ocean at middle depths, usually between 200 and 1 000 m.

Metamorphosis: A marked change in form or structure at the end of the larval stage involving acquisition of adult characters and loss of larval characters; synonymous of transformation.

Myomeres: Muscle segments occurring in series, the number is approximately equal to the number of vertebrae in adults.

Myosepta: Connecting tissue between adjacent myomeres.

Nekton: Motile, marine organisms living in the water column and capable of swimming against currents.

Neritic: Pelagic coastal zone extending from the low tide mark to the edge of the continental shelf.

Neural crest: Region of the neural ridge of the developing embryo that differentiates into many kinds of tissue and cells, including melanophores.

Neustonic: Occurring close to the surface of the ocean.

Notochord: Longitudinal flexible cartilaginous rod of cells forming the supporting axis of the body.

Notochord length (NL): The distance from the tip of the snout to the posterior tip of the notochord.

Occipital crest: A median, bony ridge, usually serrated, located on top of the head, posteriorly.

Oceanic: Open sea region beyond the edge of the continental shelf.

Oil globule: Spheres of fatty material within the yolk of some fish eggs.

Opercular: Relative to the operculum.

Operculum or Opercle: The bony plate of the gill cover.

Ovoviviparous: Producing eggs that develop within the maternal body.

Pectoral fin: Paired lateral (sometimes ventrolateral) fins located behind the head.

Peduncle: A narrow part or stalk that connects a structure to the body (e.g. caudal peduncle connecting the caudal fin to body).

Pelagic: Free living in the water column, away from the sea bottom.

Pelvic fins: Paired fins, usually located on the ventral edge of the body, in the abdominal region.

Peritoneal: Region of the body associated with the gut or the membrane of the peritoneum.

Peritoneum: The membrane and associated tissue lining the gut cavity.

Perivitelline space: Fluid–filled space between the embryo and chorion or shell of an egg.

Photophores: Luminous organs on some marine (mostly deep–sea) fish larvae.

Plankton: Small free–living organisms, passively floating or weakly swimming that drift with currents.

Pigmentation: Deposition of pigment in body tissues.

Planktonic: Passively floating, drifting, or weakly swimming with prevailing currents.

Postanal: posterior to the anus.

Postflexion stage: A stage in the development of larvae after the completion of flexion.

Preanal/preanus: Located anterior to the anus; preanal length (synonymous of snout–anus distance) measured from the tip of the snout to the posterior margin of the anus.

Preflexion stage: Larval stage before the beginning of the process of flexion.

Preopercle: Upper anterior bone of the gill cover.

Preopercular: Relative to the preopercle.

Recruitment: The amount of fish added to the exploitable stock each year due to growth and/or migration into the fishing area.

Sculptured: Egg chorion with ornamentations or surface features of different shapes and textures.

Segmented: Particulate or divided; opposite of homogeneous in referring to egg yolk.

Shell: The membrane that encloses an egg; generally, equivalent to chorion.

Shrinkage: The act or fact of shrinking, to contract or lessen in size.

Swimbladder: Sac filled with air or other gases located in the abdominal region, beneath the backbone.

Snout: Forward part of the head, anterior to the eye.

Stalked eye: Eye situated on a stalk or peduncle.

Standard length (SL): The distance from the tip of the snout to the tip of urostyle.

Stellate melanophore: Star–like pigment spot.

Stock (Fish): A group of individuals in a species occupying a well–defined spatial range independent of other stocks of the same species.

Supraorbital spine: Occurring above the eye.

Tail: The portion of the body posterior to the anus, the postanal region.

Telescopic eye: Elongate, cylindrical eye that protrudes forward or upward within an envelope of skin.

Tentacle: Any of various slender, flexible appendages in larvae.

Total length (TL): Measurement from the tip of the snout to the most posterior part of a larva, including the caudal finfold or caudal fin.

Transformation: The process (synonymous of metamorphosis) at the end of the larval stage, characterized by a marked change in form or structure and involving the acquisition of juvenile or adult characters and the loss of larval characters.

Trunk: Portion of the body between the head and the anus.

Urostyle: The last vertebral elements in fishes, formed by fusion or loss of several vertebrae.

Year class: All of the fish in a stock that were spawned in a particular year, such as all those spawned in 1990. Also referred to as a "cohort".

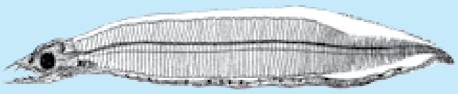
Yolk: Nutritive material of the egg forming a sac–like mass (yolk sac) below the abdominal region of a newly hatched larva.

Yolk–sac larva: Newly hatched larva with yolk sac.

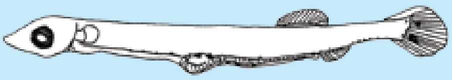
1.11 Illustrations of representative larvae of bony fish families included in this guide

Ophichthidae

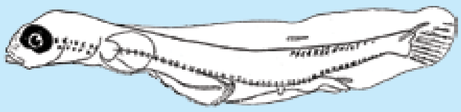
Clupeidae



Congridae

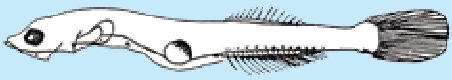


Engraulidae

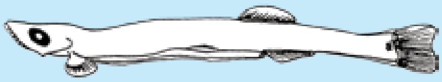


Microstomatidae

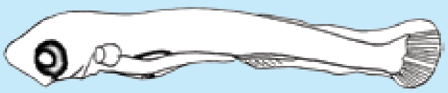
Argentinidae



Gonostomatidae



Phosichthyidae

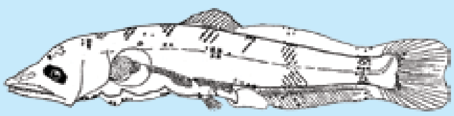


Sternoptychidae

Stomiidae

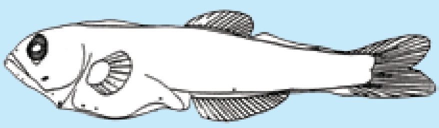
Paralepididae

Synodontidae

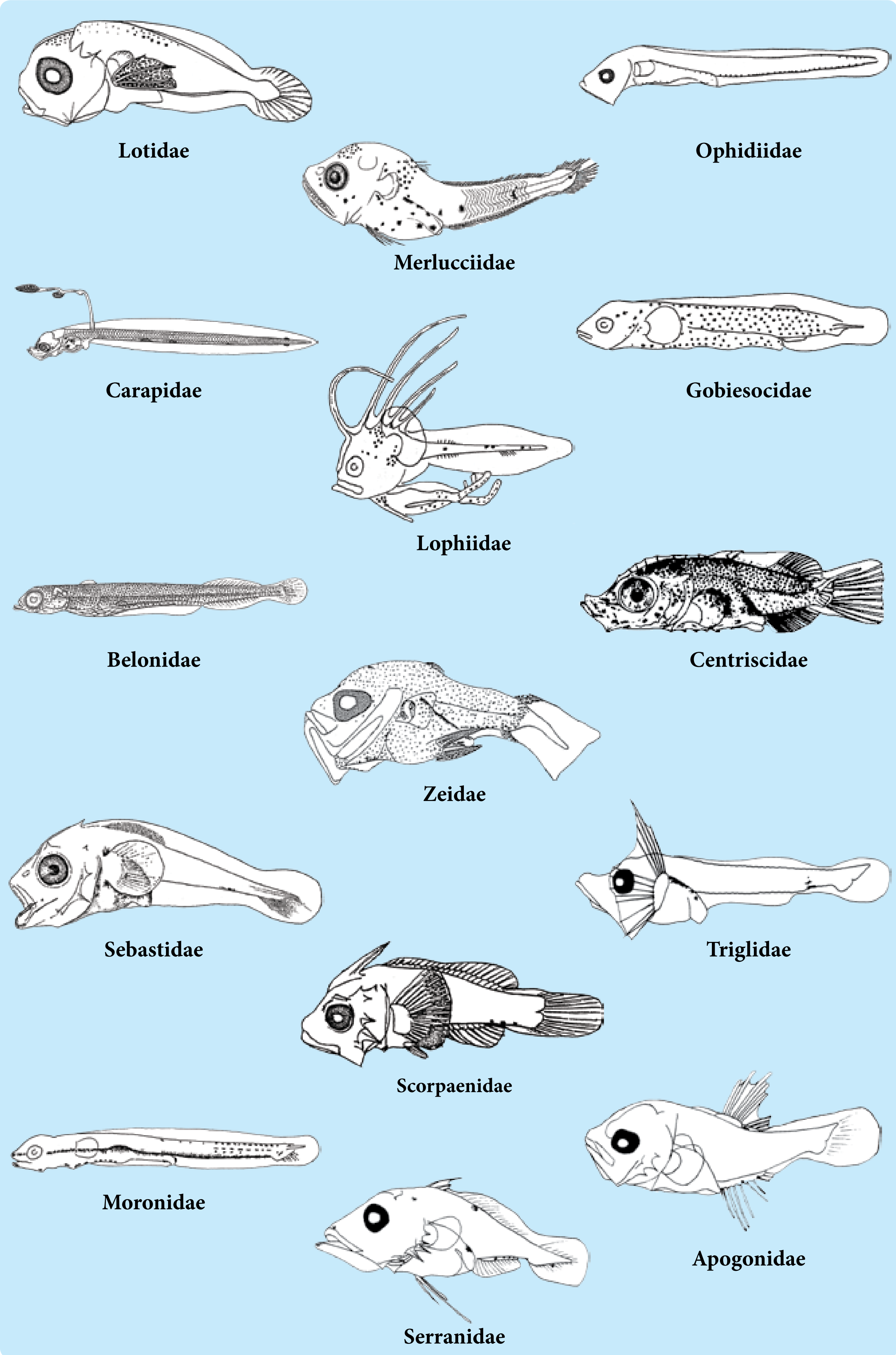


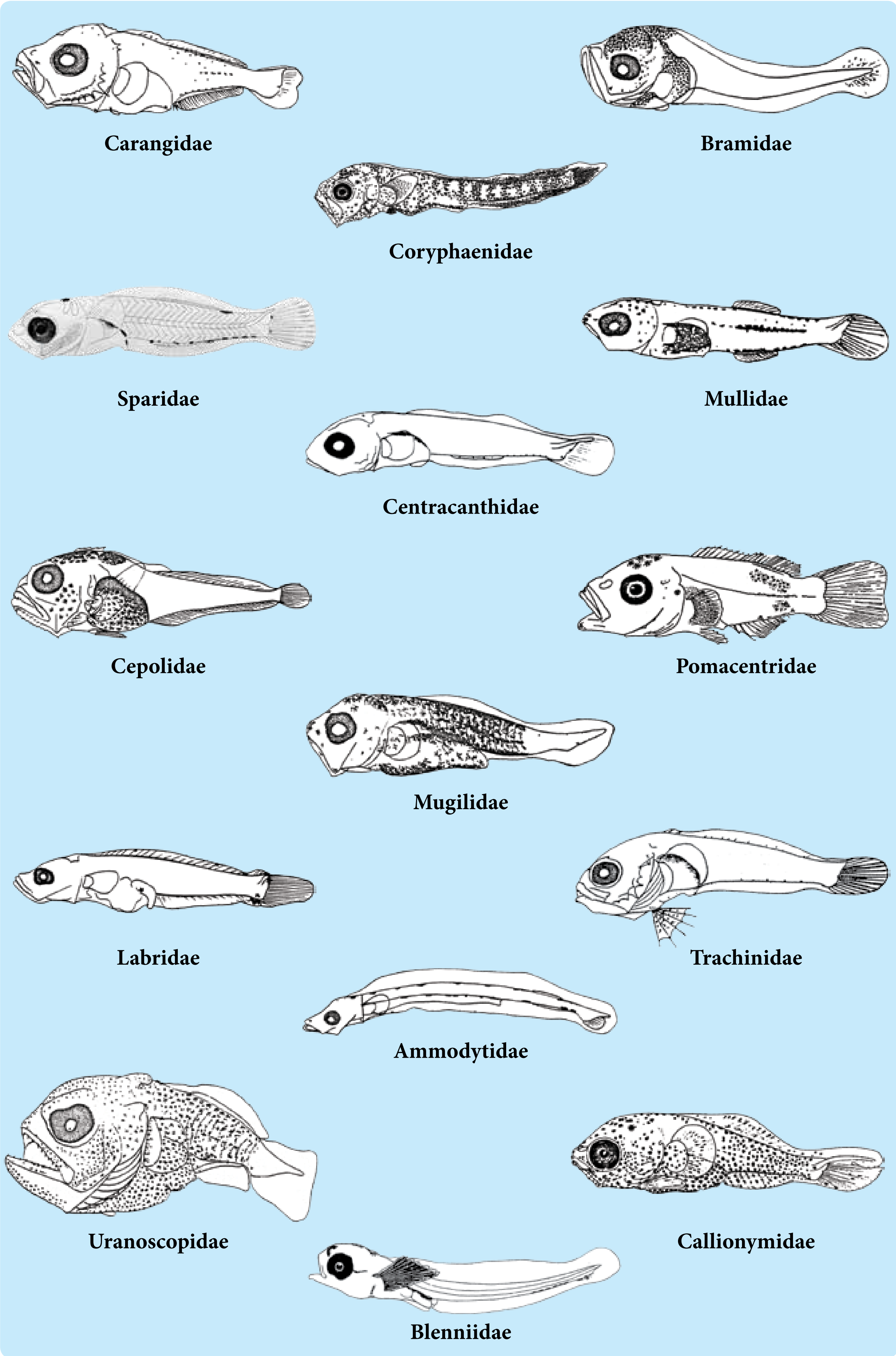
Evermannellidae

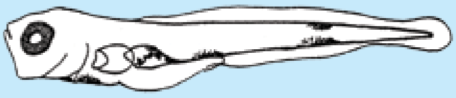
Gadidae



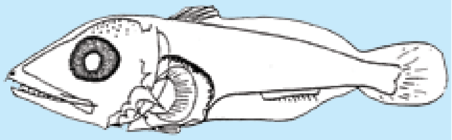
Myctophidae


Lotidae
Ophidiidae
Merlucciidae
Carapidae
Gobiesocidae
Lophiidae
Belonidae
Centriscidae
Zeidae
Sebastidae
Triglidae
Scorpaenidae
Moronidae
Apogonidae
Serranidae

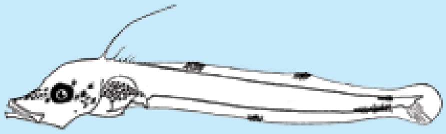

Carangidae
Bramidae
Coryphaenidae
Sparidae
Mullidae
Centracanthidae
Cepolidae
Pomacentridae
Mugilidae
Labridae
Trachinidae
Ammodytidae
Uranoscopidae
Callionymidae
Blenniidae



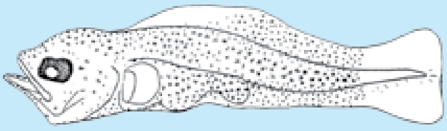
Gobiidae



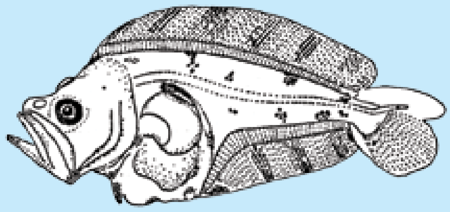
Scombridae



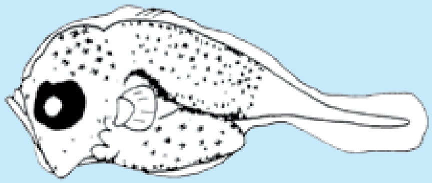
Trichiuridae



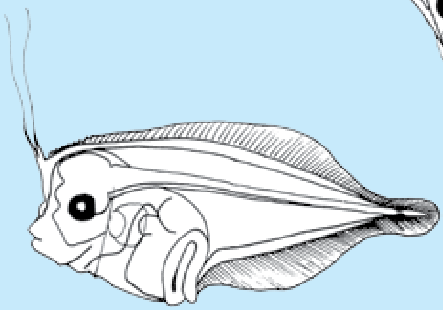
Xiphiidae



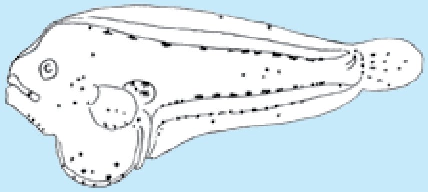
Scophthalmidae



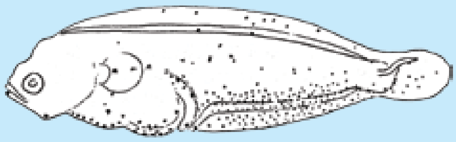
Caproidae



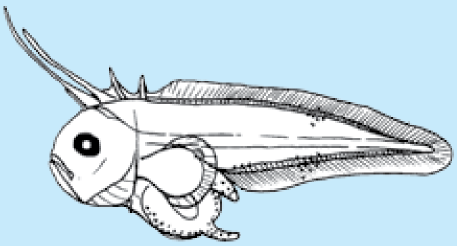
Bothidae



Soleidae



Pleuronectidae



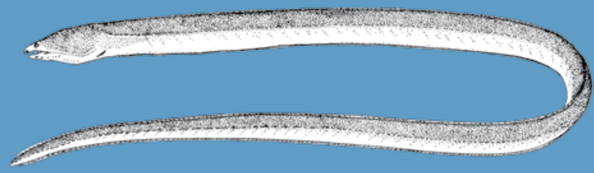
Cynoglossidae

2. IDENTIFICATION SHEETS

OPHICHTHIDAE

Dalophis imberbis (Delaroche, 1809)

En: Armless snake eel



Habitat: Benthic, littoral, burrowing in sand or mud bottoms, between 20 and 100 m depth

Spawning season: Between August and September

EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 2.10–2.40 mm
Chorion: smooth
Oil globules: 1–17
Perivitelline space: large
Yolk: segmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 5.0 mm SL
Distinctive characters: body elongate and slender; no teeth on jaws
Number of myomeres: 159; 77 ahead of anus
Pigmentation: body unpigmented

LARVAE

Figs. C–F

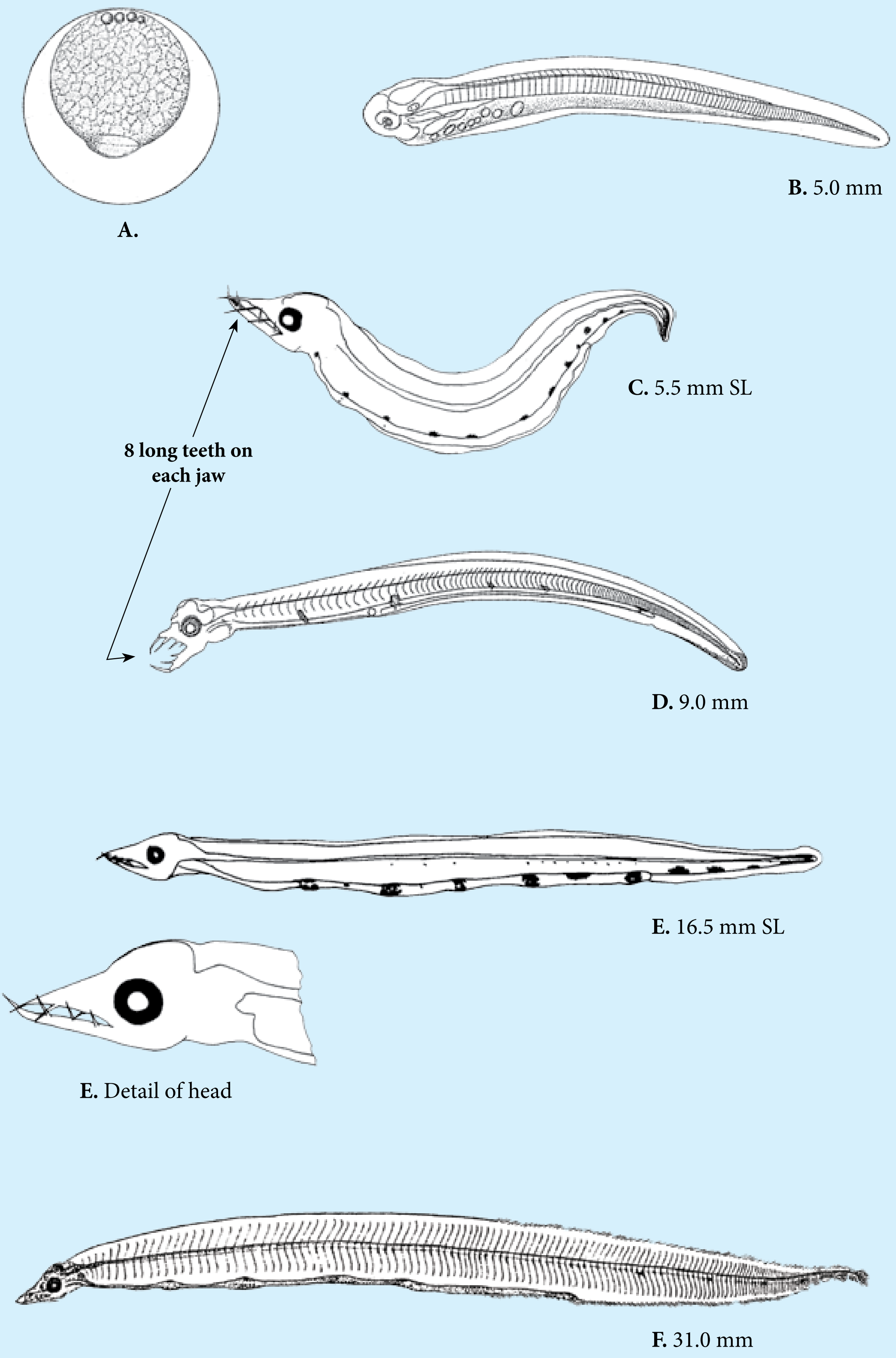
Distinctive characters: leptocephalus; body elongate, transparent, laterally compressed; in young larvae, 8 long teeth on each jaw; 5 or 6 gut loops
Preanus length: decreases with development
Number of myomeres: 152–155; 68–76 preanal
Pigmentation: in small larvae, 12 ventral spots, 9 over gut and 3 postanal; lower jaw and urostyle pigmented; larger larvae with up to 5 lateral melanophores located under the notochord
Length at transformation: unknown

PHOTOS

Not available

Literature: Alemany (1997), Bauchot (1986), D’Ancona (1931d), Sabatés (1988)

OPHICHTHIDAE **_Dalophis imberbis_** (Delaroche, 1809)



A, B, D, F: D'Ancona (1931d); **C, E:** Alemany (1997)

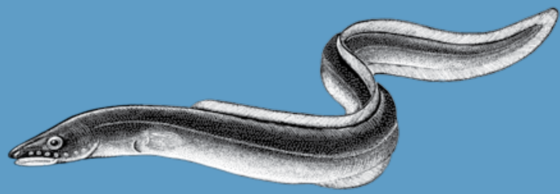
CONGRIDAE

Conger conger (Linnaeus, 1758)

En: **European conger – Fr: Congre d'Europe – Sp: Congrio común**

Habitat: Benthic, on rocky and sandy bottoms on the shelf, between 0 and 100 m depth

Spawning season: Summer



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE **Figs. A–E**

Distinctive characters: leptocephalus; body elongate, transparent, laterally compressed; head small; 6 long teeth on each jaw; pectoral fin apparent in small larvae; origin of dorsal fin quite ahead of anus (predorsal fin distance about 57% SL); single tubular gut; eye slightly oval

Preanus length: about 84% SL

Number of myomeres: 148–155

Pigmentation: small larvae with 7 melanophores over gut and 10 between anus and caudal–fin base; the number of melanophores over gut, from the 14th myomere to the anus, increases with development; older larvae show 6 melanophores in ventral side, 3 in dorsal side of postanal region and about 10 located at lateral end of body, over notochord; caudal fin pigmented

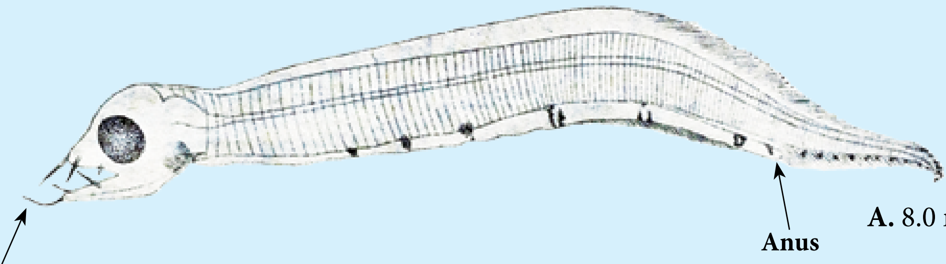
Length at transformation: about 150.0 mm

PHOTOS

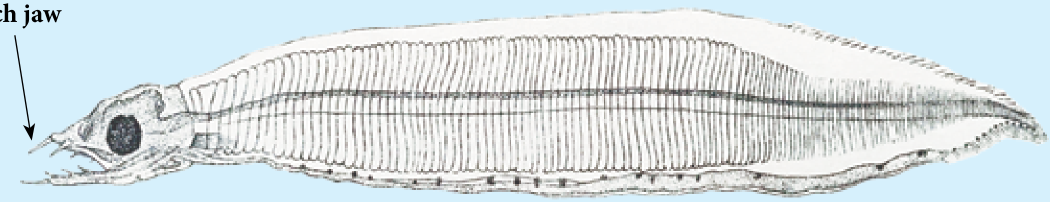
Not available

Literature: Alemany (1997), Bauchot and Saldanha (1986), D'Ancona (1931b), Sabatés (1988)

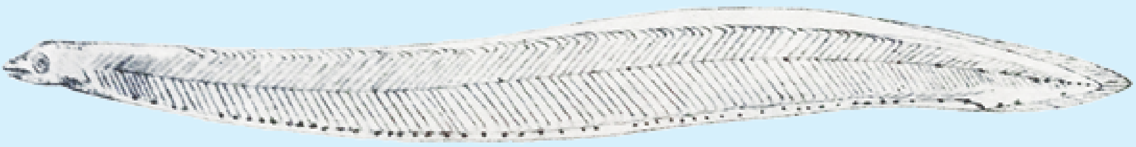
CONGRIDAE — ***Conger conger*** (Linnaeus, 1758)



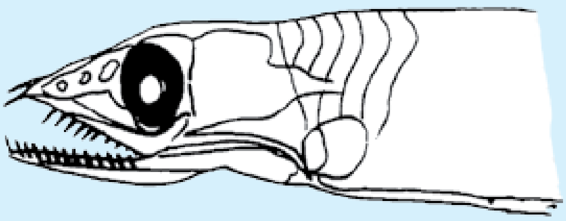
A. 8.0 mm



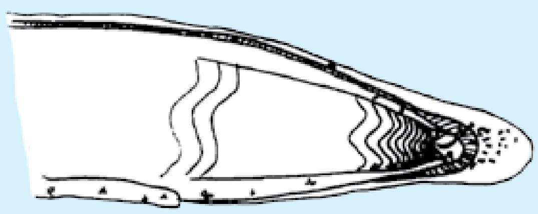
B. 16.0 mm



C. 97–131 mm



D. Detail of head
(63.8 mm SL larva)



E. Detail of caudal region
(63.8 mm SL larva)

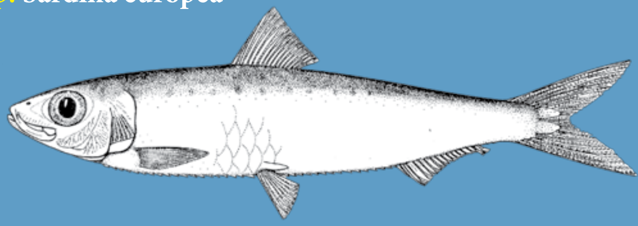
A–C: D’Ancona (1931b); **D, E:** Alemany (1997)

CLUPEIDAE *Sardina pilchardus* (Walbaum, 1792)

En: **European pilchard** – **Fr:** **Sardine commune** – **Sp:** **Sardina europea**

Habitat: Pelagic, coastal

Spawning season: Between September and May



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.30–1.90 mm
Chorion: smooth
Oil globules: single, 0.14–0.18 mm in diameter
Perivitelline space: large
Yolk: segmented

YOLK–SAC LARVAE Fig. B

Hatch size: 3.3–4.0 mm

Distinctive characters: body elongate and slender, with the typical clupeid shape; oil globule situated at posterior edge of yolk sac

Preanus length: about 80% SL

Pigmentation: two parallel rows of small melanophores in dorsal region, extending from head to tail

LARVAE Figs. C–H

Distinctive characters: body elongate and slender; head length included at least 6 times in total length; gut differentiated into two sections; dorsal fin located ahead of anus

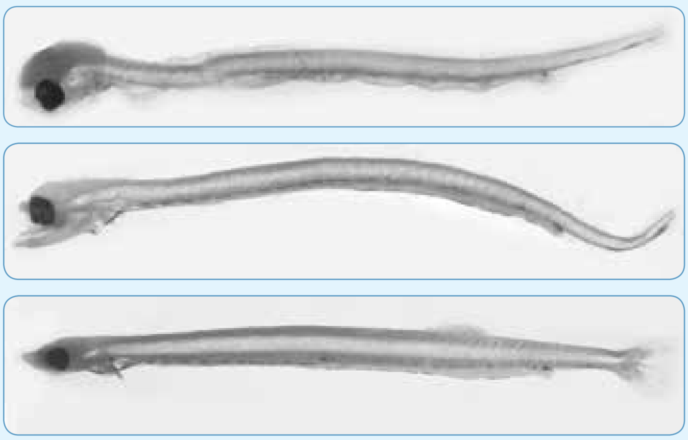
Preanus length: about 80% SL

Pigmentation: melanophores aligned on both sides of body, above gut; ventral rows of melanophores in posterior section of gut; caudal fin pigmented; some melanophores between anus and caudal fin (this character helps to distinguish this species from *Sardinella aurita*)

Length at flexion: 10.0 mm SL

PHOTOS

by J.M. Rodriguez



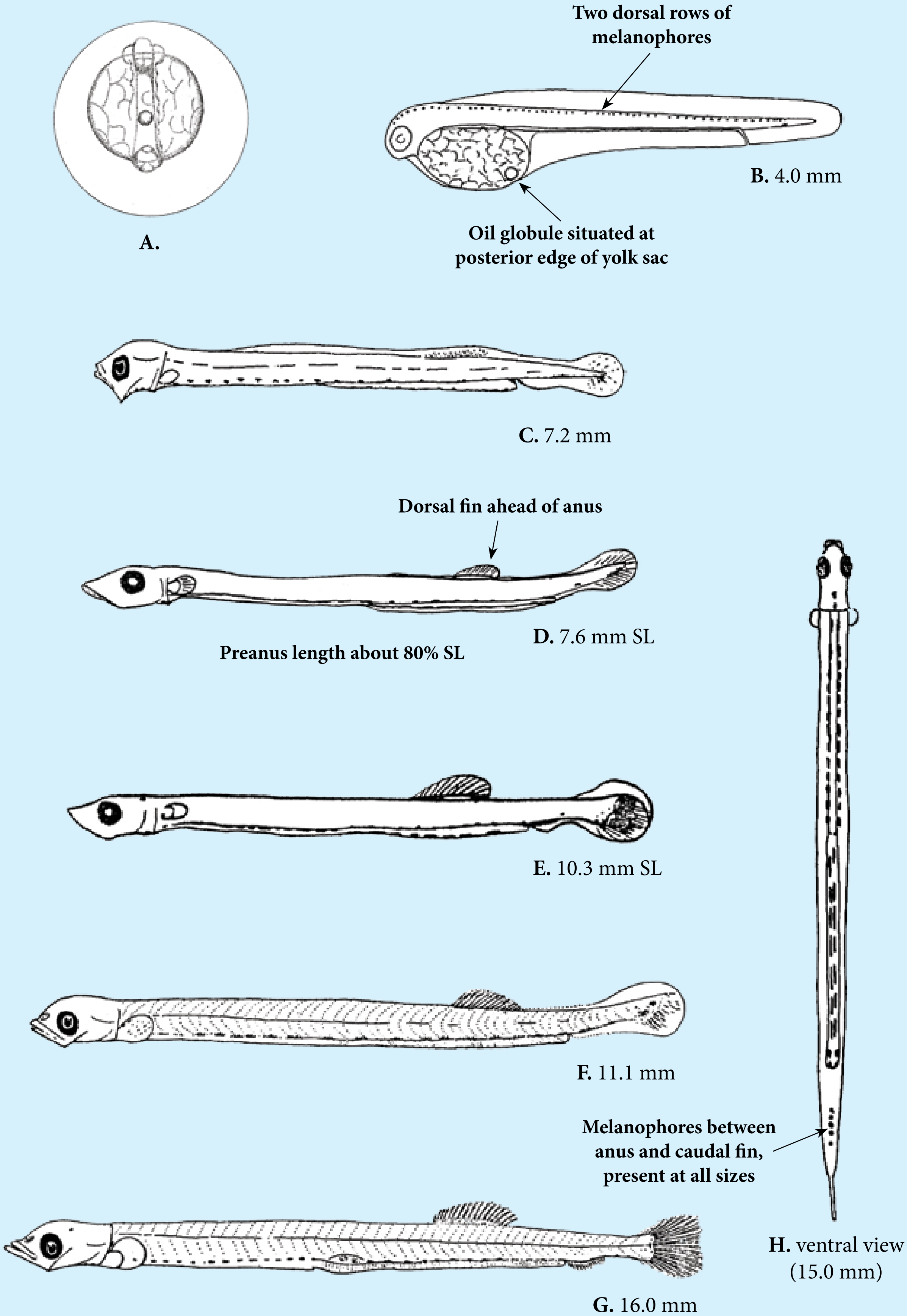
4.3 mm SL

5.2 mm SL

13.6 mm SL

Literature: Alemany (1997), Fage (1920), Russell (1976), Whitehead (1984a)

CLUPEIDAE — ***Sardina pilchardus*** (Walbaum, 1792)



A: D'Ancona (1931a); **B, H:** Russell (1976); **C, F, G:** Fage (1920); **D, E:** Alemany (1997)

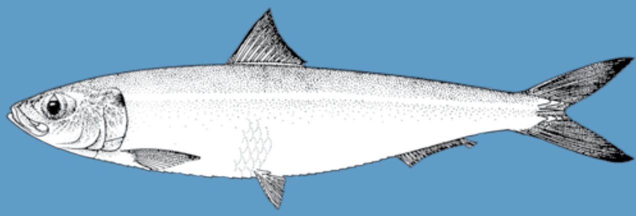
CLUPEIDAE

Sardinella aurita Valenciennes, 1847

En: Round sardinella – **Fr:** Allache – **Sp:** Alacha

Habitat: Pelagic, in inner continental shelf waters

Spawning season: Between June and September



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.20–1.40 mm
Chorion: smooth and thin
Oil globules: single, 0.12 mm in diameter
Perivitelline space: large
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

Hatch size: 3.5 mm
Distinctive characters: body with the typical clupeid shape; oil globule situated ventrally in yolk sac
Pigmentation: two parallel, dorsal rows of small melanophores, extending from head to tail

LARVAE — Figs. C–F

Distinctive characters: body elongate and slender although more robust than that of *Sardina pilchardus*; head length included less than 6 times in total length; gut differentiated into two sections; dorsal fin located ahead of anus

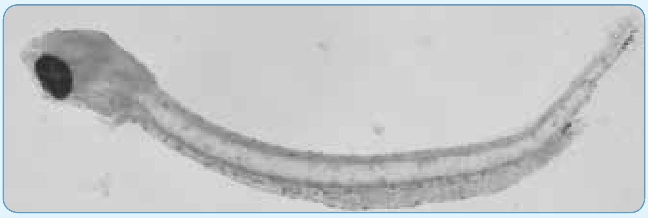
Preanus length: about 90% SL

Pigmentation: melanophores aligned on both sides of gut and over it in its posterior section; caudal fin pigmented; no melanophores between anus and caudal fin in young larvae (this character helps to distinguish this species from *S. pilchardus*)

Length at flexion: about 10.0 mm SL

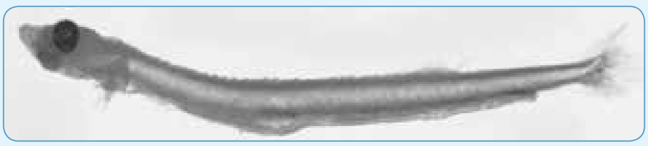
PHOTOS

by J.M. Rodriguez



3.8 mm SL

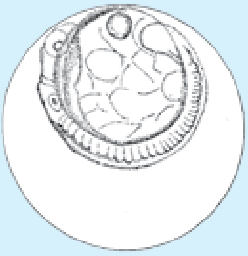
7.3 mm SL



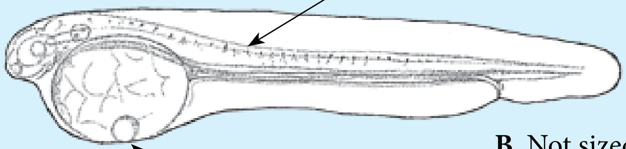
8.6 mm SL

Literature: Alemany (1997), D'Ancona (1931a), Fage (1920), Olivar and Fortuño (1991), Whitehead (1984a)

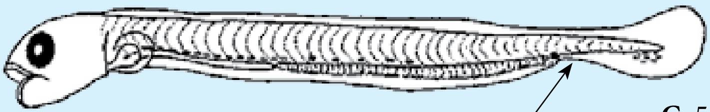
CLUPEIDAE — ***Sardinella aurita*** Valenciennes, 1847



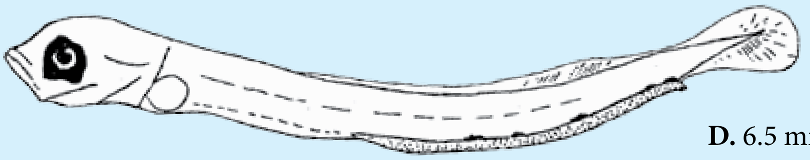
A.



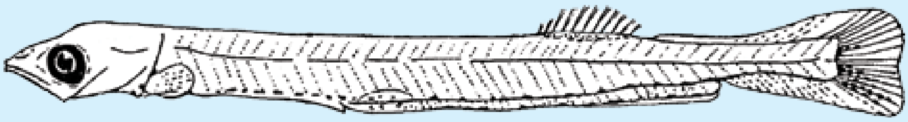
B. Not sized



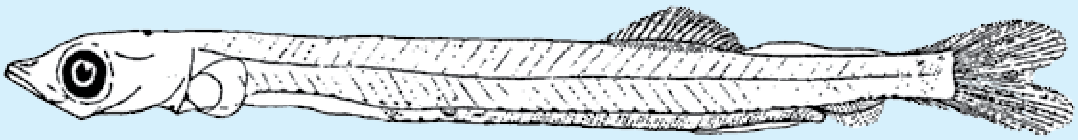
C. 5.3 mm SL



D. 6.5 mm



E. 11.0 mm



F. 15.5 mm

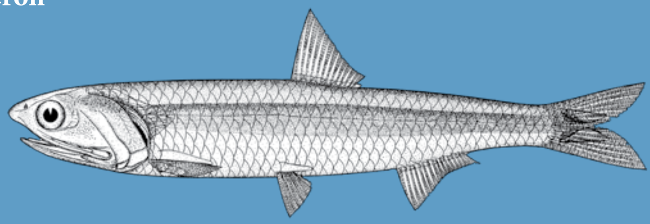
A, B: D'Ancona (1931a); **C:** Conand and Fagetti (1971); **D–F:** Fage (1920)

ENGRAULIDAE *Engraulis encrasicolus* (Linnaeus, 1758)

En: European anchovy – **Fr:** Anchois – **Sp:** Boquerón

Habitat: Pelagic, coastal

Spawning season: Summer



EGGS Fig. A

Habitat: pelagic
Shape: ovoid
Size: 1.2–1.9 x 0.5–1.2 mm
Chorion: smooth
Oil globules: not present
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE Fig. B

Hatch size: 3.3–4.0 mm

Distinctive characters: body shape similar to yolk–sac larvae of clupeid species; yolk sac very elongate, stretching nearly to anus (this feature along with the absence of an oil globule allows for distinguishing yolk–sac larvae of this species from those of clupeid species, *Sardina pilchardus* and *Sardinella aurita*)

Pigmentation: unpigmented

LARVAE Figs. C–G

Distinctive characters: body elongate and slender; gut relatively shorter than that of *S. pilchardus* and *S. aurita*; dorsal fin located over anus (allows for distinguishing this species from *S. aurita* and *S. pilchardus*)

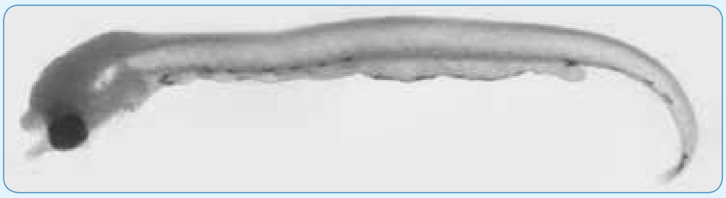
Preanus length: about 75% SL

Pigmentation: similar to *S. pilchardus*; melanophores aligned on both sides of body, above gut; row of melanophores ventrally, in posterior section of gut; caudal fin pigmented; some melanophores between anus and caudal fin

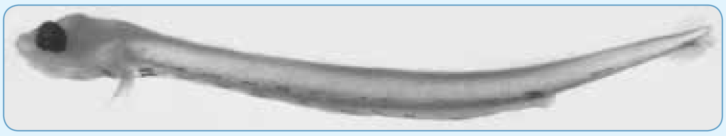
Length at flexion: unknown

PHOTOS

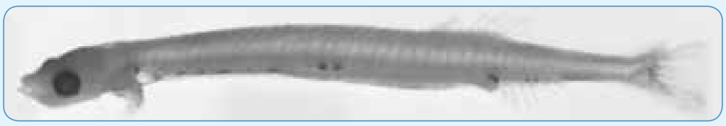
by J.M. Rodriguez



3.2 mm SL



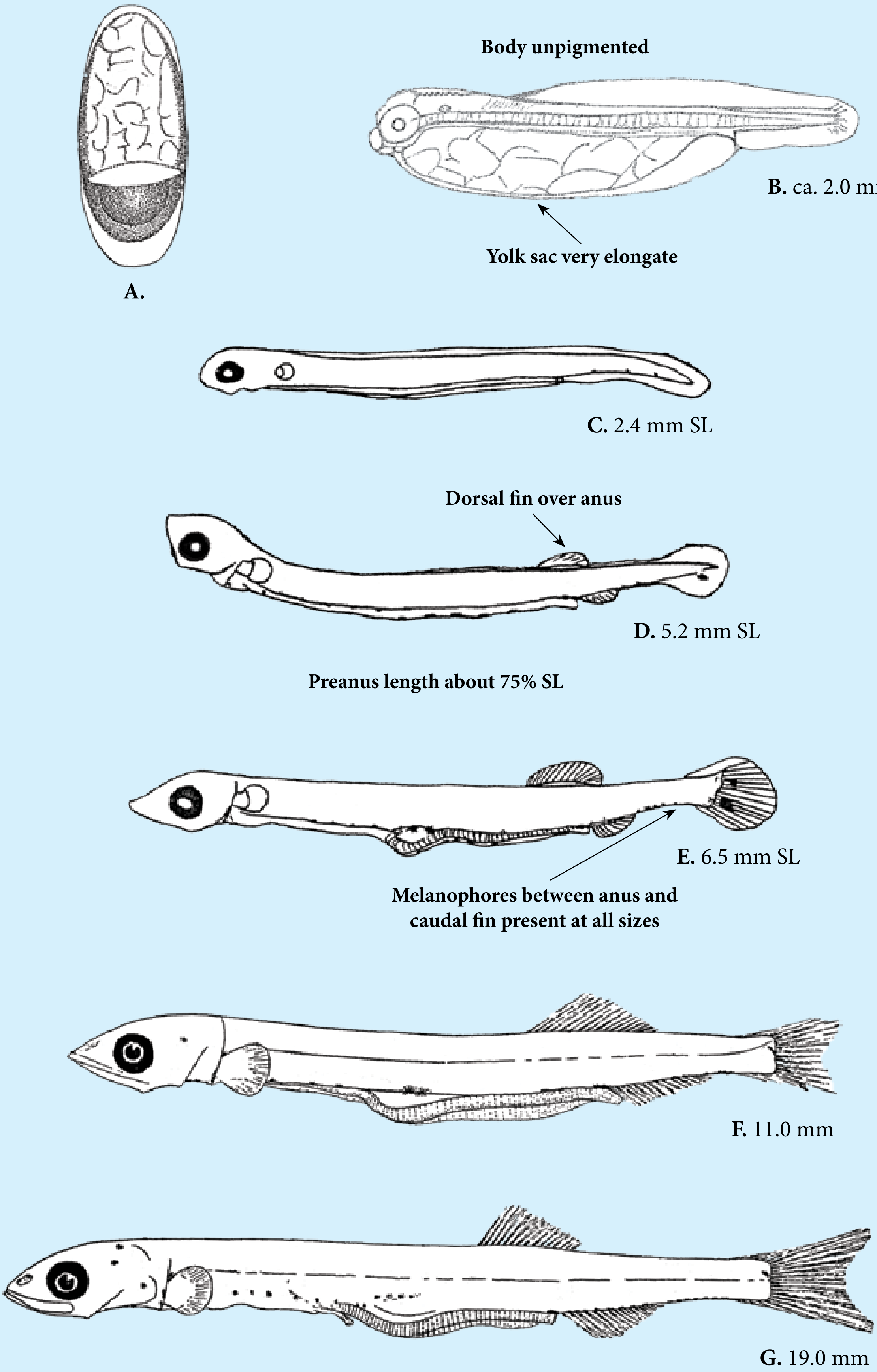
5.5 mm SL



10.8 mm SL

Literature: Alemany (1997), Fage (1920), Russell (1976), Whitehead (1984b)

ENGRAULIDAE *Engraulis encrasicolus* (Linnaeus, 1758)



A, B: D'Ancona (1931c); **C–E:** Alemany (1997); **F, G:** Fage (1920)

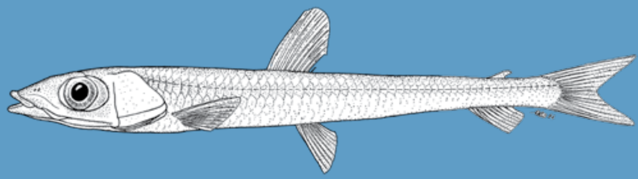
ARGENTINIDAE

Argentina sphyraena Linnaeus, 1758

En: Argentine – **Fr:** Petite argentine – **Sp:** Pez plata

Habitat: Pelagic, coastal

Spawning seasons: Winter and spring



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.70–1.85 mm
Chorion: smooth
Oil globules: single, 0.37–0.47 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE

Figs. B, C

Hatch size: may be between 7.0 and 7.5 mm
Distinctive characters: body elongate
Pigmentation: large stellate melanophores on yolk sac and groups of melanophores along dorsal side of gut; caudal–dorsal and ventral groups of melanophores

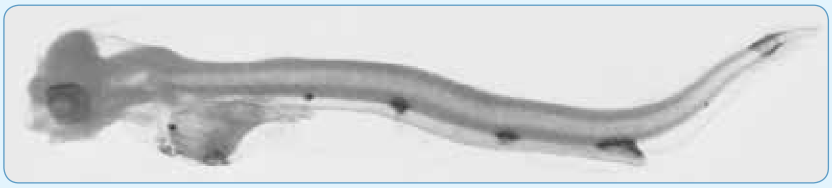
LARVAE

Figs. D–F

Distinctive characters: body elongate and slender
Preanus length: about 76% SL
Pigmentation: 6 groups of melanophores, approximately equidistant, situated along ventral region of trunk (above gut) and tail; two opposing melanophores near caudal end; tips of upper and lower jaw pigmented; caudal fin pigmented
Length at flexion: flexion begins at about 13.0 mm

PHOTOS

by J.M. Rodriguez



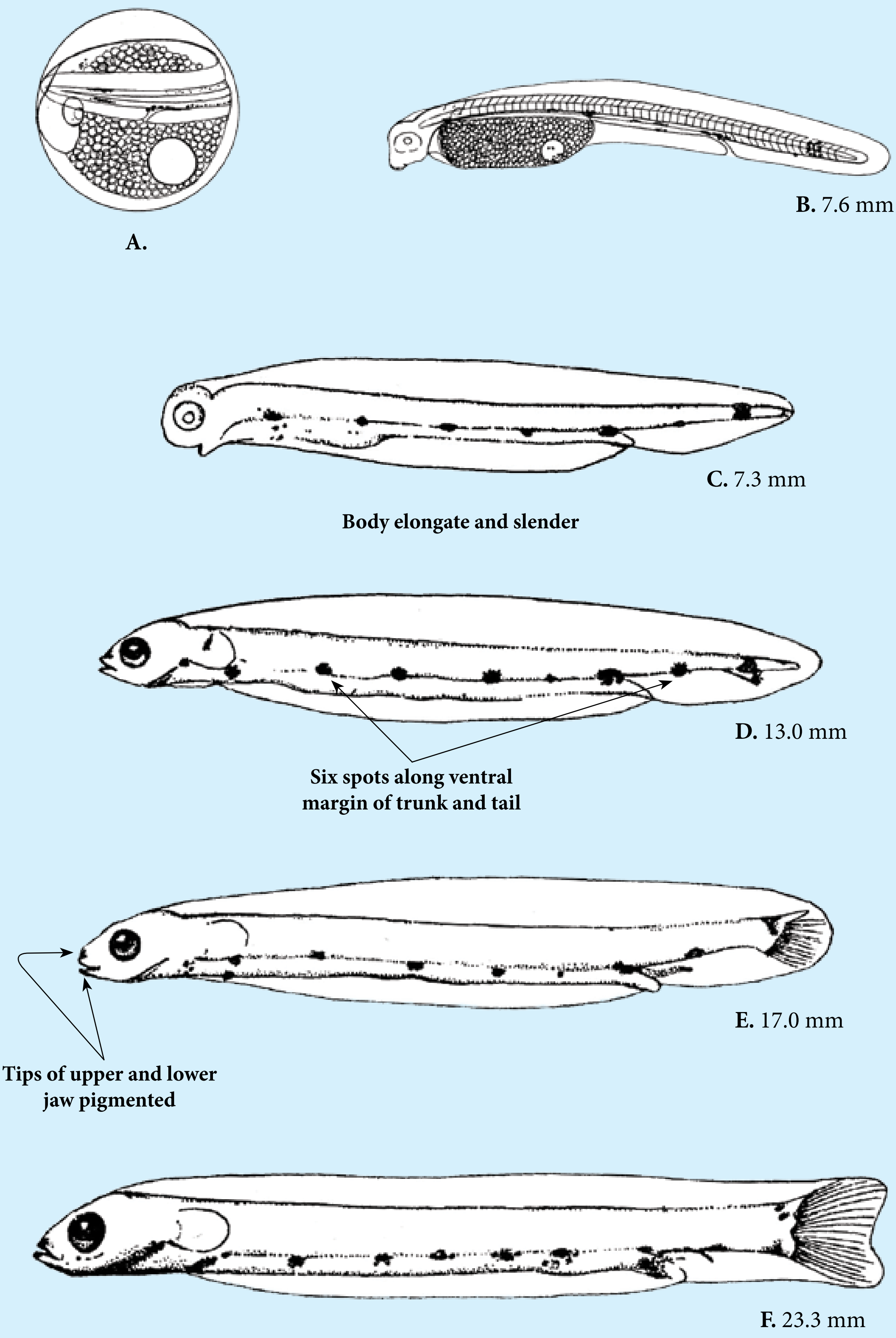
6.0 mm SL

11.8 mm SL

Literature: Cohen (1984), Russell (1976), Sanzo (1931a), Schmidt (1918)

ARGENTINIDAE

Argentina sphyraena Linnaeus, 1758



A–F: Sanzo (1931a)

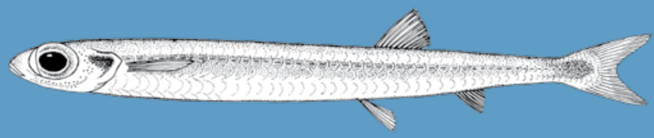
MICROSTOMATIDAE

Microstoma microstoma (Risso, 1810)

En: Slender argentine

Habitat: Mesopelagic

Spawning season: Throughout the year, mainly in winter



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.60–1.72 mm
Chorion: with 'pustules' on inner surface
Oil globules: single, 0.48–0.52 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. B–F

Distinctive characters: body moderately elongate and laterally compressed in early larvae, becomes rounded in older larvae; gut locally swollen and detached from body at its end

Preanus length: about 75% TL

Pigmentation: some melanophores on snout; continuous row of melanophores running along ventral side of body, from posterior margin of eye to caudal fin; row of ventral melanophores from pectoral fins to caudal peduncle; short series of spots under developing dorsal fin, becomes longer in older larvae

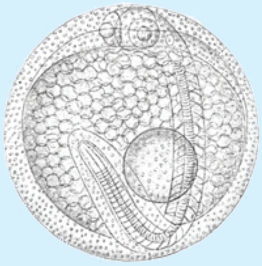
Length at flexion: flexion occurs between 7.0 and 11.0 mm

PHOTOS

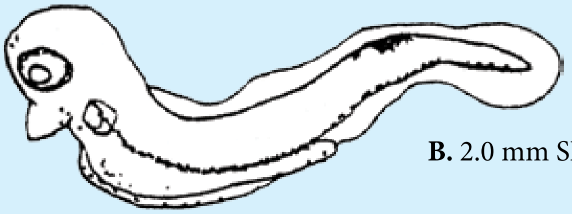
Not available

Literature: Alemany (1997), Cohen (1984), Sanzo (1931c), Schmidt (1918)

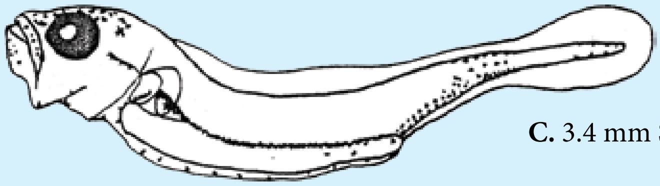
MICROSTOMATIDAE *Microstoma microstoma* (Risso, 1810)



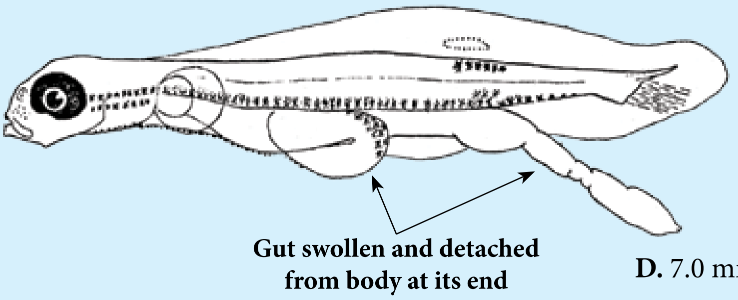
A.



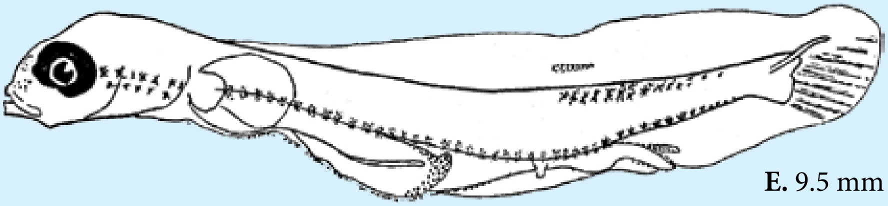
B. 2.0 mm SL



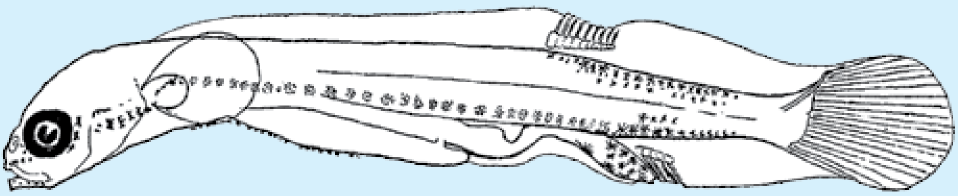
C. 3.4 mm SL



D. 7.0 mm



E. 9.5 mm



F. 11.0 mm

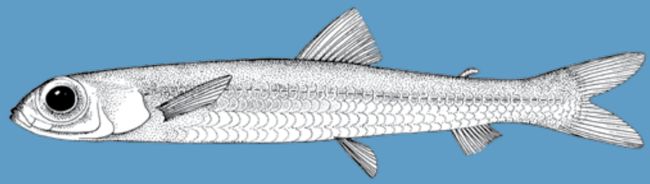
A: Sanzo (1931c); **B, C:** Alemany (1997); **D–F:** Schmidt (1918)

MICROSTOMATIDAE

Nansenia oblita (Facciolà, 1887)

Habitat: Mesopelagic

Spawning season: Winter



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.48–1.50 mm
Chorion: with 'pustules' on inner surface
Oil globules: single, 0.40–0.43 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE

Hatch size: about 4.0 mm SL
Pigmentation: not pigmented

LARVAE

Figs. B–F

Distinctive characters: body moderately elongate and laterally compressed, becomes rounded in larger larvae; end of gut detached from body in early larvae

Preanus length: about 75% TL

Pigmentation: a row of melanophores along both the dorsal and ventral margin of the notochord; scattered melanophores on head appear as a bar through the eye; rows of small melanophores along ventral side of trunk and tail, from pectoral–fin base to level of anus; row of melanophores along lower jaw; pigment spreads over most of body with development, except on caudal peduncle

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

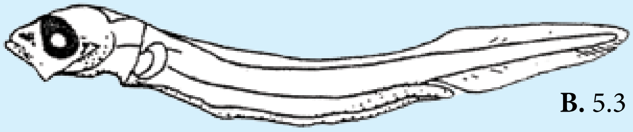
3.4 mm SL

3.5 mm SL

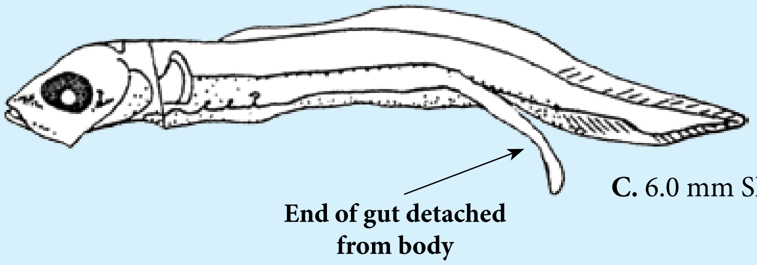
Literature: Alemany (1997), Cohen (1984), Sabatés (1988), Sanzo (1931c), Schmidt (1918)

MICROSTOMATIDAE *Nansenia oblita* (Facciolà, 1887)

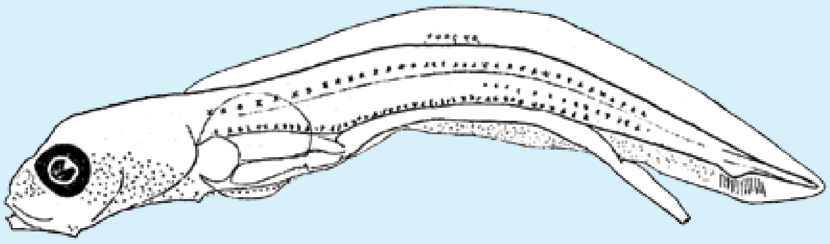
A.



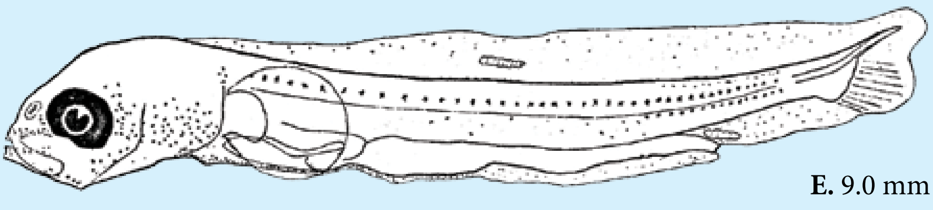
B. 5.3 mm SL



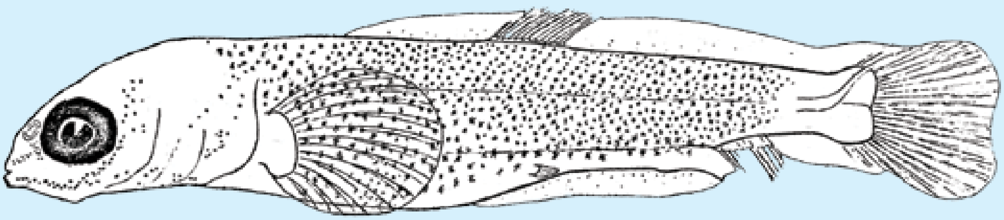
C. 6.0 mm SL



D. 7.8 mm



E. 9.0 mm



F. 13.0 mm

A: Sanzo (1931c); **B, C:** Alemany (1997); **D–F:** Schmidt (1918)

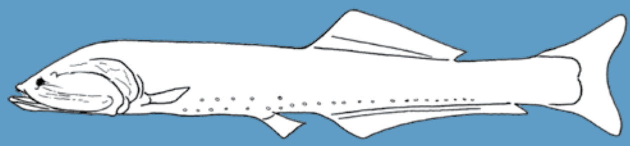
GONOSTOMATIDAE

Cyclothone braueri **Jespersen & Täning, 1926**

En: Garrick

Habitat: Oceanic, mesopelagic, between 250 and 900 m depth

Spawning season: Mainly between April and October



***Cyclothone* sp.**

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–F

Distinctive characters: body quite elongate with a large swimbladder; eye round and small; dorsal and anal fins located at same level, just after anus

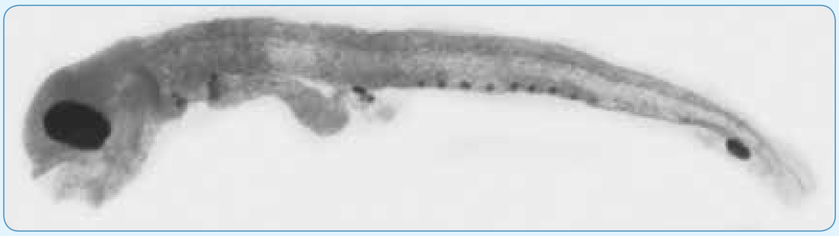
Preanus length: about 50% SL

Pigmentation: prominent spot on ventral side of caudal peduncle; 3 pairs of melanophores along lateral sides of gut: one close to pectoral–fin base, another at mid–gut and a third one over hindgut; dorsum of swimbladder pigmented; a series of 9 to 12 equidistant melanophores along the postanal ventral region; later larvae with a regular ventral postanal row of internal melanophores in correspondence with the external postanal row; row of 5 or 6 internal melanophores on ventrolateral anterior region of body and about 3 internal melanophores on upper part of caudal peduncle

Length at flexion: about 4.8 mm

PHOTOS

by J.M. Rodriguez



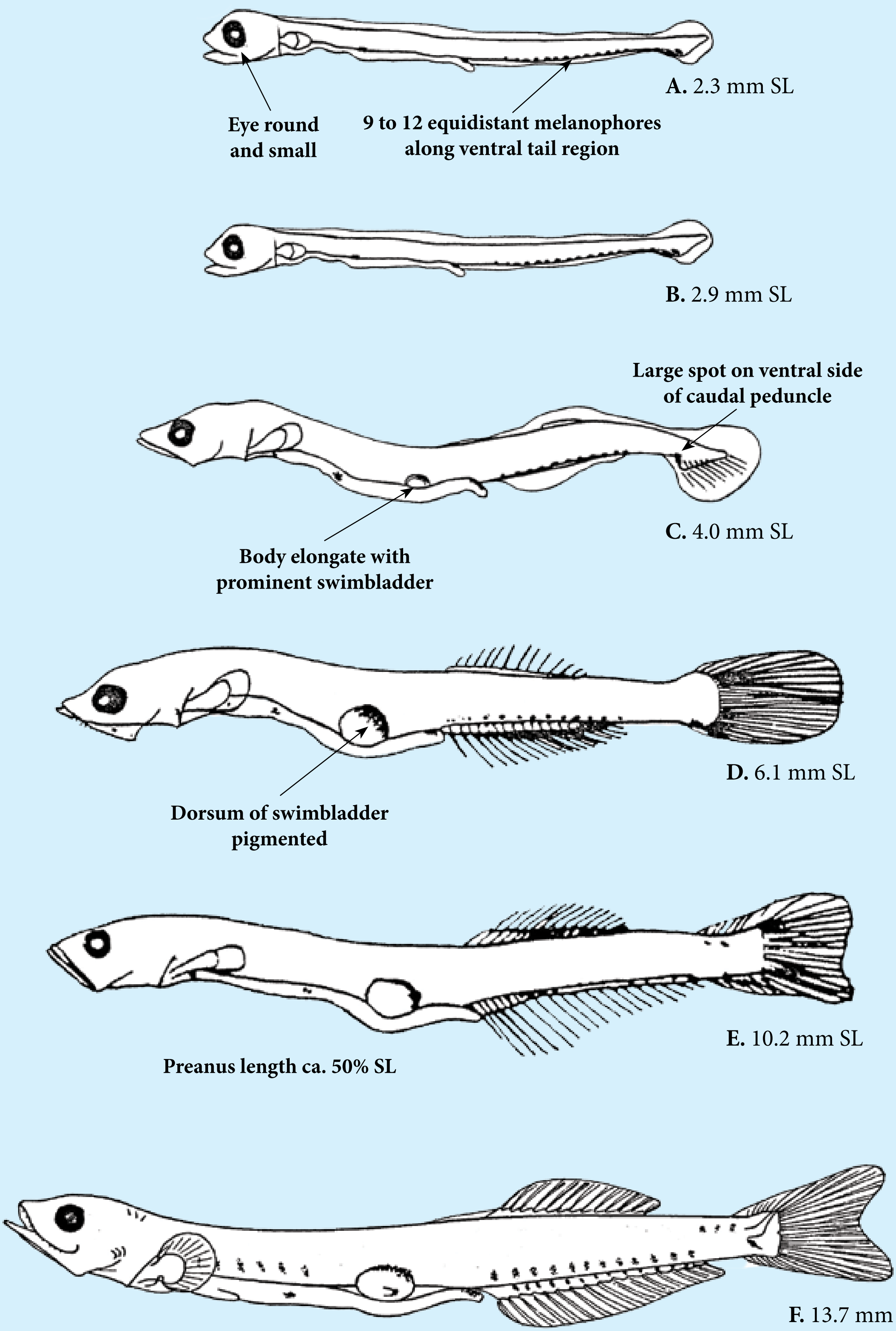
3.6 mm SL

5.0 mm SL

10.5 mm SL

Literature: Alemany (1997), Badcock (1984a), Jespersen and Täning (1926), Sabatés (1988)

GONOSTOMATIDAE *Cyclothone braueri* Jespersen & Täning, 1926



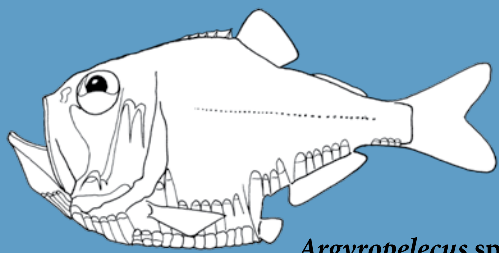
A–E: Alemany (1997); **F:** Jespersen and Täning (1926)

STERNOPTYCHIDAE *Argyropelecus hemigymnus* Cocco, 1829

En: **Half–naked hatchetfish** – **Sp:** **Hacha de plata**

Habitat: **Oceanic, mesopelagic, between 200 and 800 m during the day and 100 to 600 m at night, making marked vertical migrations**

Spawning season: **Throughout the year, peaking in winter and early summer**



***Argyropelecus* sp.**

EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.92–1.04 mm
Chorion: smooth, with a secondary membrane inside chorion
Oil globules: single, 0.26–0.28 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE Fig. B

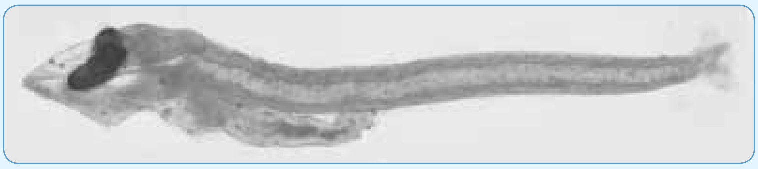
Hatch size: 2.5 mm SL
Distinctive characters: body elongate and slender; yolk sac very large; oil globule situated at ventral side of yolk sac
Pigmentation: unpigmented

LARVAE Figs. C–F

Distinctive characters: body moderately elongate in young larvae, shortens at transformation; eye oval and narrow in early stages, becomes slightly telescopic in older larvae; gut detached from body
Preanus length: 44–59% SL in early larvae
Pigmentation: body unpigmented in preflexion stage; photophores present in older larvae
Length at flexion: 10.0–11.0 mm
Length at transformation: 7.8–12.0 mm; initially, during transformation, larvae shrink (mainly the anterior part of body), gut shortens, head deepens, and eyes become telescopic

PHOTOS

by J.M. Rodriguez

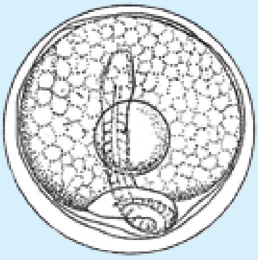


4.9 mm SL

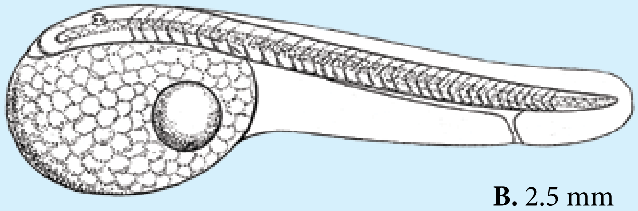
6.7 mm SL

Literature: Alemany (1997), Badcock (1984c), Sanzo (1931b), Täning (1918)

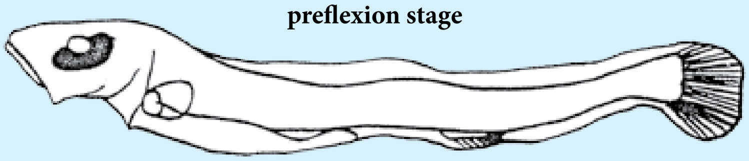
STERNOPTYCHIDAE *Argyropelecus hemigymnus* Cocco, 1829



A.

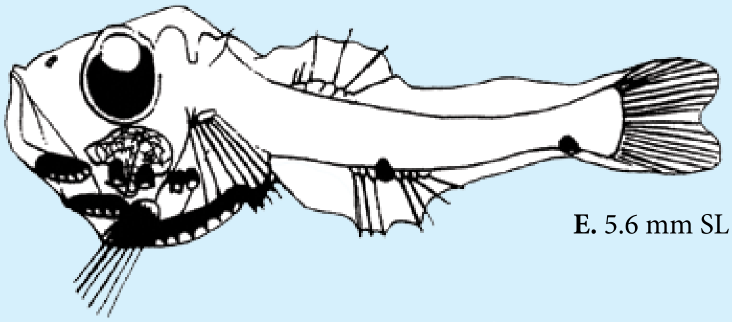


B. 2.5 mm

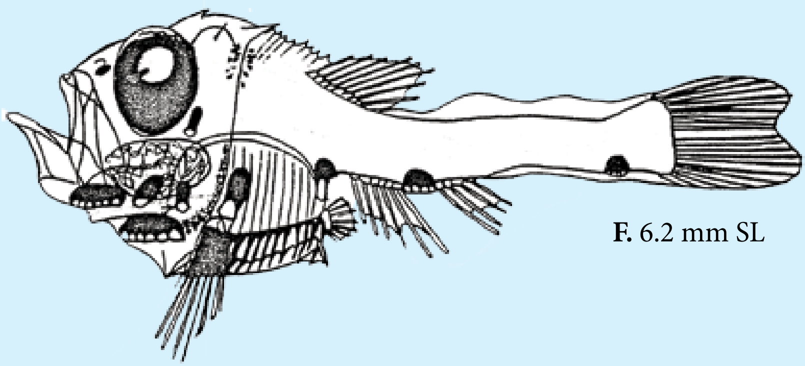


C. 6.9 mm SL

D. 9.0 mm



E. 5.6 mm SL



F. 6.2 mm SL

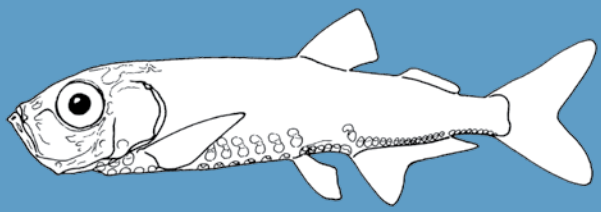
A, B: Sanzo (1931b); **C, E, F:** Alemany (1997); **D:** Täning (1918)

STERNOPTYCHIDAE *Maurolicus muelleri* (Gmelin, 1789)

En: Silvery lightfish

Habitat: Mesopelagic, between 40 and 400 m depth

Spawning season: Over the whole year



***Maurolicus* sp.**

EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.32–1.58 mm
Chorion: sculptured with hexagonal structures
Oil globules: single, 0.26–0.28 mm in diameter
Perivitelline space: narrow
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

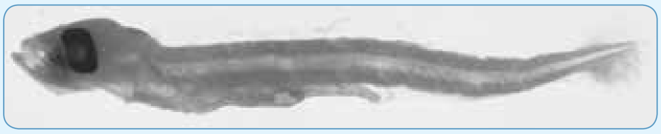
Hatch size: around 3.0 mm
Distinctive characters: body relatively elongate and slender, transparent; yolk sac very large, oval and projected beyond snout; oil globule situated at ventral side of yolk sac; anus reaches the border of finfold
Pigmentation: unpigmented

LARVAE — Figs. C–F

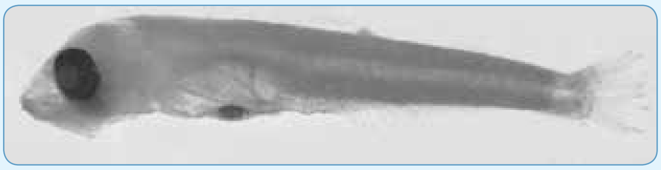
Distinctive characters: body relatively elongate with a prominent swimbladder; eye vertically elliptical, becoming round in late larvae; at about 6 mm SL, a photophore under eye and two in ventral region, under swimbladder
Preanus length: about 50% SL, increasing with development
Pigmentation: young larvae unpigmented; pigment first appears on dorsum of swimbladder; in later larvae, pigmentation limited to dorsum of swimbladder and photophores
Length at flexion: flexion completed at 5.8 mm SL

PHOTOS

by J.M. Rodriguez



5.4 mm SL

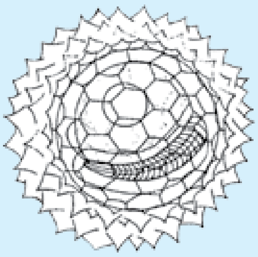


7.6 mm SL

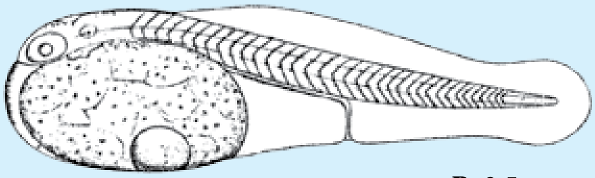
10.5 mm SL

Literature: Alemany (1997), Badcock (1984c), Jespersen and Täning (1926), Sanzo (1935)

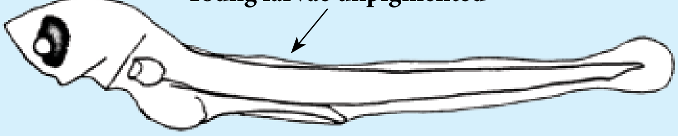
STERNOPTYCHIDAE — ***Maurolicus muelleri*** (Gmelin, 1789)



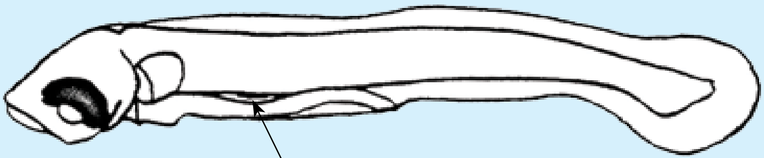
A.



B. 2.5 mm

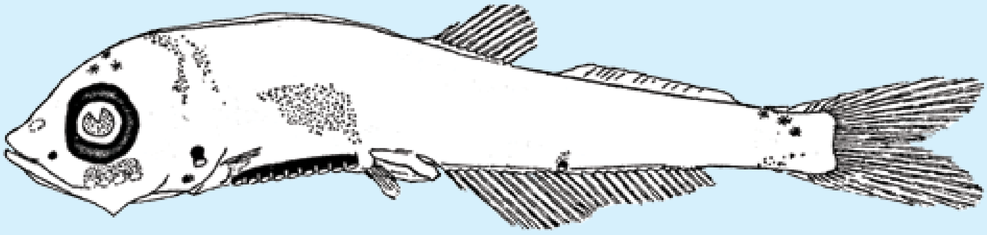


C. 2.9 mm SL



D. 4.2 mm SL

E. 6.4 mm



F. 10.0 mm

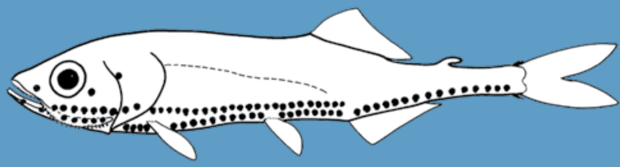
A, B: Sanzo (1935); **C, D:** Alemany (1997); **E, F:** Jespersen and Täning (1926)

PHOSICHTHYIDAE *Vinciguerria attenuata* (Cocco, 1838)

En: Silvery lightfish

Habitat: Mesopelagic, between 250 and 600 m depth

Spawning season: Spring–summer



Phosichthyidae

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–F

Distinctive characters: body elongate and slender with a prominent swimbladder (not present in young larvae); dorsal and anal fins located at level of anus

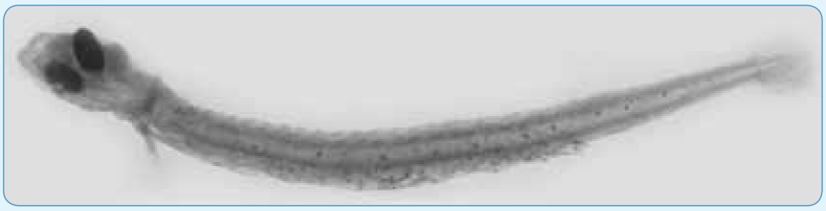
Preanus length: about 75% SL

Pigmentation: larvae less than 6 mm SL with 6–8 stellate melanophores on both sides of body; in larger larvae, lateral rows disappear and a prominent median caudal spot develops; dorsum of swimbladder pigmented

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez



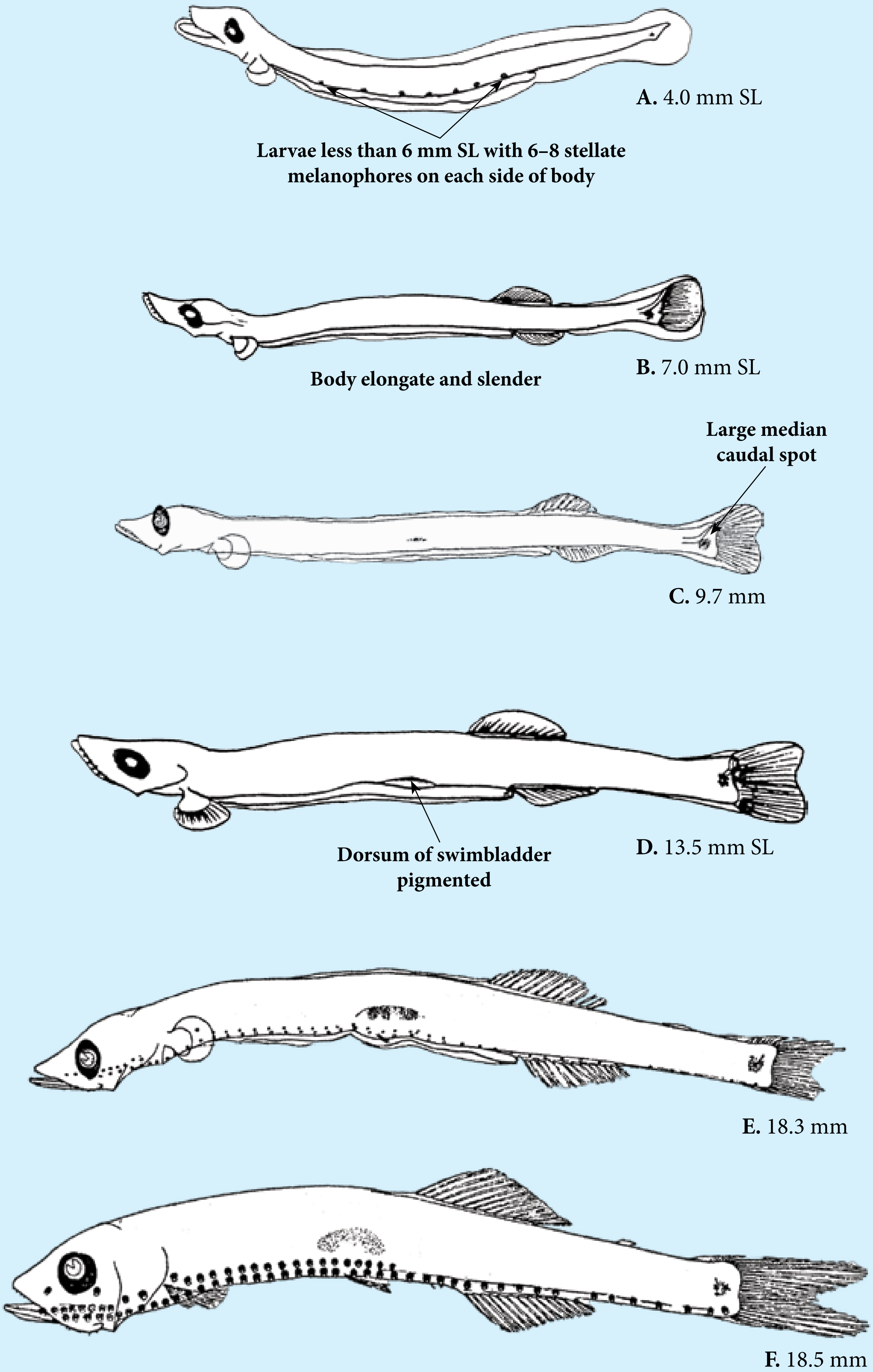
7.2 mm SL

10.2 mm SL

10.7 mm SL

Literature: Alemany (1997), Badcock (1984b), Jespersen and Täning (1926)

PHOSICHTHYIDAE *Vinciguerria attenuata* (Cocco, 1838)



A, B, D: Alemany (1997); **C, E, F:** Jespersen and Täning (1926)

STOMIIDAE *Stomias boa* (Risso, 1810)

En: Boa dragonfish – **Sp:** Estomias

Habitat: Mesopelagic, in deep oceanic waters to more than 1 000 m depth

Spawning season: Spring–summer

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body very elongate with a long head and large jaws; eye oval; small dorsal and anal fins located at same level, at end of body

Preanus length: about 88% SL

Pigmentation: in young larvae, row of small melanophores over gut, between pectoral and caudal–fin base; some melanophores appear in dorsal–caudal region in larvae of about 6 mm SL, extending forward with growth; dorsal and ventral series of melanophores disappear in older larvae

Length at flexion: unknown

PHOTOS

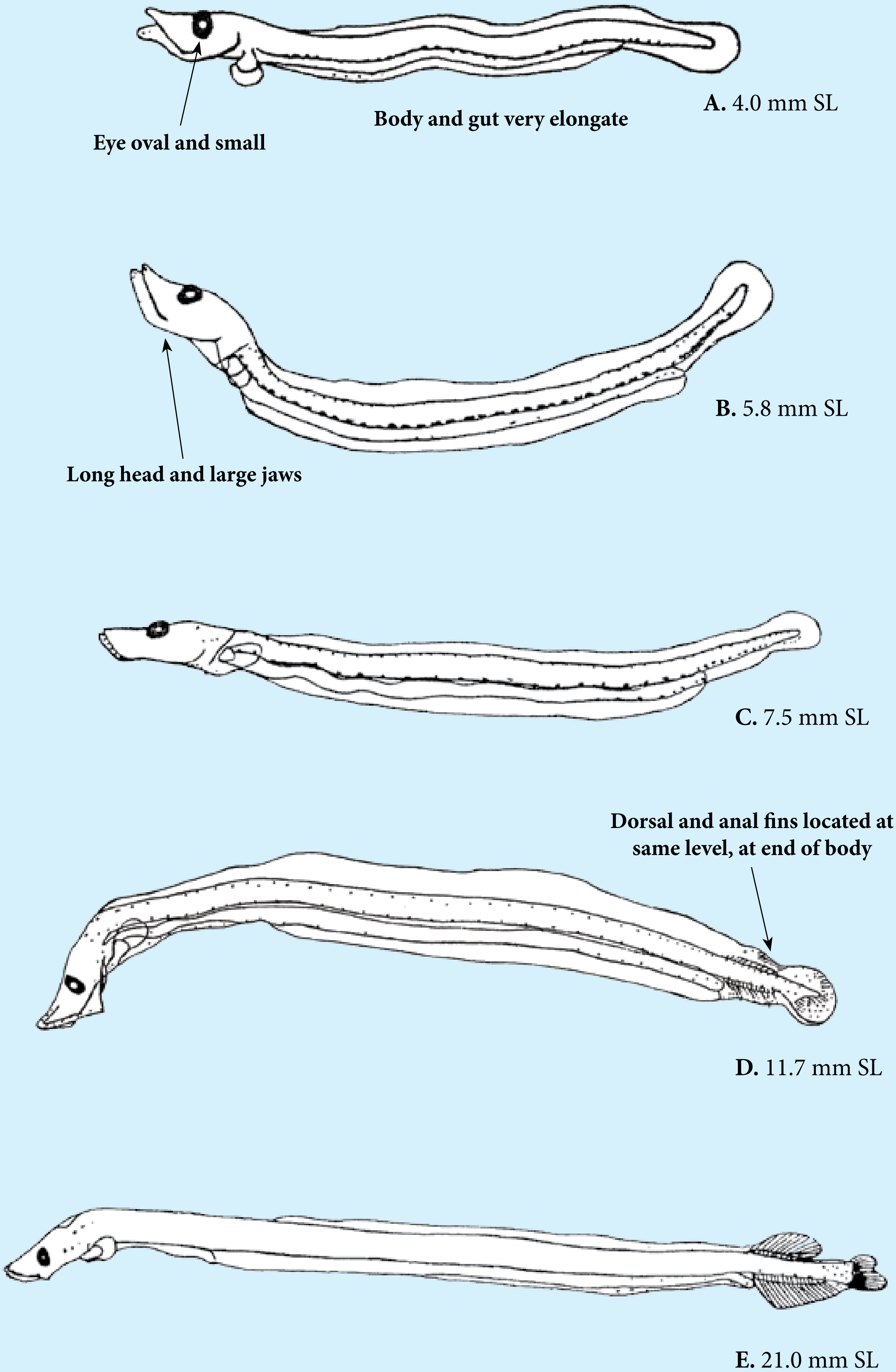
by J.M. Rodriguez

6.0 mm SL

16.6 mm SL

Literature: Alemany (1997), Fahay (1983), Gibbs (1984), Sabatés (1988)

STOMIIDAE — ***Stomias boa*** (Risso, 1810)



A–E: Alemany (1997)

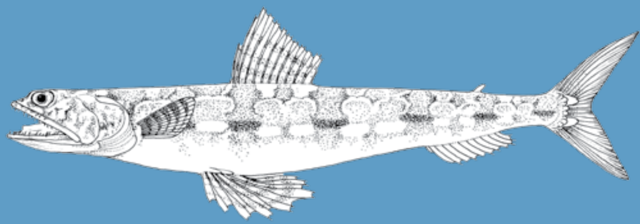
SYNODONTIDAE

Synodus saurus **(Linnaeus, 1758)**

En: Atlantic lizardfish – Sp: Pez lagarto

Habitat: Benthic, between 20 and 400 m depth, mostly in depths less than 50 m

Spawning season: Unknown



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.10–1.35 mm
Chorion: ornamented, covered with a hexagonal reticulum
Oil globules: none
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Hatch size: 4.0–4.5 mm SL
Pigmentation: 5 large ventral spots approximately equidistant, 4 over gut, between pectoral fin and anus and another in caudal region; melanophores arranged radially over caudal end of primordial fin

LARVAE

Figs. B–F

Distinctive characters: body elongate and slender
Preanus length: about 80% SL
Pigmentation: similar to yolk–sac larvae, difference lies in the number of ventral patches that may be 6; caudal fin pigmented
Length at flexion: unknown

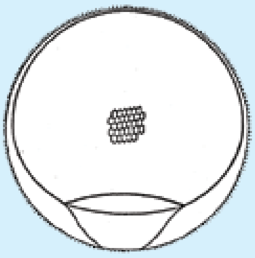
PHOTOS

by J.M. Rodriguez

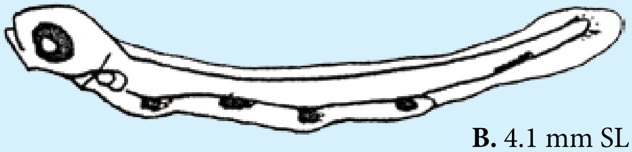
3.4 mm SL

Literature: Alemany (1997), Sulak (1984), Täning (1918), Tortonese (1956b)

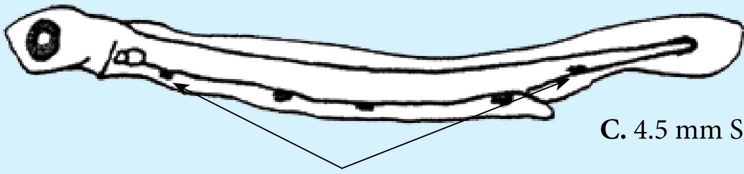
SYNODONTIDAE *Synodus saurus* (Linnaeus, 1758)



A.

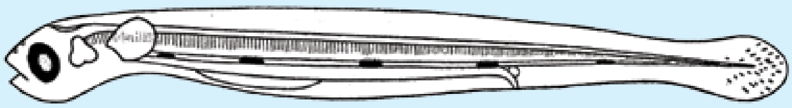


B. 4.1 mm SL

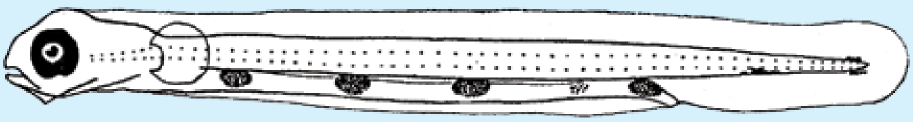


C. 4.5 mm SL

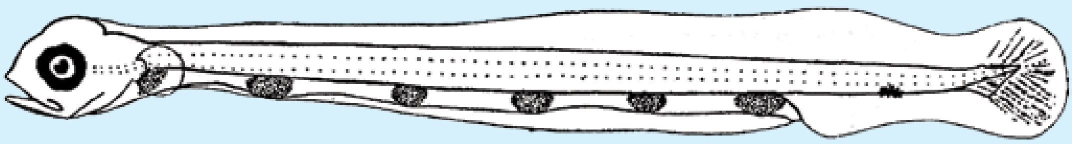
5 (6 in larger larvae) large spots along ventral side of trunk and tail



D. 4.6 mm



E. 5.0 mm



F. 12.0 mm

A, D: Tortonese (1956b); **B, C:** Alemany (1997); **E, F:** Täning (1918)

PARALEPIDIDAE *Lestidiops jayakari* (Boulenger, 1889)

Habitat: Mesopelagic, between 200 and 2000 m depth

Spawning season: Probably throughout all year

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–G

Distinctive characters: body elongate and slender; head short and deep in small larvae, becomes larger with development; eye large and round

Preanus length: about 20% SL in young larvae, increases with development

Pigmentation: two large stellate postanal, ventral melanophores (congener species, *L. sphyrenoides*, has 3 postanal ventral patches) and two series of small melanophores, one above and another below urostyle; tip of upper and lower jaw pigmented; up to 12 peritoneal patches of pigment form during development

Length at flexion: 12.0–16.0 mm

PHOTOS

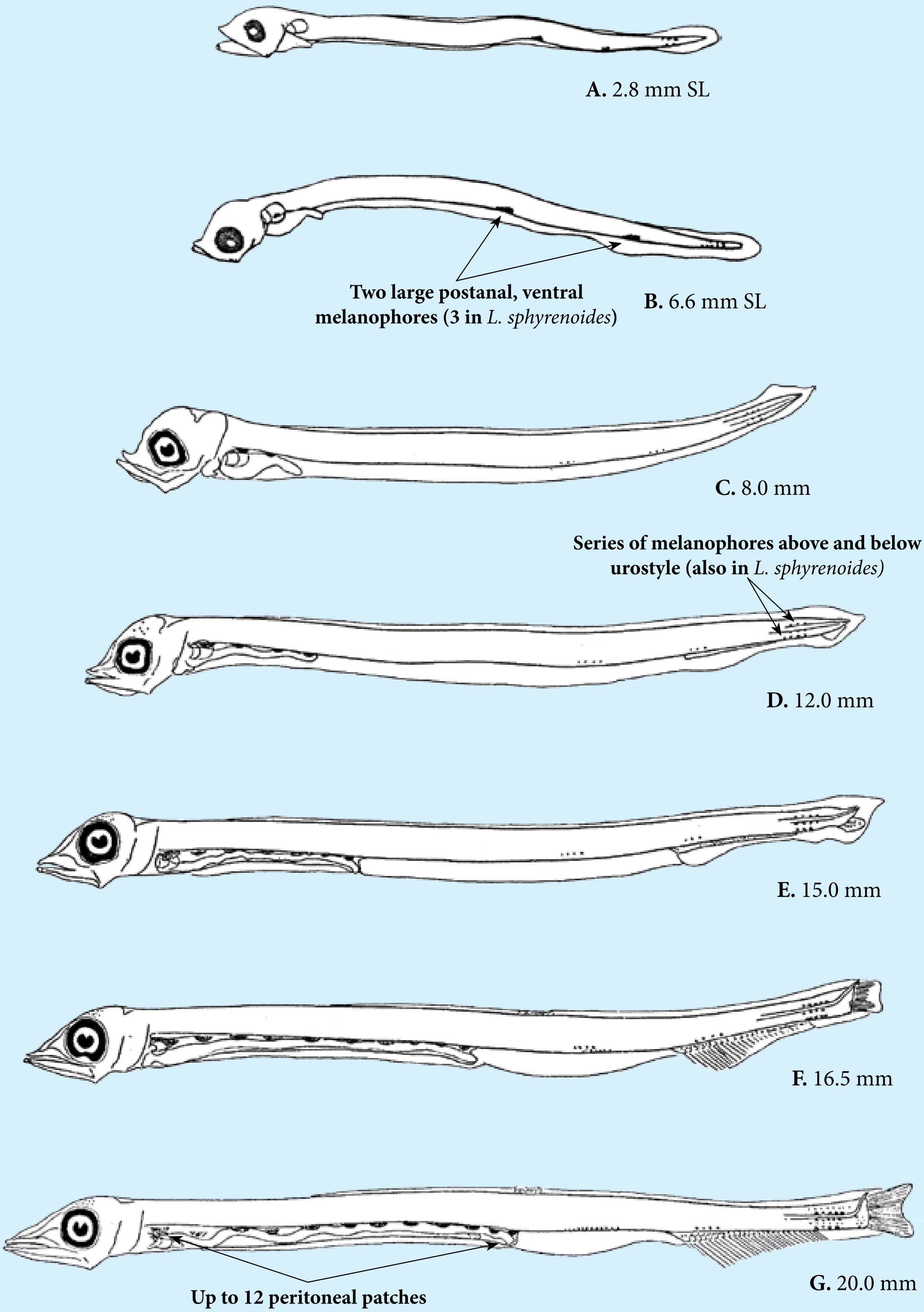
by J.M. Rodriguez

5.5 mm SL

10.5 mm SL

Literature: Alemany (1997), Ege (1930), Fahay (2007), Post (1984), Richards (2006)

PARALEPIDIDAE ***Lestidiops jayakari*** **(Boulenger, 1889)**



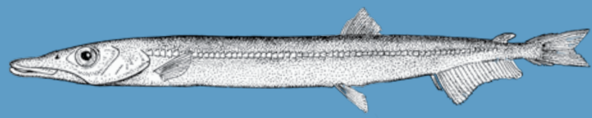
A, B: Alemany (1997); **C–G:** Ege (1930)

PARALEPIDIDAE

Paralepis coregonoides Risso, 1820

Habitat: Meso– to bathypelagic

Spawning season: Spring–summer



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–G

Distinctive characters: body elongate, snout relatively long; eye big and ovoid at first stages of development, becomes round in older larvae

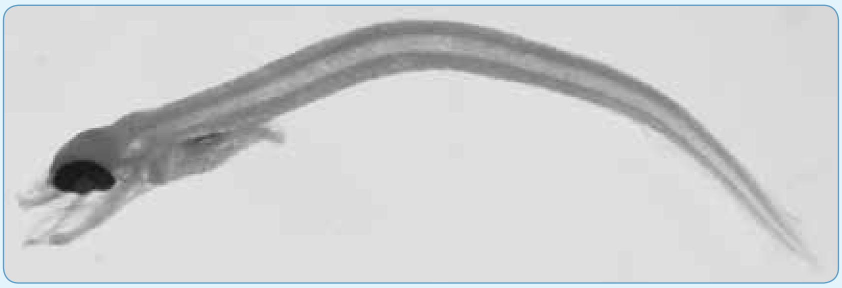
Preanus length: about 30% SL in early larvae, increases with development

Pigmentation: postanal region unpigmented up to about 5 mm when a deep spot appears above notochord, close to its end; long series of internal melanophores above notochord and a short one, below it; the number of peritoneal patches increases from 1 in larvae of 6 mm SL to 3 in older larvae

Length at flexion: about 10.0–15.0 mm

PHOTOS

by J.M. Rodriguez



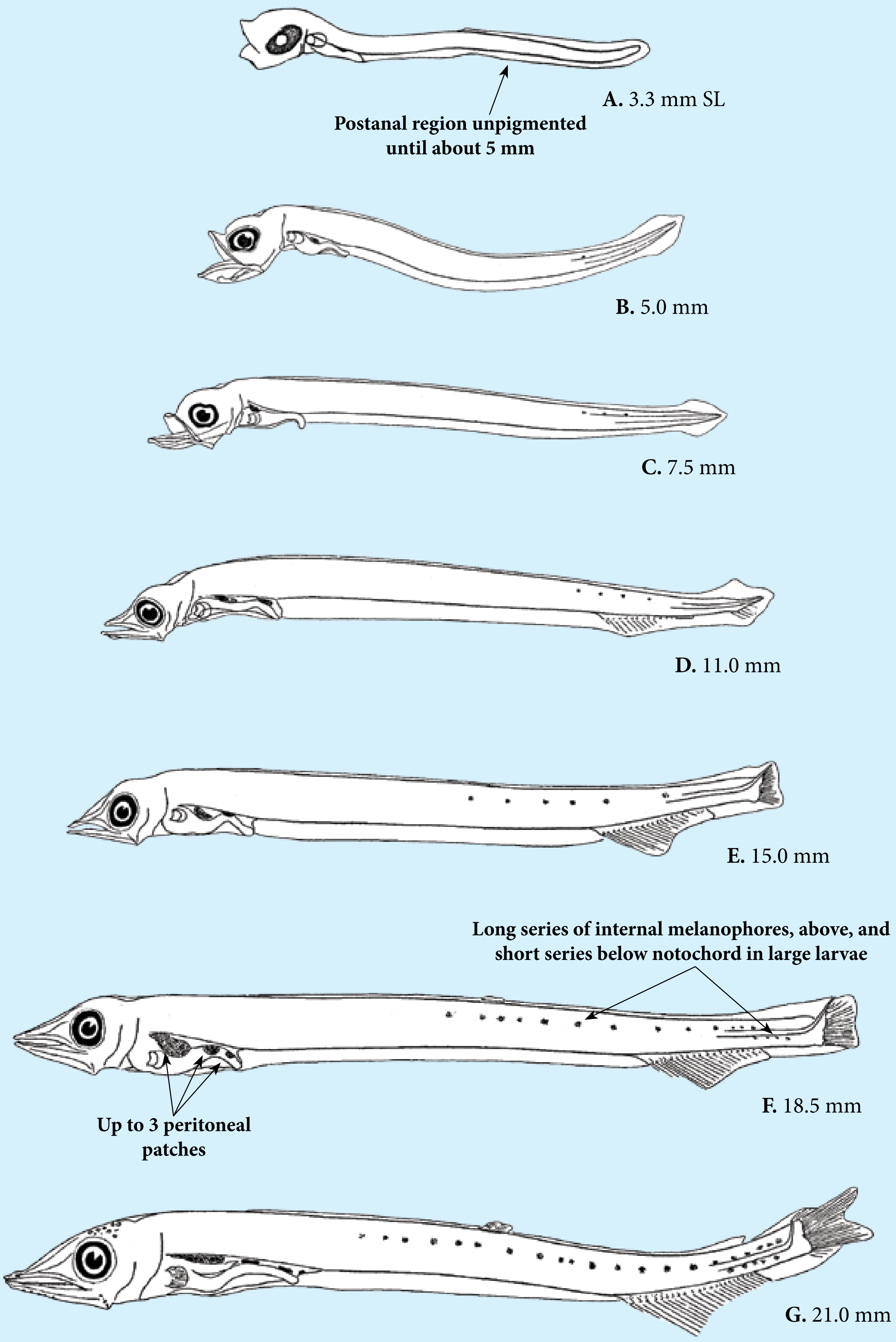
8.8 mm SL

10.2 mm SL

15.0 mm SL

Literature: Alemany (1997), Ege (1930), Fahay (2007), Post (1984), Richards (2006)

PARALEPIDIDAE — ***Paralepis coregonoides*** Risso, 1820



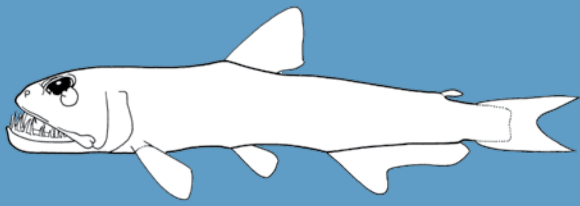
A: Alemany (1997); **B–G:** Ege (1930)

EVERMANNELLIDAE *Evermannella balbo* (Risso, 1820)

En: Balbo sabretooth

Habitat: Mesopelagic, between 100 and 800 m depth

Spawning season: No information



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body fairly elongate; snout long and pointed; eye elliptical; large teeth in both jaws

Preanus length: less than 50% SL

Pigmentation: 3 large peritoneal pigment patches; in young larvae, melanophores scattered on lateral preanal region and some melanophores on caudal–fin base; in later larvae, melanophores arranged in transversal bars, following myosepta; melanophores on head, snout and neck; caudal–fin base pigmented

Length at flexion: flexion completed at 6.8 mm SL

PHOTOS

by J.M. Rodriguez

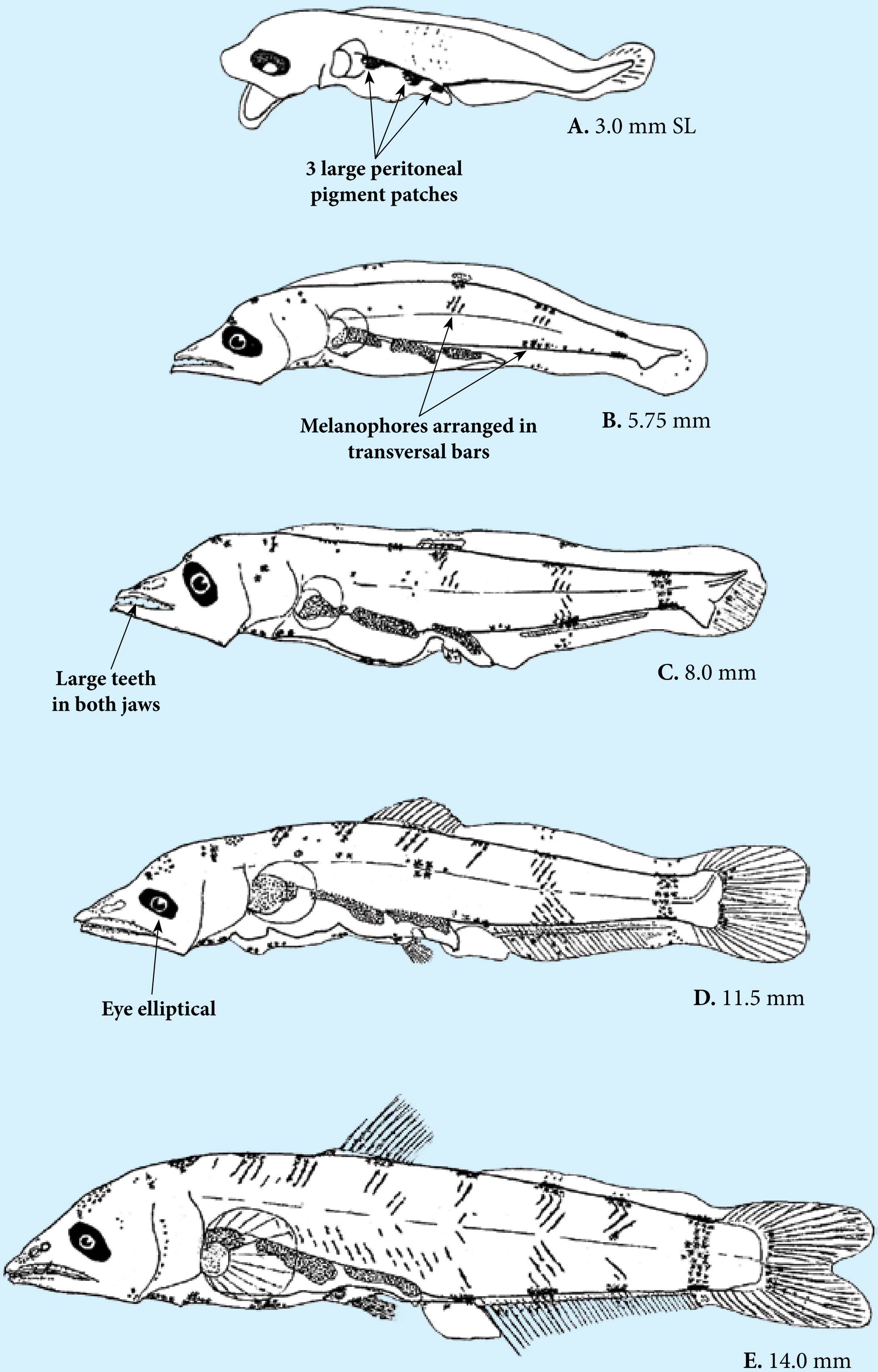
5.2 mm SL

6.5 mm SL

7.4 mm SL

Literature: Alemany (1997), Fahay (2007), Johnson (1984), Richards (2006), Schmidt (1918)

EVERMANNELLIDAE — ***Evermannella balbo*** (Risso, 1820)



A: Alemany (1997); **B–E:** Schmidt (1918)

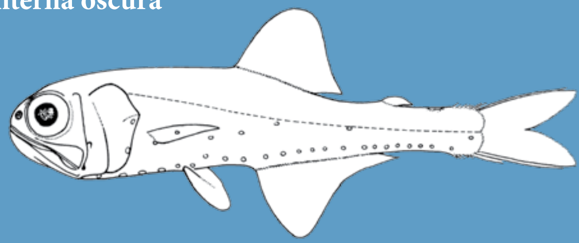
MYCTOPHIDAE

Benthosema glaciale (Reinhardt, 1837)

En: Glacier lantern fish – **Fr:** Lanterne glaciaire – **Sp:** Linterna oscura

Habitat: Mesopelagic, between 275 and 850 m depth during daytime; from surface down to 225 m depth at night

Spawning season: Spawning peaks in late spring, summer



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–E

Distinctive characters: body moderately elongate; eye slightly elliptical with choroid tissue ventrally; gap between anus and anal fin present in young larvae, closes at about 8.0 mm

Preanus length: about 33% of SL in young larvae, increases with development

Pigmentation: melanophores at posterior edge of opercle, at tip of snout and lower jaw; 3 ventral melanophores on cleithral symphysis, lateral sides of gut and hindgut; several melanophores on postanal ventral region, decreasing in number to a single one over mid of anal fin in older larvae; pectoral–fin rays pigmented; premature preopercular photophore

Length at flexion: 5.0–7.0 mm

PHOTOS

by J.M. Rodriguez

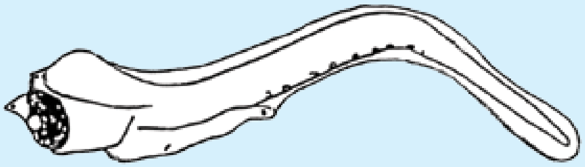
4.1 mm SL

6.2 mm SL

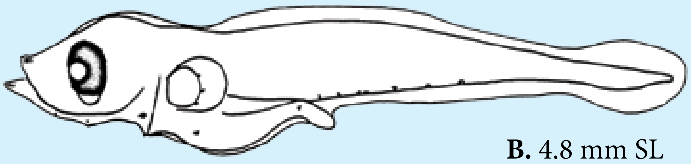
8.2 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

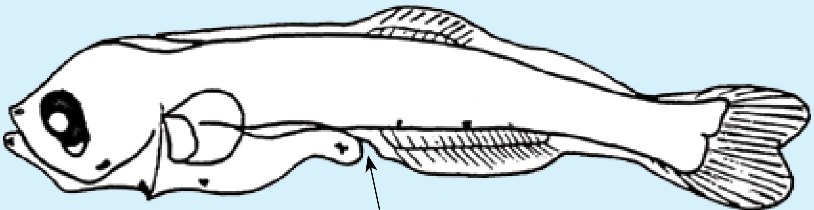
MYCTOPHIDAE *Benthosema glaciale* (Reinhardt, 1837)



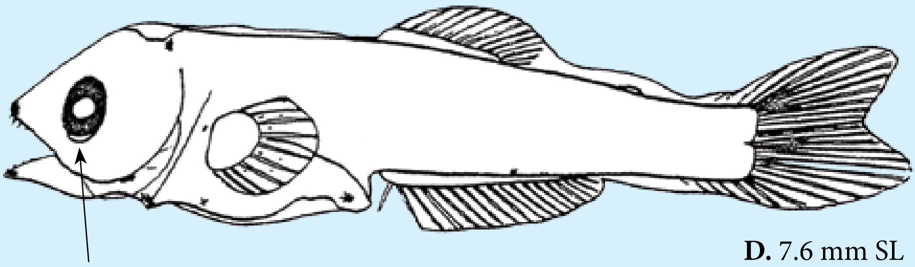
A. 2.3 mm SL



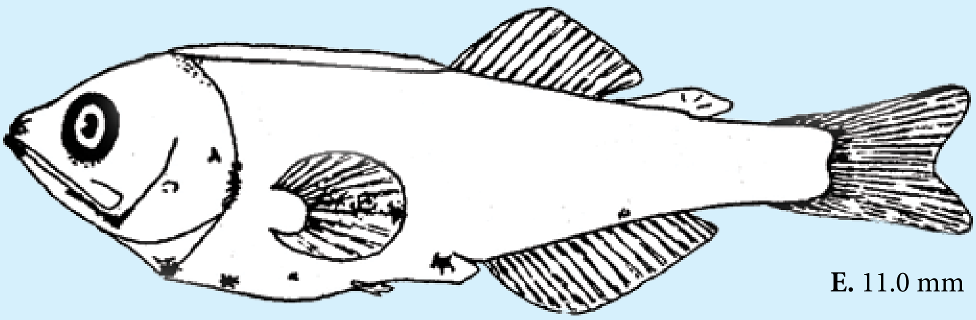
B. 4.8 mm SL



C. 5.7 mm SL



D. 7.6 mm SL



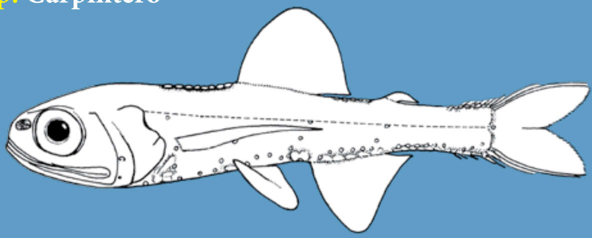
E. 11.0 mm

A–D: Alemany (1997); **E:** Täning (1918)

MYCTOPHIDAE *Ceratoscopelus maderensis* (Lowe, 1839)

En: Madeira lantern fish – **Fr:** Lanterne de Madère – **Sp:** Carpintero

Habitat: Mesopelagic, between 330 and 600 m depth during daytime, 0 to 175 m at night
Spawning season: Spawning peaks in spring, summer



EGGS

Undescribed

YOLK–SAC LARVAE

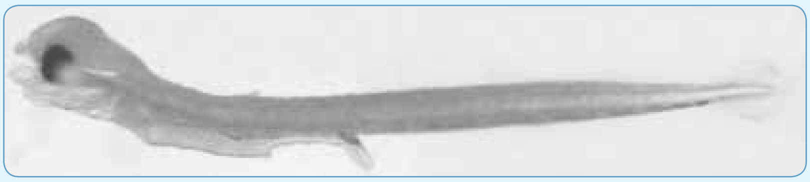
Undescribed

LARVAE Figs. A–F

Distinctive characters: body elongate, moderately slender; eye spherical and relatively large
Preanus length: more than 50% SL in early larvae, increases to more than 60% SL in older larvae
Pigmentation: a single melanophore on each side of gut and on hindgut; a continuous line of melanophores between anus and caudal fin decreasing in number with development; 3 or 4 melanophores on dorsal side of caudal peduncle (not present in young larvae); no melanophores at cleithral symphysis
Length at flexion: about 6 mm SL

PHOTOS

by J.M. Rodriguez



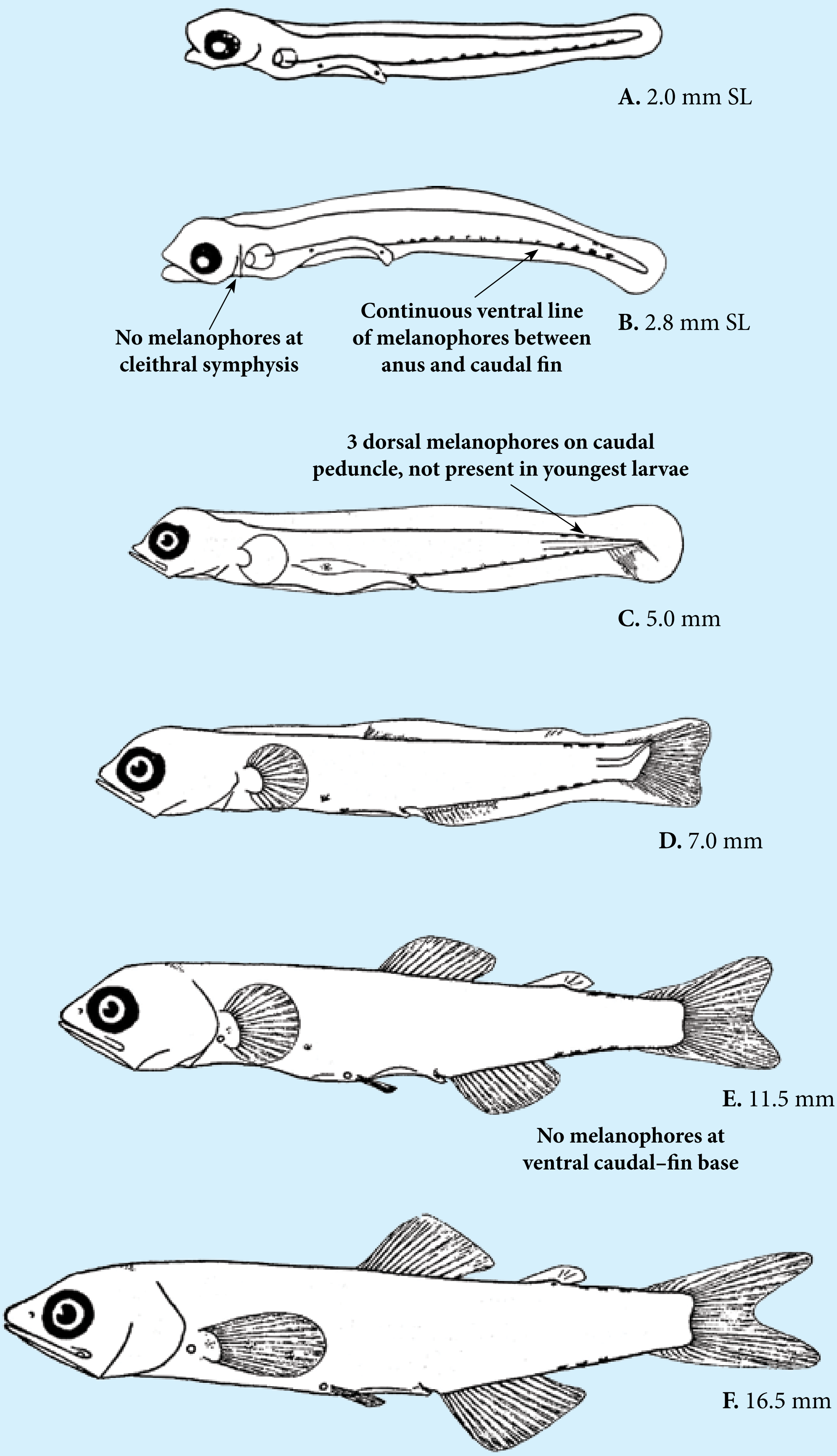
4.3 mm SL

6.0 mm SL

7.9 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

MYCTOPHIDAE *Ceratoscopelus maderensis* (Lowe, 1839)



A, B: Alemany (1997); **C–F:** Täning (1918)

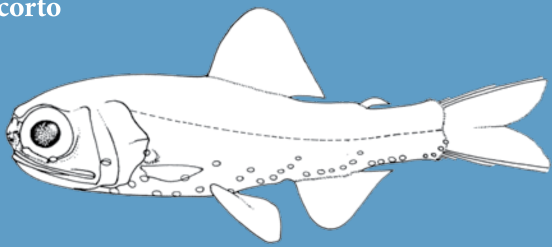
MYCTOPHIDAE

Diaphus holti Täning, 1918

En: Small lantern fish – **Fr:** Lanterne courte – **Sp:** Rafino corto

Habitat: Mesopelagic, between 80 and 675 m depth

Spawning season: Spring and summer



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–E

Distinctive characters: body moderately slender; eye round and relatively large

Preanus length: less than 50% SL

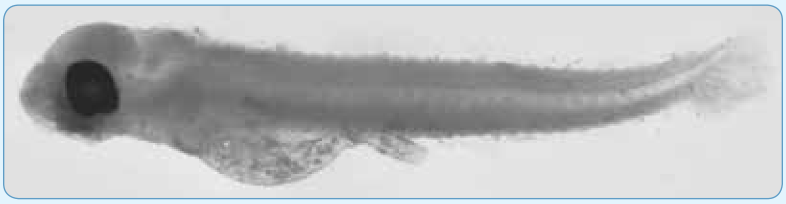
Pigmentation: melanophores on cleithral symphysis; a single melanophore on lateral sides of gut and over hindgut; regular row of ventral melanophores between anus and caudal region; single, large melanophore on lower half of caudal–fin base

Length at flexion: less than 5 mm

PHOTOS

by J.M. Rodriguez

3.9 mm SL

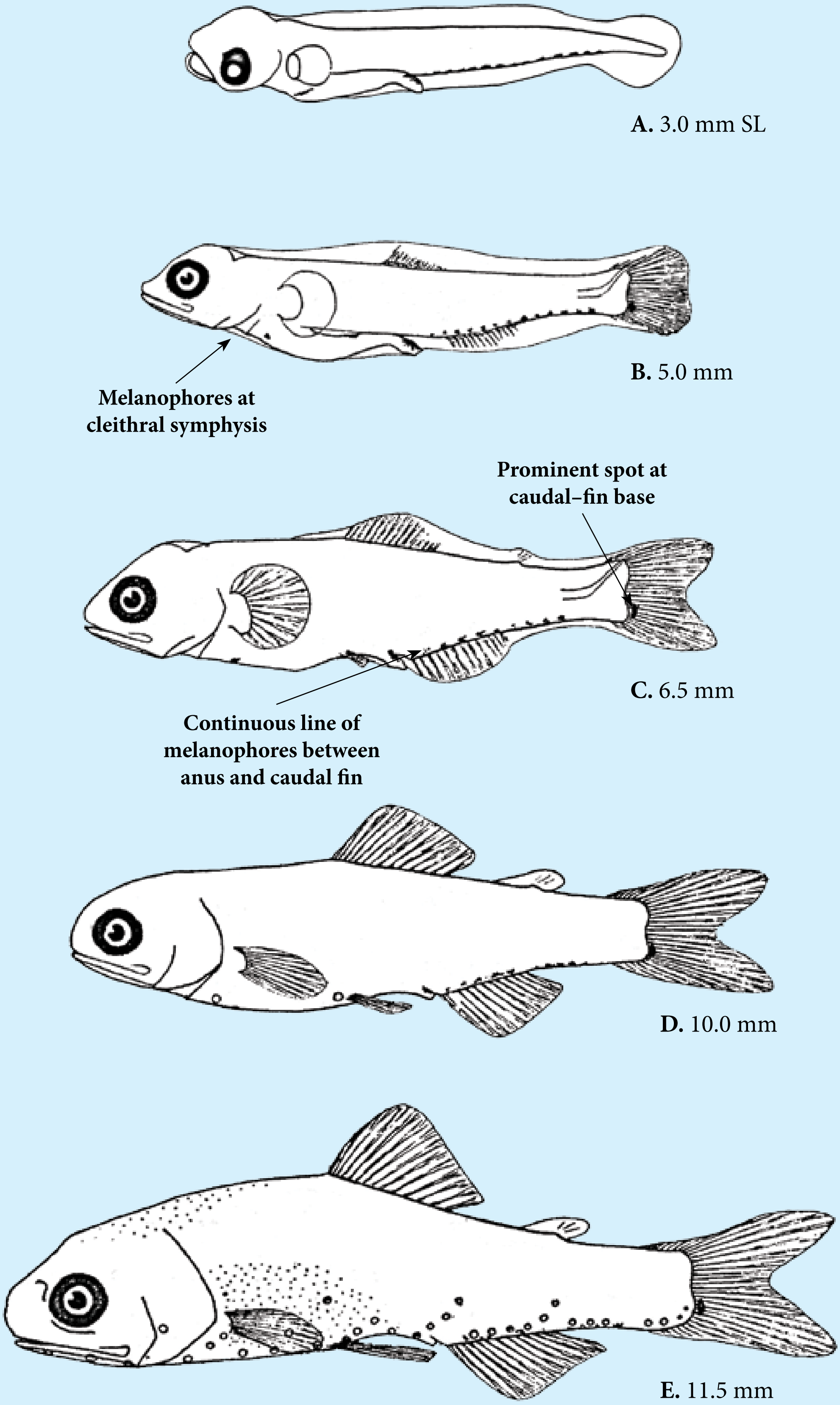


4.6 mm SL

5.5 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

MYCTOPHIDAE *Diaphus holti* Täning, 1918

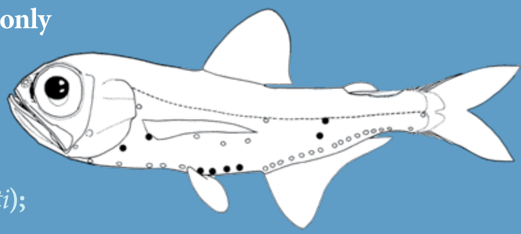


A: Alemany (1997); **B–E:** Täning (1918)

MYCTOPHIDAE

Hygophum **Bolin, 1939**

Larvae of the two species of this genus inhabiting the Mediterranean Sea, *H. benoiti* and *H. hygomii*, are very similar. They are almost only differentiated by their pigmentation patterns



Habitat: Mesopelagic, between 100 and 1000 m depth during daytime, 12 to 400 m and 700 to 1000 m at night (*H. benoiti*); 600 to 750 m during the day, 0 to 225 m at night (*H. hygomii*)

Spawning season: Spawning peaks in spring–summer (*H. benoiti*); end of summer–autumn (*H. hygomii*)

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–F

Distinctive characters: body moderately slender; body depth increases with development; eye unstalked, moderately elliptical with a prominent conical mass of choroid tissue ventrally; anus situated at anterior margin of anal fin; gut thick with a fold–end section; dorsal anterior part of finfold globose

Preanus length: 50% SL in young larvae, increases with development

Pigmentation: ventral series of melanophores on isthmus, continuing to cleithrum; a series of usually 3 melanophores on lateral sides of gut (disappearing with development in *H. hygomii*); a melanophore on hindgut; melanophores on caudal–fin base in some individuals

Length at flexion: 5.0–5.5 mm SL

PHOTOS

by J.M. Rodriguez

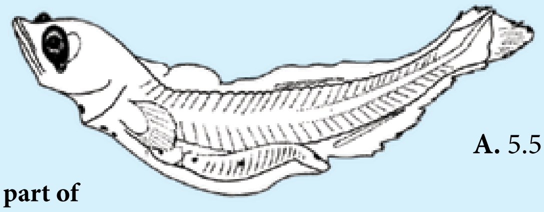
8.1 mm SL

10.3 mm SL

Literature: Badcock and Merrett (1976), Fahay (2007), Hulley (1984), Olivar and Palomera (1994), Täning (1918)

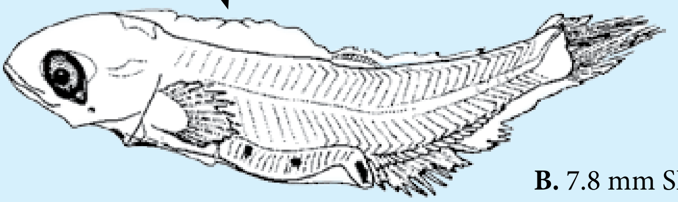
MYCTOPHIDAE — ***Hygophum*** Bolin, 1939

Hygophum benoiti

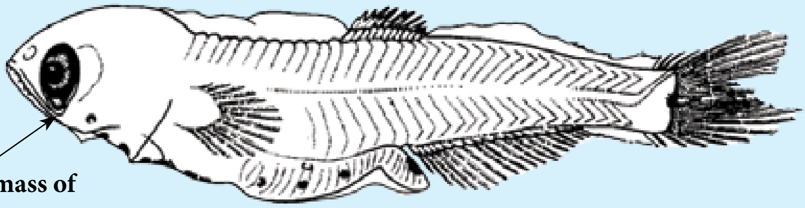


A. 5.5 mm SL

Dorsal anterior part of finfold globose



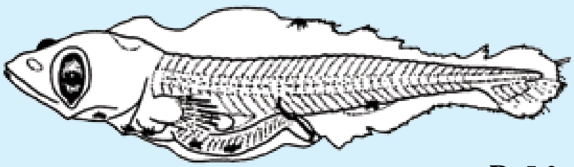
B. 7.8 mm SL



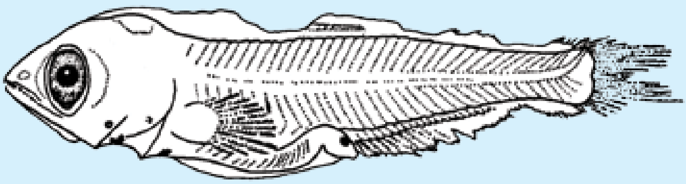
Prominent mass of choroid tissue

C. 9.2 mm SL

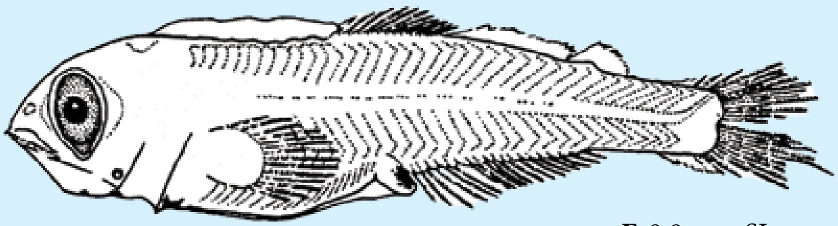
Hygophum hygomii



D. 5.3 mm SL



E. 7.0 mm SL



F. 9.9 mm SL

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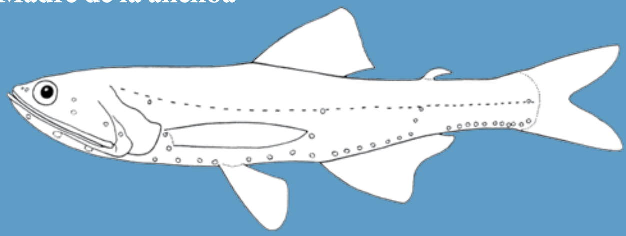
A–F: Olivar and Palomera (1994)

MYCTOPHIDAE *Lampanyctus crocodilus* (Risso, 1810)

En: Jewel lanternfish – **Fr:** Lanterne crocodile – **Sp:** Madre de la anchoa

Habitat: Mesopelagic between 100 and 200 m depth and 700 to 1000 m during daytime, 45 to 150 and 400 to 1000 m at night

Spawning season: Spring–summer



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–F

Distinctive characters: body initially elongate, soon deepens, especially at level of pectoral region; eye moderately large and round; well–developed, protruding teeth in the upper jaw from young larvae on

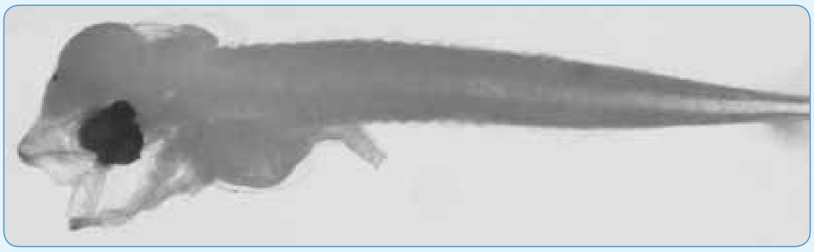
Preanus length: increases from about 25% SL, in young larvae, to about 60% SL, in older larvae

Pigmentation: prominent, single melanophore on top of head; a single melanophore on body dorsum, between dorsal and adipose fins, from the flexion stage on; melanophores at tip of lower jaw and over hindgut; peritoneal pigment develops in older larvae; spots on pectoral–fin base; late stages add pigment to anterior myosepta; in some individuals, melanophores at top of upper jaw and at middle of forehand

Length ant flexion: about 5 mm

PHOTOS

by J.M. Rodriguez



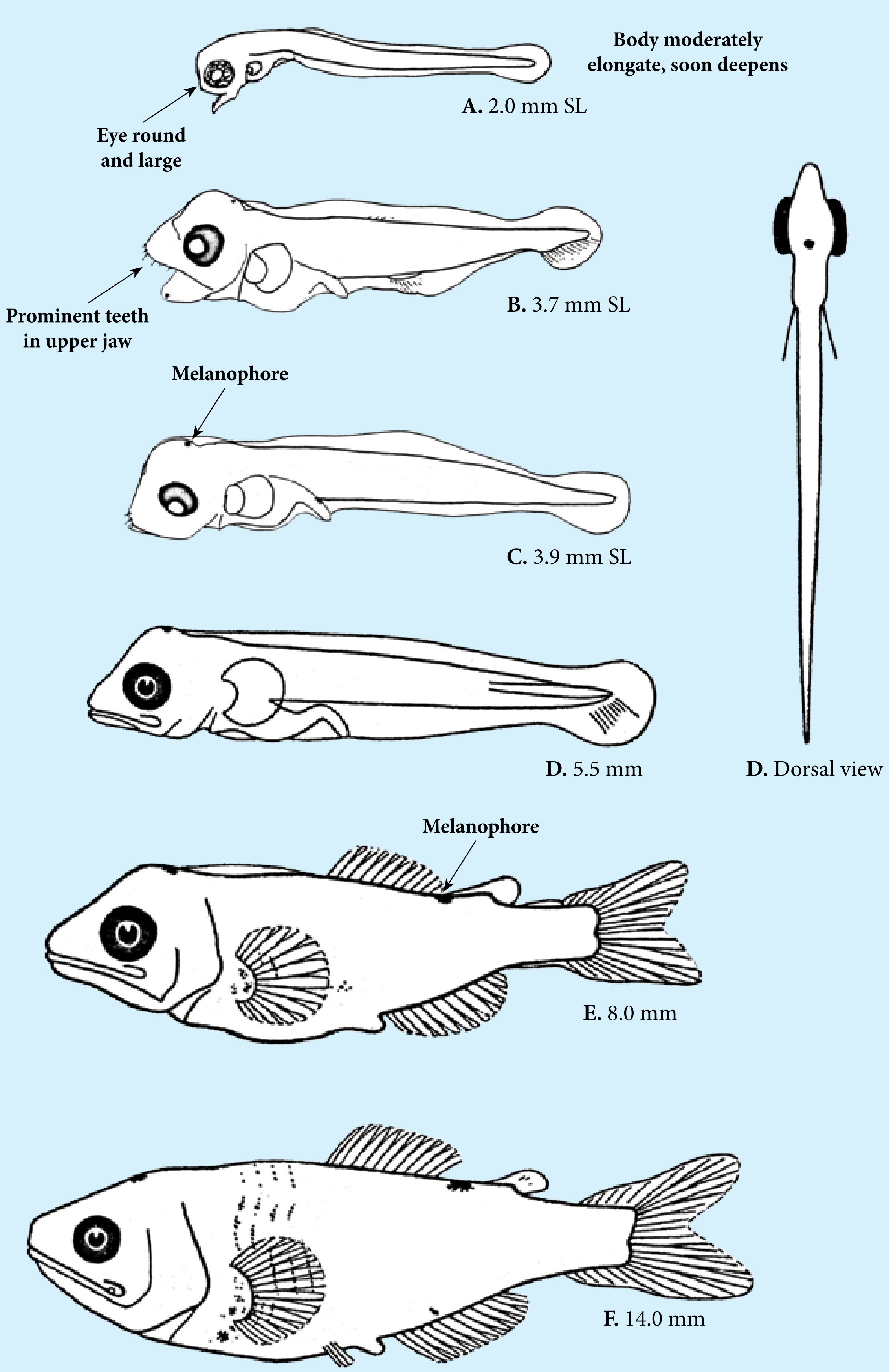
4.5 mm SL

6.3 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Richards (2006), Täning (1918)

MYCTOPHIDAE

Lampanyctus crocodilus (Risso, 1810)



A–C: Alemany (1997); **D–F:** Täning (1918)

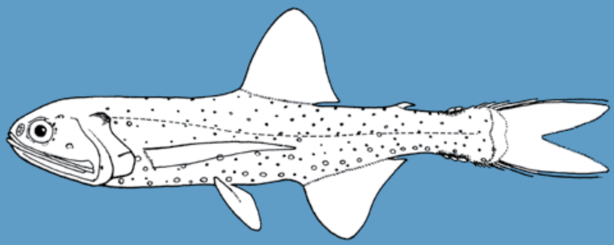
MYCTOPHIDAE

Lampanyctus pusillus (Johnson, 1890)

En: Pigmy lanternfish

Habitat: Mesopelagic, between 500 and 1000 m depth during the day, 50 to 150 m at night

Spawning season: Spawning peaks at the end of summer–autumn



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–F

Distinctive characters: body initially elongate, soon becomes very deep and stout; head large; eye large and round; gut thick; well–developed teeth in upper jaw from young larvae on

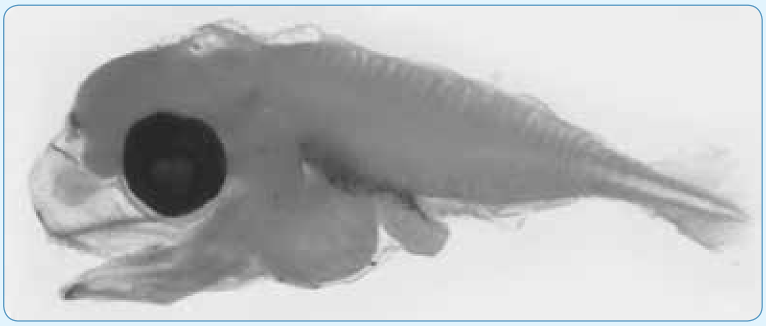
Preanus length: increases from about 30% SL, in young larvae, to about 65% SL, in late larvae

Pigmentation: 1 to 3 melanophores from snout to top of head, these melanophores become internal, located at bases of brain and forebrain, in older larvae; spots at tip of lower jaw, over opercle, pectoral–fin base, anterior gut and over hindgut; internal pigment on swimbladder; ventral spots on abdominal region; a series of paired melanophores along dorsum and another along lateral midline in older larvae

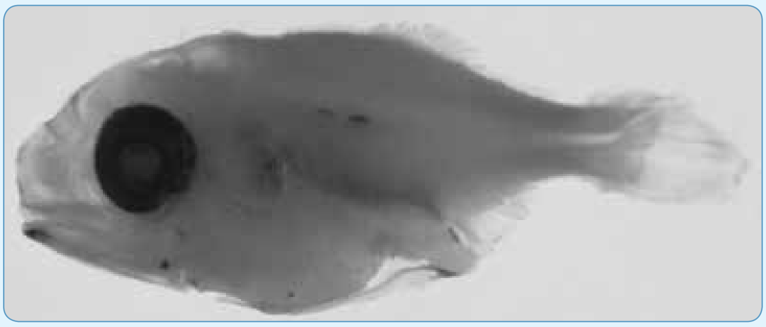
Length at flexion: about 4.0–5.0 mm

PHOTOS

by J.M. Rodriguez



3.4 mm SL



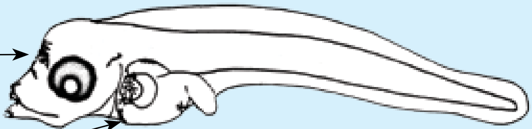
4.3 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

MYCTOPHIDAE

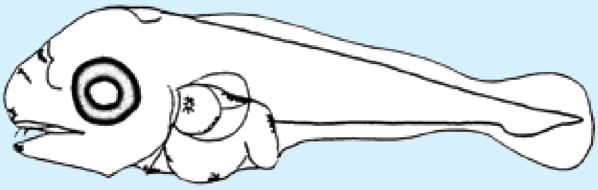
Lampanyctus pusillus (Johnson, 1890)

A. 1.9 mm SL



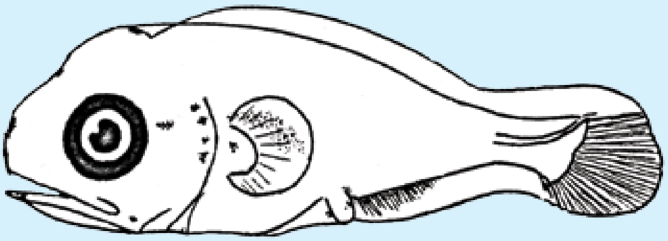
Top of head and gut pigmented from young stages on

B. 3.0 mm SL

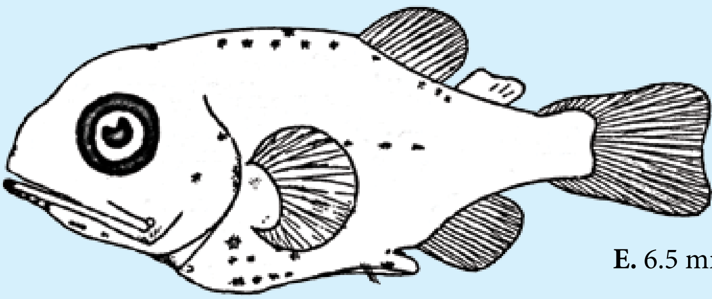


C. 3.3 mm SL

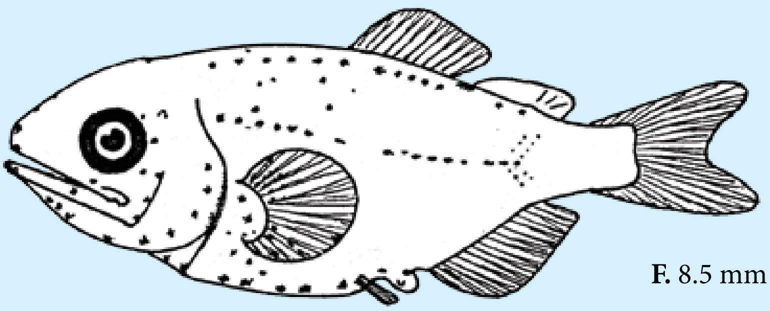
Body shorter and thicker than that of *L. crocodilus*



D. 5.0 mm



E. 6.5 mm



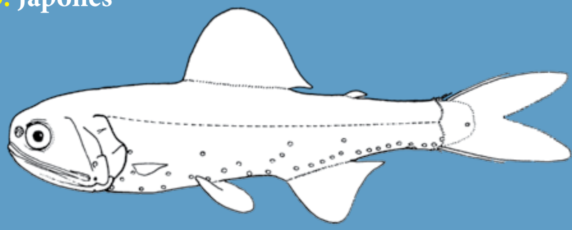
F. 8.5 mm

A–C: Alemany (1997); **D–F:** Täning (1918)

MYCTOPHIDAE

Lobianchia dofleini (Zugmayer, 1911)

En: Dofleini's lantern fish – **Fr:** Lanterne de Dofleini – **Sp:** Japonés



Habitat: Mesopelagic, between 375 and 600 m depth during daytime, 25 to 400 m at night

Spawning season: Throughout the year, peaking in February–June

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–E

Distinctive characters: body relatively elongate in young larvae, soon becoming deep and stout, especially its anterior half; eye small and round in early stages, becoming slightly elliptical, with a mass of choroid tissue ventrally; pectoral fin well developed, with elongate (almost reaching anus) upper rays, these rays shortening with development

Preanus length: 50–60% SL in late larvae

Pigmentation: swimbladder pigmented; spots on each side of hindgut; melanophores on gut, on ventral midline, anterior to cleithral symphysis, over the latter and along base of anal fin; base and rays of pectoral fin pigmented; in late stages, spots appear on dorsum of body

Length at flexion: 5–6 mm

PHOTOS

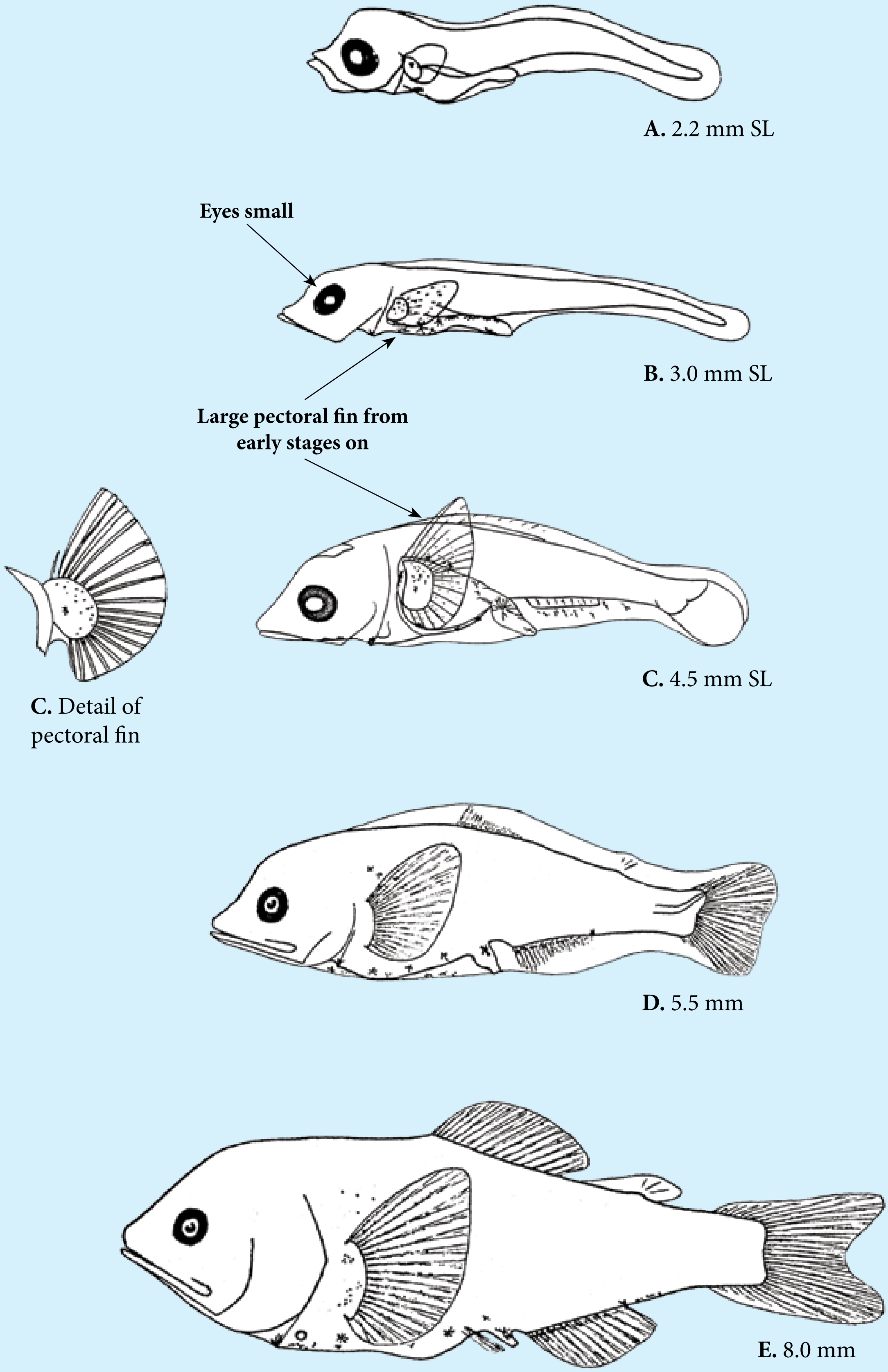
by J.M. Rodriguez

5.2 mm SL

6.7 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

MYCTOPHIDAE — ***Lobianchia dofleini*** (Zugmayer, 1911)



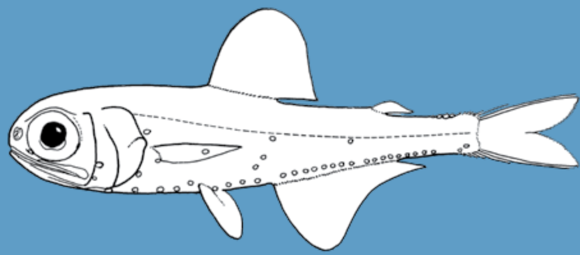
A–C: Alemany (1997); **D, E:** Täning (1918)

MYCTOPHIDAE *Myctophum punctatum* Rafinesque, 1810

En: Spotted lanternfish

Habitat: Mesopelagic, between 100 to 150 and 700 to 1000 m depth during daytime, less than 190 and 700 to 800 m at night

Spawning season: Late winter–summer



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body elongate in young larvae, becoming slightly deeper with development; head large and flat; eye elliptical, stalked in young larvae, with tapered choroid mass, ventrally

Preanus length: about 50–60% SL

Pigmentation: ventral series of spots from anus to head; spots on edges of both jaws and on upper part of opercle; several ventral postanal melanophores; two single, well developed melanophores, in an opposite position over and under urostyle; pigment may be present on posterior rays of dorsal, anal and adipose fins; rays and base of pectoral fin pigmented; spots on edges of both jaws and on upper part of opercle; dorsal melanophore on caudal region

Length at flexion: 7 mm SL

PHOTOS

by J.M. Rodriguez

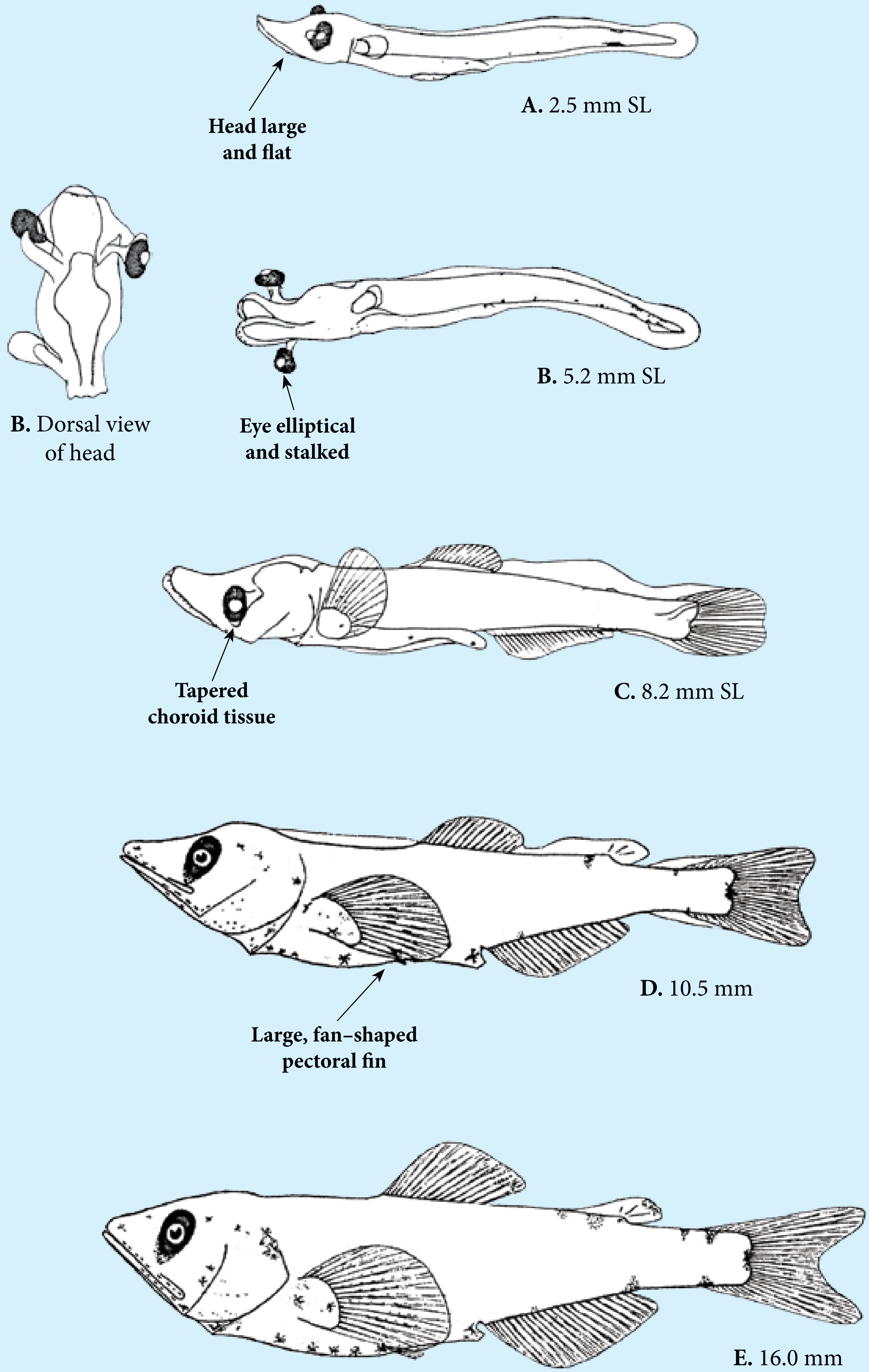
5.3 mm SL

7.0 mm SL

9.1 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

MYCTOPHIDAE *Myctophum punctatum* Rafinesque, 1810

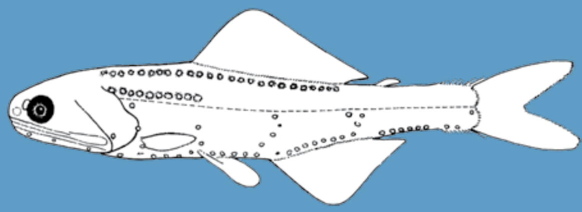


A–C: Alemany (1997); **D, E:** Täning (1918)

MYCTOPHIDAE *Notoscopelus elongatus* (Costa, 1844)

Habitat: Mesopelagic, between 375 to 1 000 m depth during daytime, 45 to 150 m at night

Spawning season: Winter–spring



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body elongate in young larvae, becomes deep and compressed with development; eye large and round; large swimbladder

Preanus length: increases from about 25 to 50–60% SL with development

Pigmentation: increases with development; initially, melanophores at jaw tips, and two on head (increasing to 4 in older larvae); peritoneum and dorsum of swimbladder, pigmented; two parallel dorsal rows of melanophores in older larvae

Length at flexion: almost completed at 6.0 mm SL

PHOTOS

by J.M. Rodriguez

3.7 mm SL

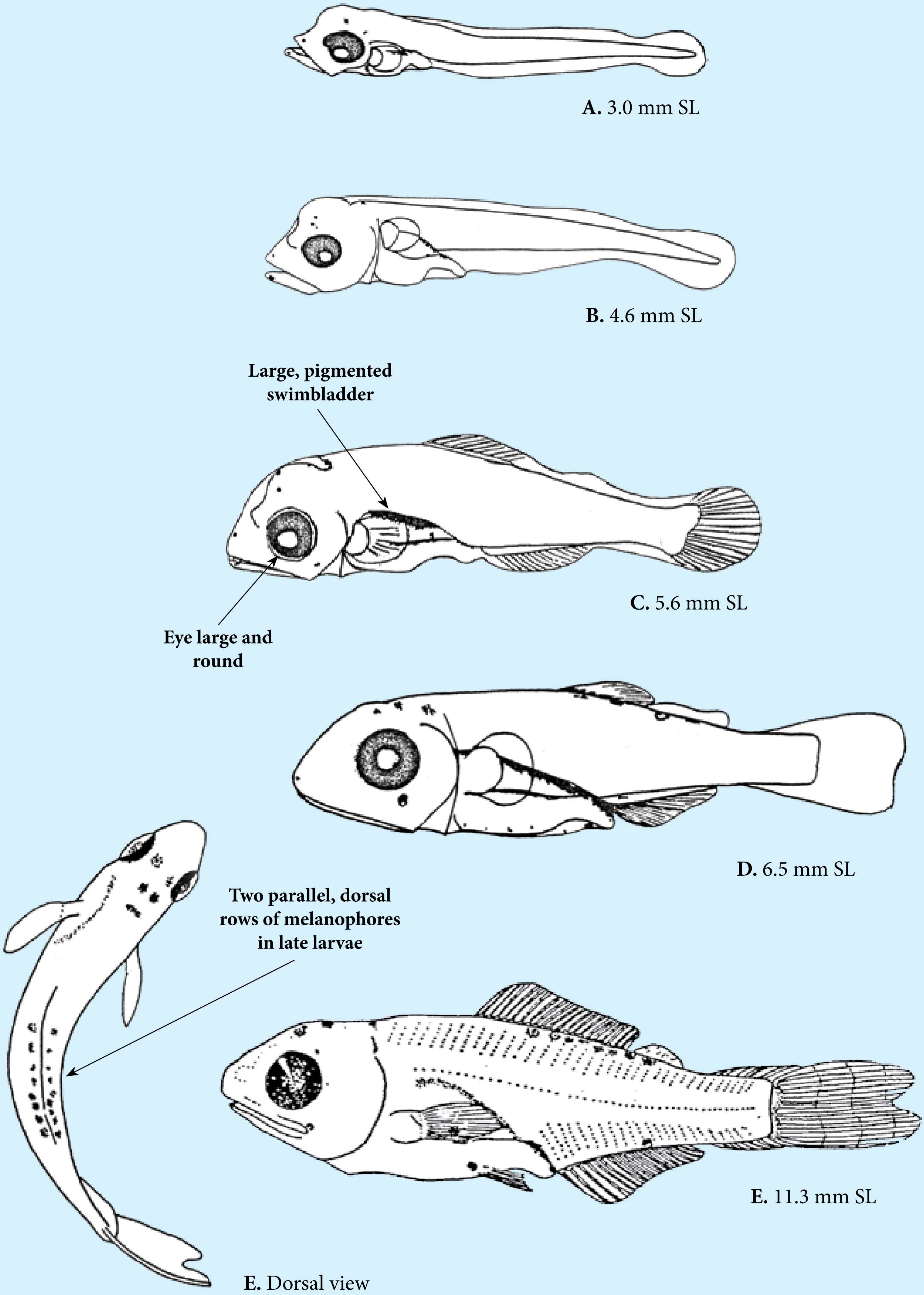
4.2 mm SL

6.8 mm SL

Literature: Alemany (1997), Hulley (1984), Palomera (1983)

MYCTOPHIDAE

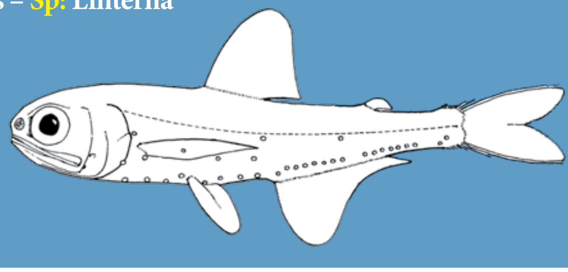
Notoscopelus elongatus (Costa, 1844)



A–D: Alemany (1997); **E:** Palomera (1983)

MYCTOPHIDAE — *Symbolophorus veranyi* (Moreau, 1888)

En: Large scale lantern fish – Fr: Lanterne à grandes écailles – Sp: Linterna



Habitat: Oceanic, mesopelagic, between 100 and 700–800 m during daytime, surface to 150 m depth at night

Spawning season: No information

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE — Figs. A–F

Distinctive characters: body moderately elongate and slender, similar to that of *Myctophum punctatum*; narrow eyes on short stalks; small ventral cone of choroid tissue; snout pointed, flat in young larvae; large pectoral fins with elongated bases, extending beyond anus

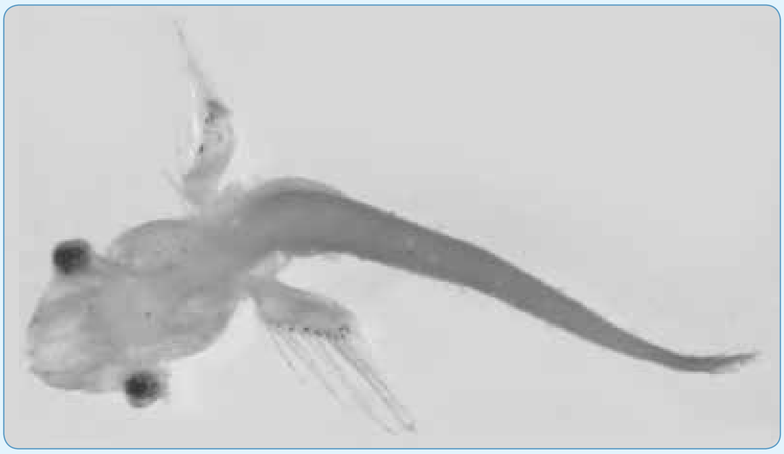
Preanus length: about 50% SL

Pigmentation: few preanal ventral spots; spots on tips of snout and lower jaw; large spot on posterior edge of opercle; row of ventral–postanal melanophores; row of spots along gut; pigment on pectoral–fin rays (heavier at ray base); pigment decreases towards the end of the larval period

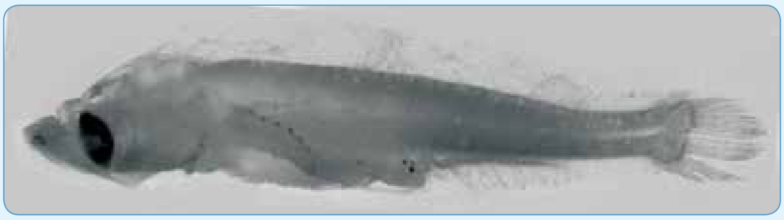
Length at flexion: flexion almost completed at 7.5 mm SL

PHOTOS

by J.M. Rodriguez



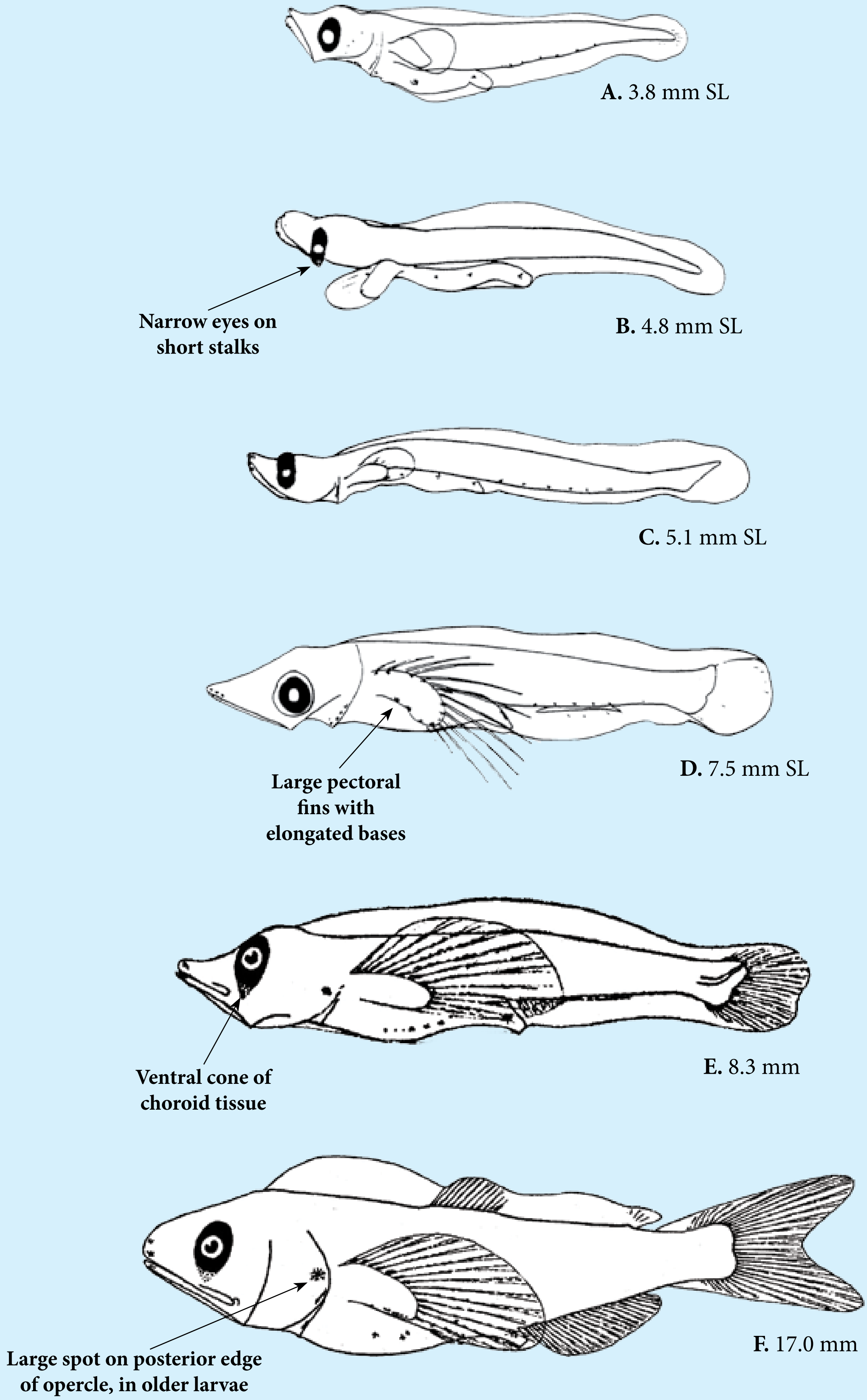
7.0 mm SL



9.1 mm SL

Literature: Alemany (1997), Fahay (1983), Hulley (1984), Täning (1918)

MYCTOPHIDAE — ***Symbolophorus veranyi*** (Moreau, 1888)



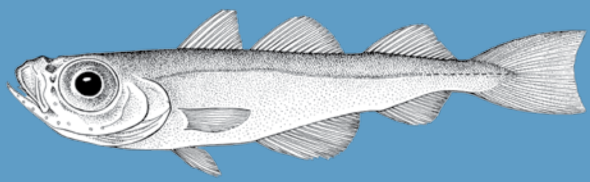
A–D: Alemany (1997); **E, F:** Täning (1918)

GADIDAE — *Gadiculus argenteus* Guichenot, 1850

En: Silvery pout – **Fr:** Merlan argenté – **Sp:** Faneca plateada

Habitat: Bathypelagic, forming shoals in midwater over the continental–shelf edge, between 200 and 1 000 m depth

Spawning season: December and January



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE — Figs. A–D

Distinctive characters: body shape typical of a gadid species, relatively short, with a relatively large head and deep abdominal region; pelvic fins, short, develop in later larvae

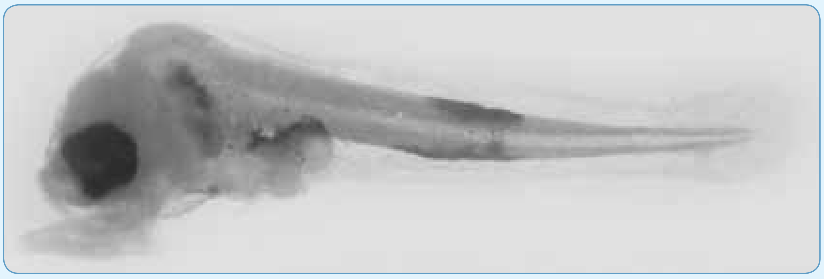
Preanus length: less than 50% SL

Pigmentation: two opposing pigment patches (one dorsal and another ventral) about midway along tail, growing on lateral sides of body to form a continuous bar in later larvae; some melanophores on head, and upper and lower jaw tips; peritoneal region pigmented; fins, except the caudal, unpigmented

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

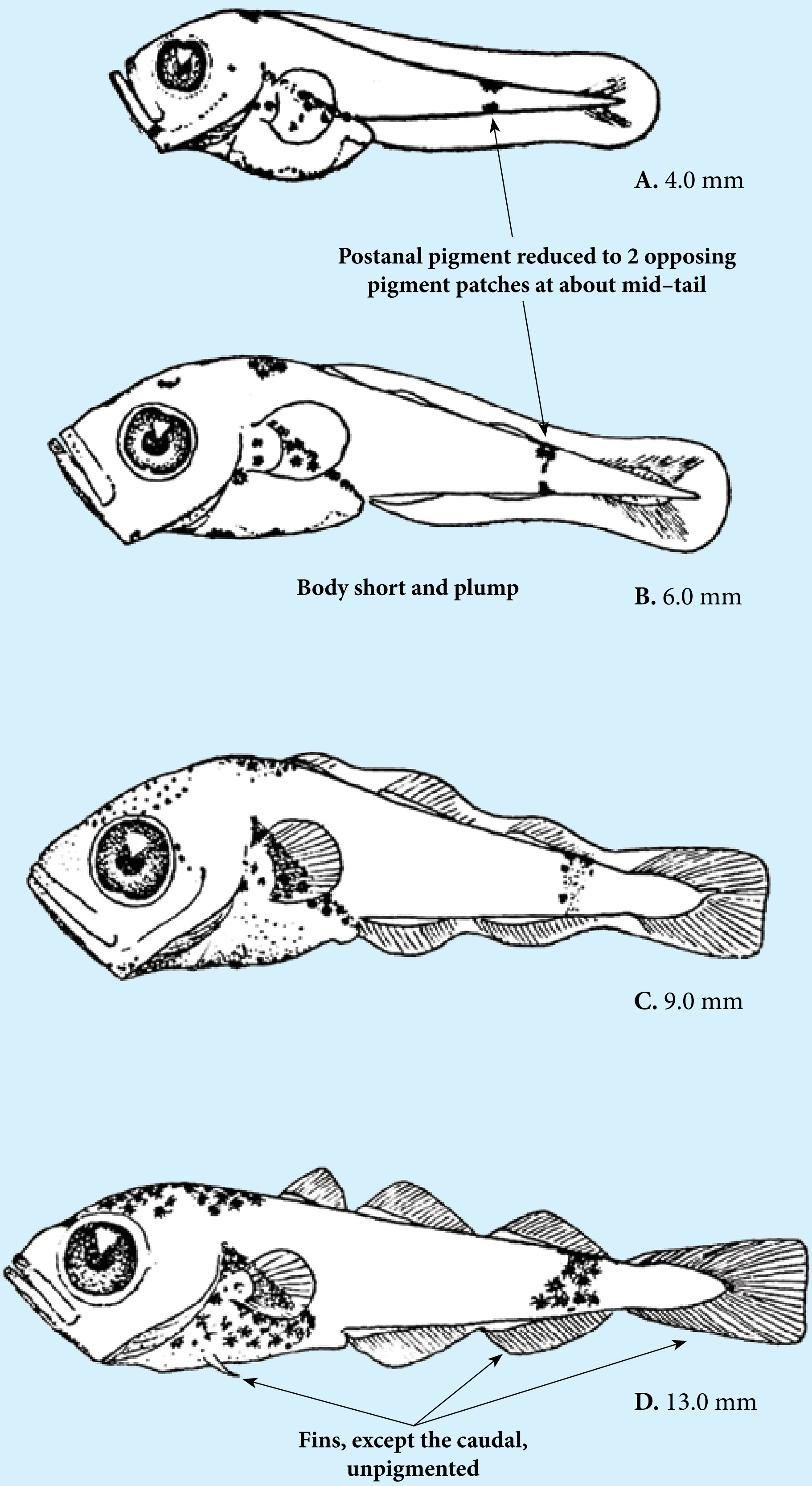


2.1 mm SL

2.7 mm SL

Literature: D'Ancona (1933a), Russell (1976), Sabatés (1988), Svetovidov (1986a)

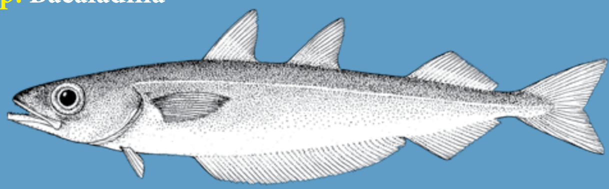
GADIDAE — ***Gadiculus argenteus*** Guichenot, 1850



A–D: D'Ancona (1933a)

GADIDAE *Micromesistius poutassou* (Risso, 1827)

En: Blue whiting(=Poutassou) – **Fr:** Merlan bleu – **Sp:** Bacaladilla



Habitat: Mesopelagic, between 30 to 400 m depth, over depths of 160 to 3 000 m

Spawning season: Between January and March

EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.14 mm
Chorion: smooth
Oil globules: no oil globule
Perivitelline space: narrow
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: 2.0–2.2 mm

Pigmentation: melanophores scattered over body, except caudal region; posteriorly, dorsal and ventral rows of paired melanophores over trunk and a cap of melanophores on head; yolk sac unpigmented

LARVAE Figs. C–G

Distinctive characters: body shape typical of a gadid species, relatively short with a relatively large head and deep abdominal region

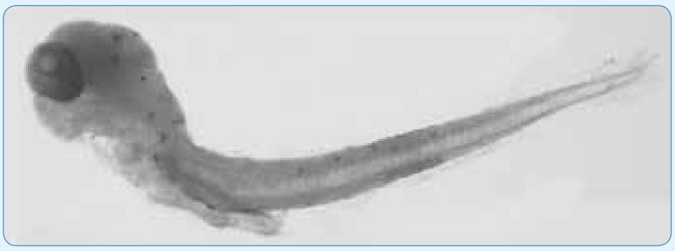
Preanus length: less than 50% SL

Pigmentation: dorsal (from head) and ventral (from anus) rows of paired melanophores to about mid–caudal region, with dorsal rows longer than ventral ones; melanophores on head; peritoneal region pigmented; no melanophores on lateral sides of trunk in larvae less than 6 mm long; dorsal and ventral rows of pigment extend backwards with development

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez



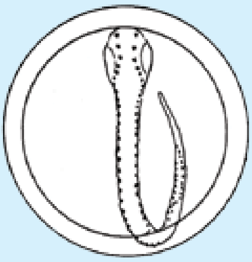
2.4 mm SL

6.0 mm SL

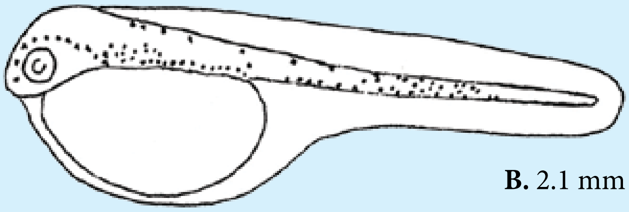
Literature: D'Ancona (1933a), Sabatés (1988), Seaton and Bailey (1971), Schmidt (1905), Svetovidov (1986a)

GADIDAE

Micromesistius poutassou (Risso, 1827)



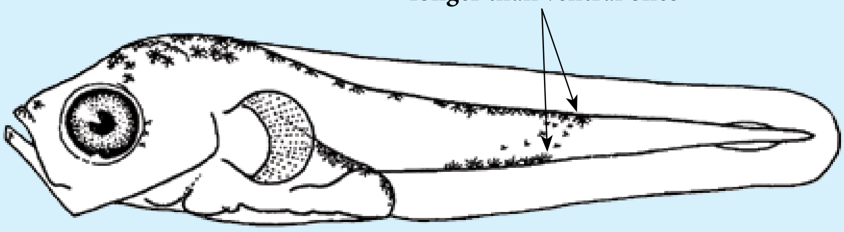
A.



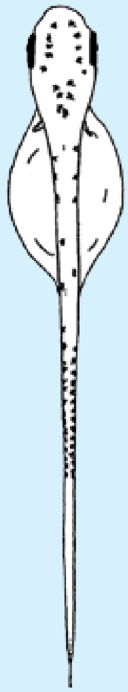
B. 2.1 mm

C. 3.4 mm

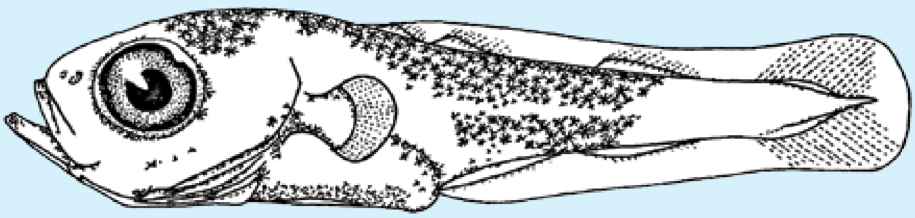
Dorsal rows of paired melanophores longer than ventral ones



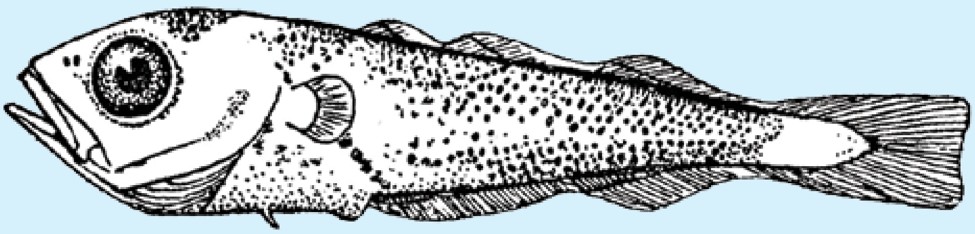
D. 6.5 mm



G. 3.29 mm (dorsal view)



E. 9.0 mm



F. 15.0 mm

A–C, G: Seaton and Bailey (1971); **D, E:** Schmidt (1905); **F:** D'Ancona (1933a)

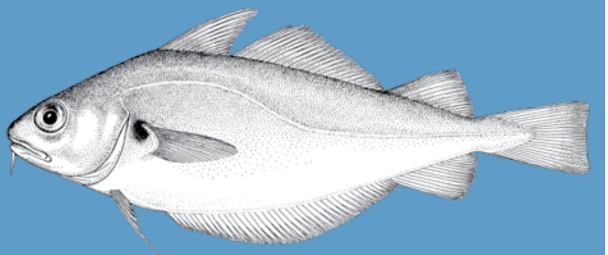
GADIDAE

Trisopterus luscus (Linnaeus, 1758)

En: Pouting(=Bib) – **Fr:** Tacaud commun – **Sp:** Faneca

Habitat: Benthic, between 30 and 100 m depth

Spawning season: March and April



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.23 mm
Chorion: smooth
Oil globules: no oil globule
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: less than 3.0 mm

Pigmentation: recently hatched larvae, very similar to those of *Micromesistius poutassou*; posteriorly, well–marked dorsal (from head) and a ventral (from anus) paired rows of melanophores, extending to about two–thirds of postanal region

LARVAE — Figs. C–F

Distinctive characters: body shape typical of a gadid species, relatively short with a relatively large head and deep abdominal region

Preanus length: about 50% of SL

Pigmentation: dorsal (from head) and ventral (from anus) rows of paired melanophores, ending at same level, at about mid–tail region

Length at flexion: unknown

PHOTOS

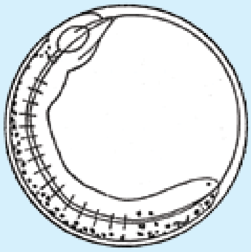
by J.M. Rodriguez

3.3 mm SL

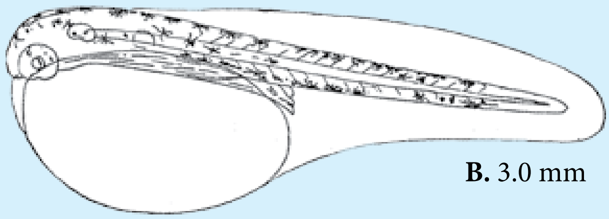
12.0 mm SL

Literature: Russell (1976), Svetovidov (1986a)

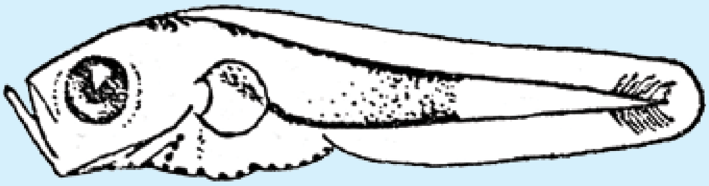
GADIDAE *Trisopterus luscus* (Linnaeus, 1758)



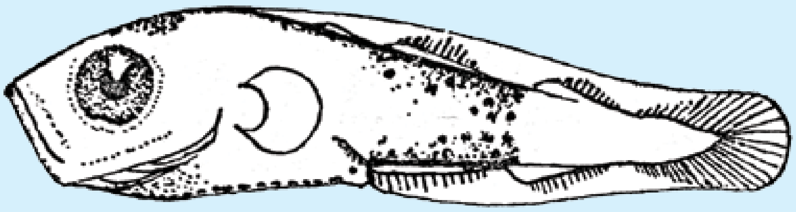
A.



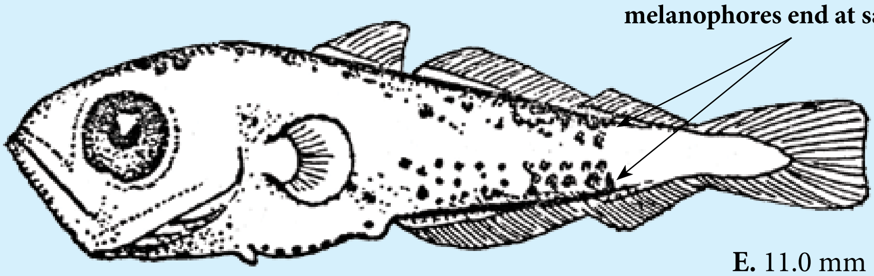
B. 3.0 mm



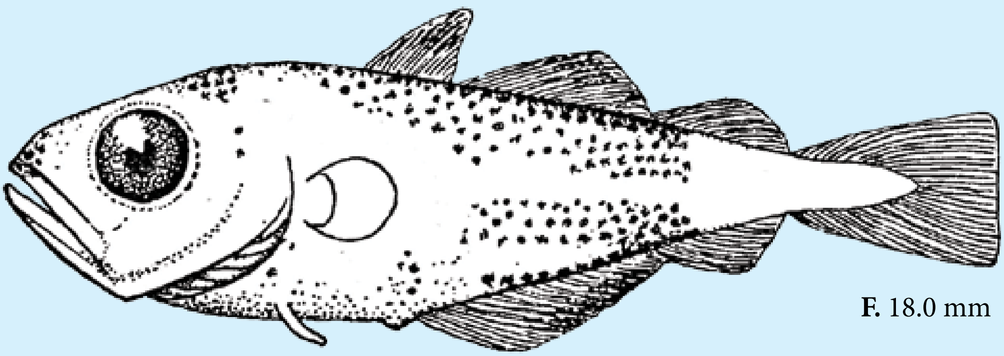
C. 4.5 mm



D. 7.3 mm



E. 11.0 mm



F. 18.0 mm

A–F: D'Ancona (1933a)

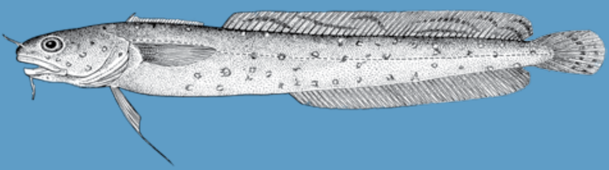
LOTIDAE

Gaidropsarus biscayensis (Collett, 1890)

En: **Mediterranean bigeye rockling** – **Fr:** **Motelle** – **Sp:** **Barbada**

Habitat: Benthic, possibly bathypelagic over soft bottoms, between 140 and 600 m depth

Spawning season: Winter



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–E

Distinctive characters: body shape typical of a gadid species, relatively short with a relatively large head and deep abdominal region; body depth decreases gradually with development starting from a size of 3.5–4.0 mm; anus does not reach finfold edge in early larvae; 2 prominent cephalic spines on each side of head; large pelvic fins with 4 rays, located on sides of gut

Preanus length: less than 60% SL in early larvae, decreases slightly with development

Pigmentation: dorsal side of peritoneum strongly pigmented; melanophores on top of head and on lateral surface of trunk, these latter increase in number and widen joining those on head and forming a continuous bar; upper and lower jaw tips pigmented; pelvic fins heavily pigmented; postanal region unpigmented, in young larvae

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

2.6 mm SL

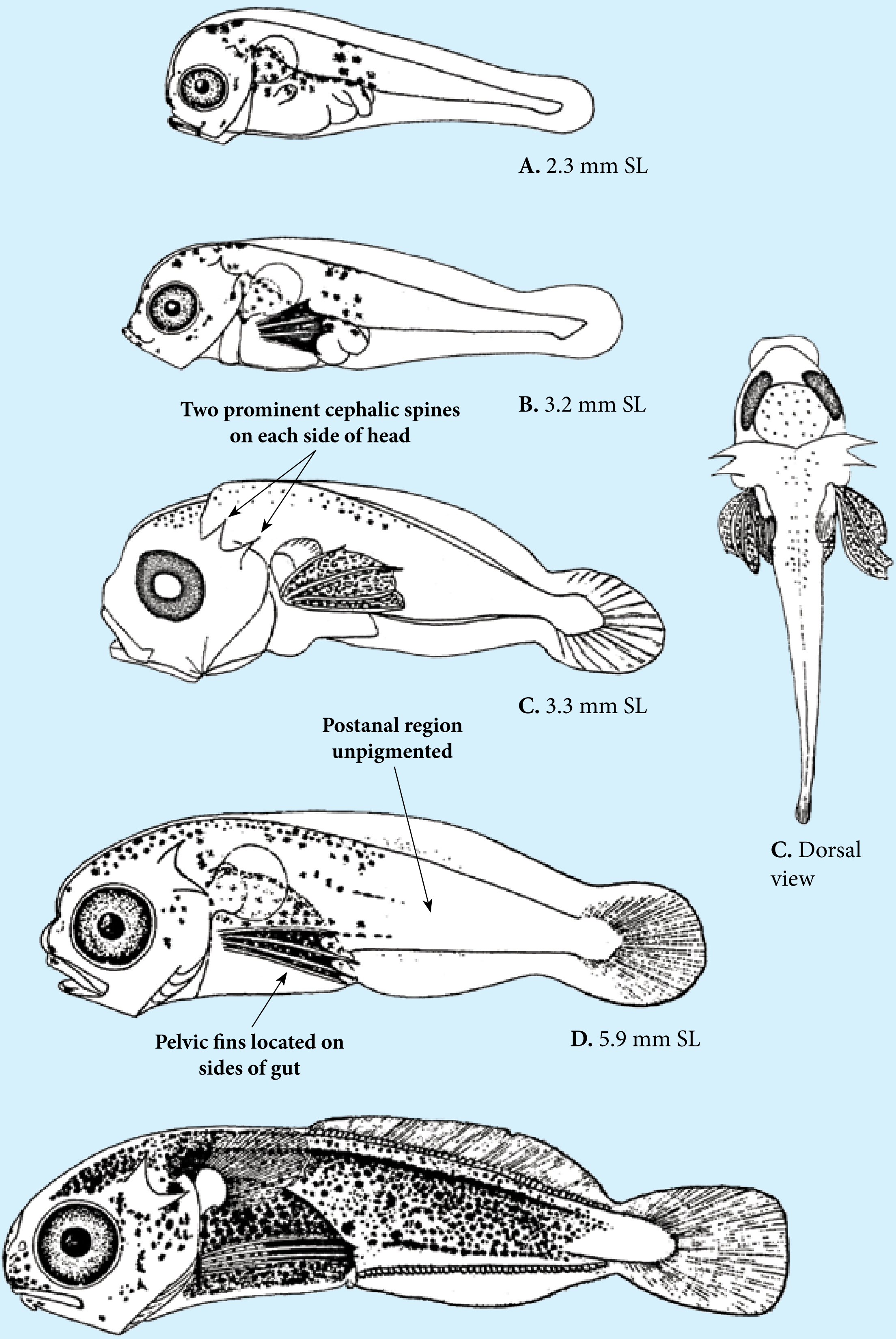
3.9 mm SL

5.2 mm SL

Literature: Alemany (1997), Demir (1982), Svetovidov (1986a)

LOTIDAE

Gaidropsarus biscayensis (Collett, 1890)



A. 2.3 mm SL

B. 3.2 mm SL

C. 3.3 mm SL

C. Dorsal view

D. 5.9 mm SL

E. 10.4 mm SL

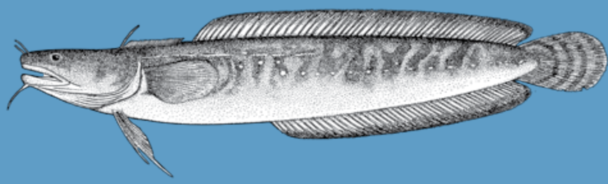
A, B, D, E: Demir (1982); **C:** Alemany (1997)

LOTIDAE *Gaidropsarus mediterraneus* (Linnaeus, 1758)

En: Shore rockling – **Fr:** Motelle de Méditerranée – **Sp:** Bertorella

Habitat: Benthic, littoral, from about 20 to 120 m depth

Spawning season: Winter to early spring



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.66–0.72 mm
Chorion: smooth
Oil globules: single, 0.15–0.19 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: 1.8–1.9 mm

Pigmentation: similar to that of the larva, with the only difference of a pigment patch located at end of gut that extends to the dorsal region of the body

LARVAE — Figs. C–F

Distinctive characters: body shape typical of a gadid species, relatively short with a relatively large head and deep abdominal region; cephalic spines on each side of head; pelvic fins large with 4 rays

Preanus length: less than 50% SL

Pigmentation: two opposing pigment patches (one dorsal and another ventral) about midway along tail; pigment patch on ventral part of caudal fin; melanophores on neck, head, lower jaw and peritoneal region; pelvic fins heavily pigmented

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

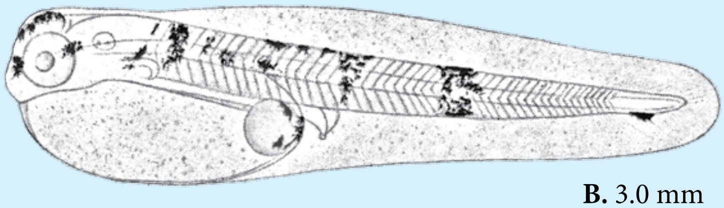
2.4 mm SL

3.5 mm SL

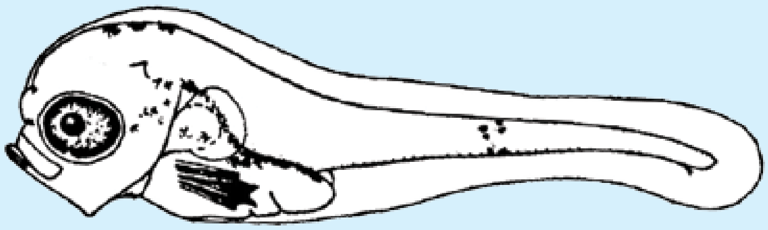
Literature: Aboussouan (1964), Alemany (1997), Cipria (1939), D'Ancona (1933a), Demir (1982)

LOTIDAE — ***Gaidropsarus mediterraneus*** (Linnaeus, 1758)

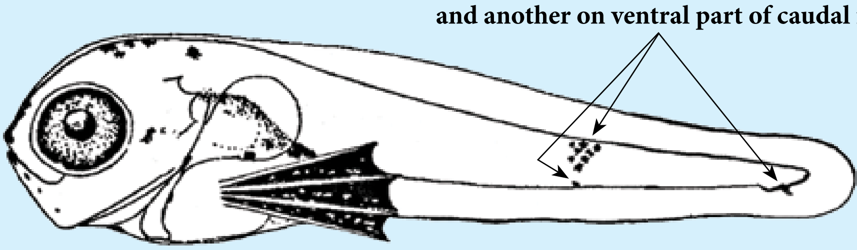
A.



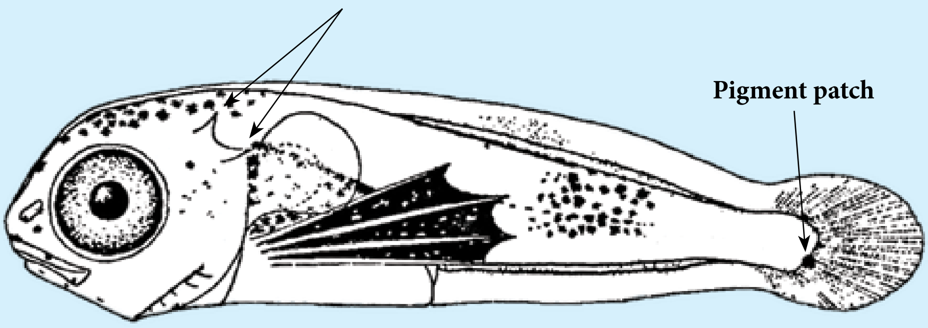
B. 3.0 mm



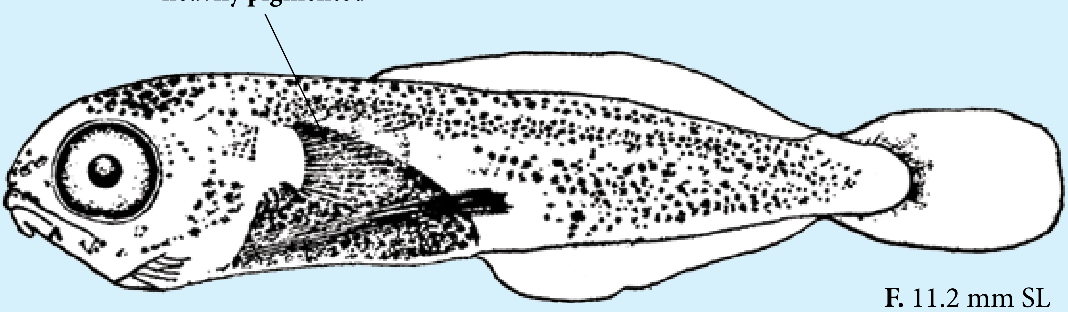
C. 2.3 mm SL



D. 3.2 mm SL



E. 6.1 mm SL



F. 11.2 mm SL

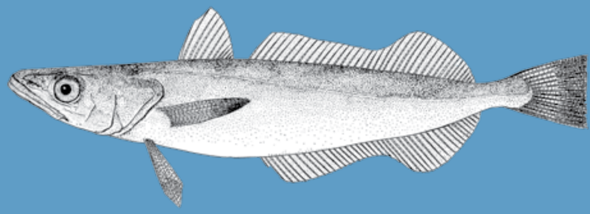
A, B: Cipria (1939); **C–F:** Demir (1982)

MERLUCCIIDAE *Merluccius merluccius* (Linnaeus, 1758)

En: **European hake** – **Fr:** **Merlu européen** – **Sp:** **Merluza europea**

Habitat: Midwater or close to the bottom, mainly between 70 and 700 m depth

Spawning season: Throughout the whole year, mostly in winter and spring



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.94–1.03 mm
Chorion: smooth
Oil globules: single, 0.25–0.28 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 3 mm SL
Pigmentation: 3 postanal stellate melanophores

LARVAE Figs. C–F

Distinctive characters: body relatively short with a large and deep head and abdominal region; pelvic fins appear early, at 4–6 mm in length

Preanus length: about 45% SL

Pigmentation: three stellate melanophores in lateral–postanal region; peritoneal region and pelvic fins pigmented; melanophores on snout, lower jaw and on neck; no melanophores on the postanal ventral side of body

Length at flexion: no information; for other *Merluccius* species, it has been established at about 9.0–10.0 mm

PHOTOS

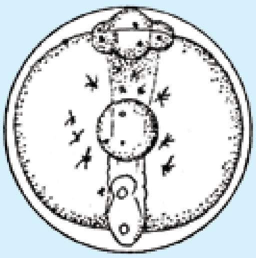
by J.M. Rodriguez

3.5 mm SL

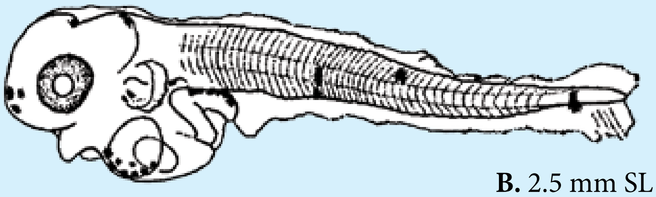
7.0 mm SL

Literature: D'Ancona (1933a), Palomera *et al.* (2005), Russell (1976), Svetovidov (1986b)

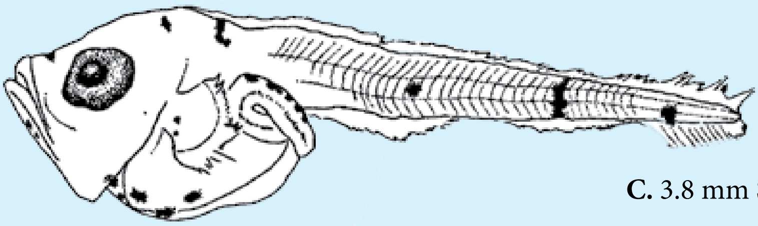
MERLUCCIIDAE *Merluccius merluccius* (Linnaeus, 1758)



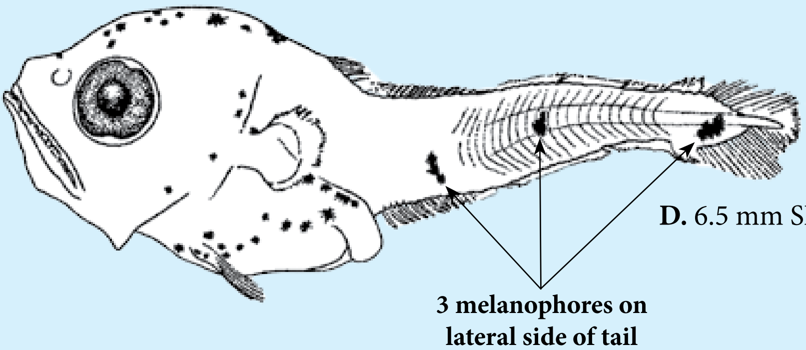
A.



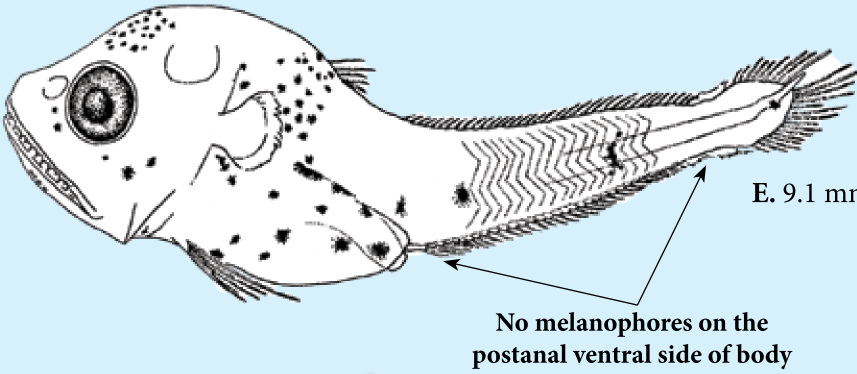
B. 2.5 mm SL



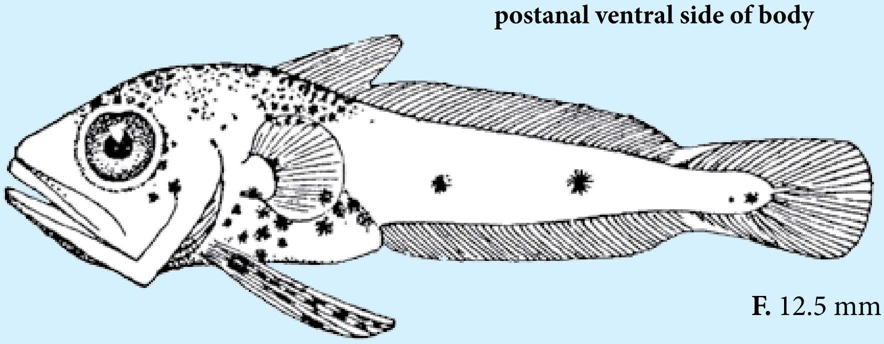
C. 3.8 mm SL



D. 6.5 mm SL



E. 9.1 mm SL



F. 12.5 mm

A, F: D'Ancona (1933a); **B–E:** Palomera *et al.* (2005)

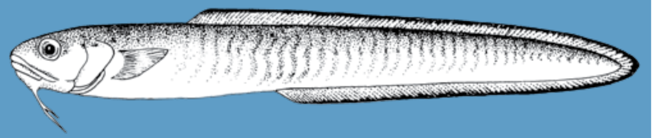
OPHIDIIDAE

Ophidion barbatum **Linnaeus, 1758**

Larvae of *Ophidion barbatum* and *Parophidion vassali* are very similar and many times their identification has been confusing. Even the systematics and the taxonomic validity of these two genera and their corresponding species have been questioned

Habitat: Benthic, over sand and mud bottoms, from shallow down to 150 m depth

Spawning season: Summer



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.76 mm
Chorion: smooth
Oil globules: none
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: may be about 2.5 mm SL
Distinctive characters: body slender
Pigmentation: dotted melanophores under gut; a series of dotted melanophores extending from pectoral fin to urostyle end; some melanophores on dorsal posterior half of tail

LARVAE — Figs. C–E

Distinctive characters: body elongate and slender
Preanus length: less than 50% SL
Pigmentation: in early stages, similar to that of yolk–sac larvae; in late larvae, dorsal melanophores decrease in number and melanophores on lower jaw and posterior edge of operculum appear
Length at flexion: unknown

PHOTOS

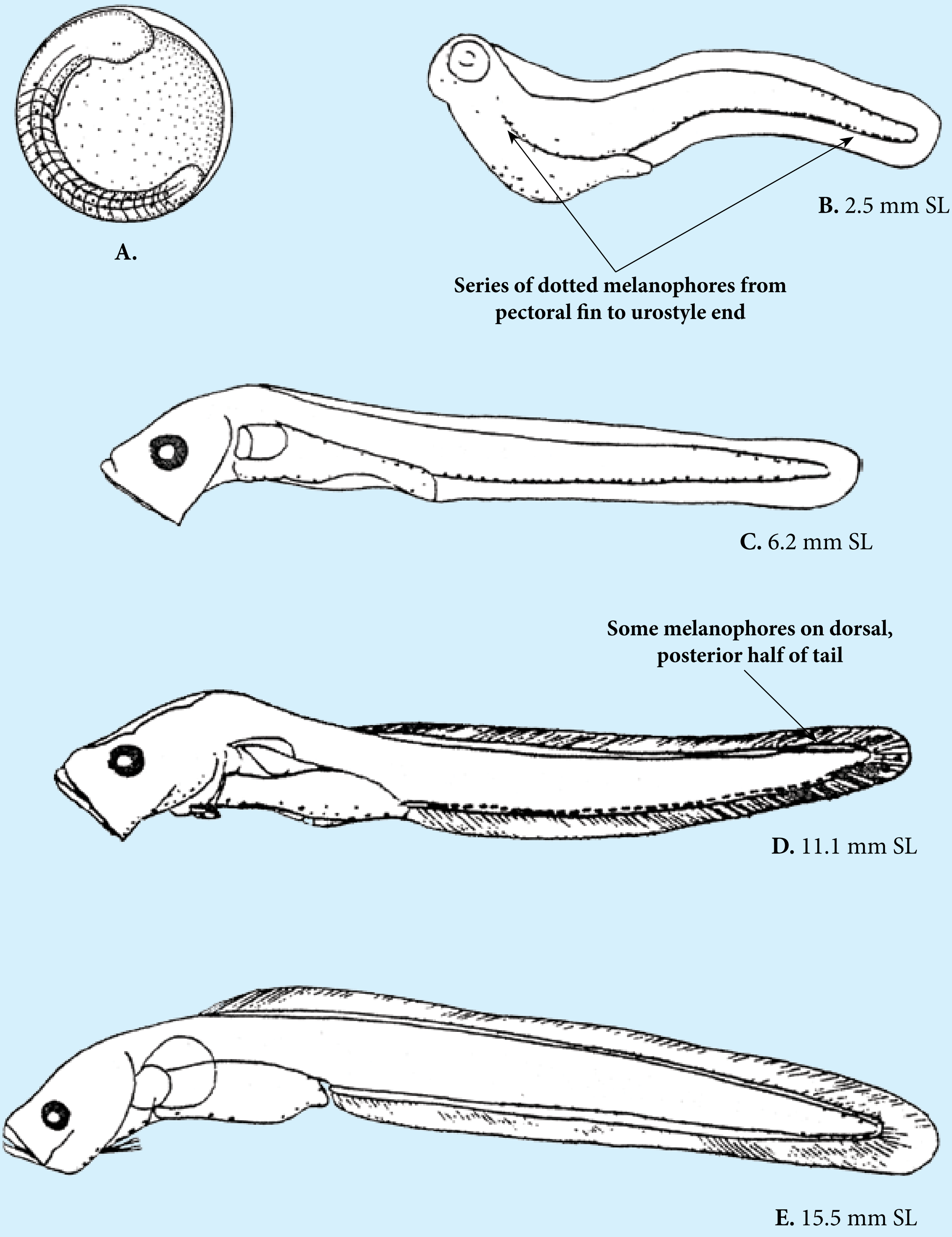
by J.M. Rodriguez

3.0 mm SL

6.8 mm SL

Literature: Alemany (1997), Nielsen (1986b), Padoa (1956j), Sabatés (1988), Tortonese (1975)

OPHIDIIDAE — *Ophidion barbatum* Linnaeus, 1758

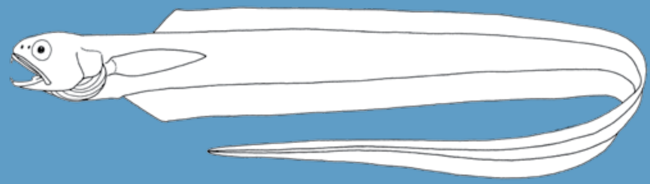


A: Padoa (1956j); **B–E:** Alemany (1997)

CARAPIDAE *Echiodon dentatus* (Cuvier, 1829)

Habitat: Benthic; young swimming in the water column

Spawning season: Winter



EGGS Fig. A

Habitat: pelagic, in slimy masses
Shape: ellipsoidal
Size: 1.43 x 0.89 mm
Chorion: smooth
Oil globules: single, about 0.23 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 3.84 mm

Distinctive characters: incipient dorsal appendage situated above posterior end of yolk sac; oil globule situated at anterior end of yolk sac

Pigmentation: pigment patch over trunk, at base of dorsal appendage; some melanophores on dorsal surface of yolk sac; 2 melanophores in ventral tail region; opposing dorsal and ventral melanophores at caudal–end region

LARVAE Figs. C–E

Distinctive characters: body very elongate with a dorsal appendage situated a little posterior to anus

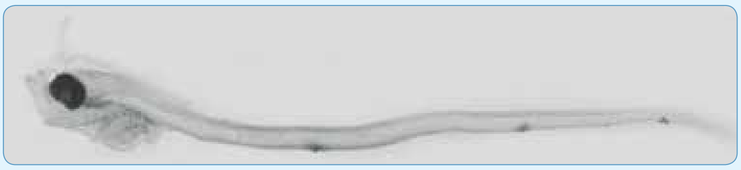
Preanus length: about 20% SL

Pigmentation: melanophores on snout, on lower jaw and over gut; 3 relatively large and another small postanal ventral melanophores; opposing dorsal and ventral melanophores at caudal–end region; dorsal appendage pigmented

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

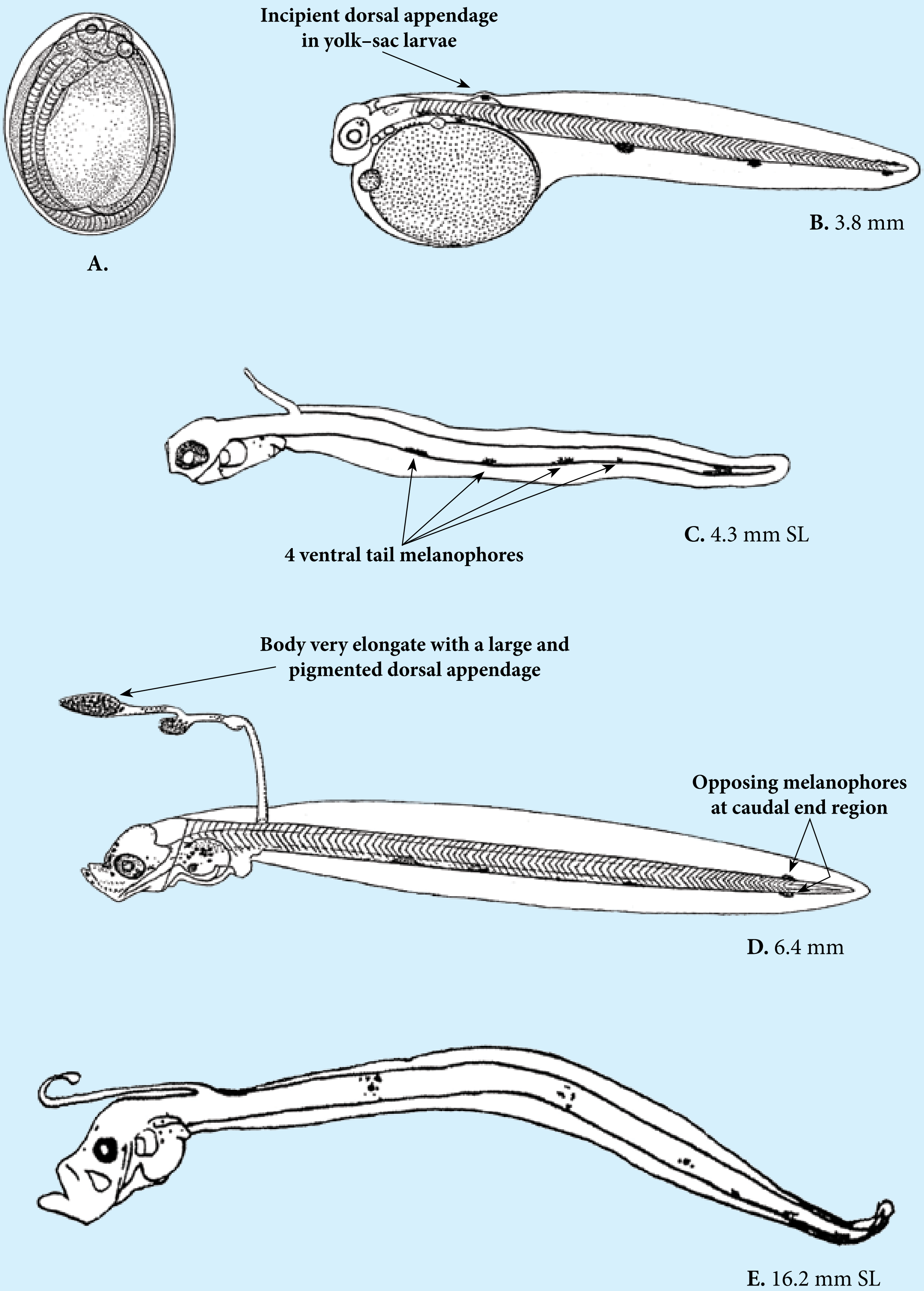


Not sized

Not sized

Literature: Alemany (1997), Padoa (1956f), Russell (1976)

CARAPIDAE — *Echiodon dentatus* (Cuvier, 1829)



A, B, D: Padoa (1956f); **C, E:** Alemany (1997)

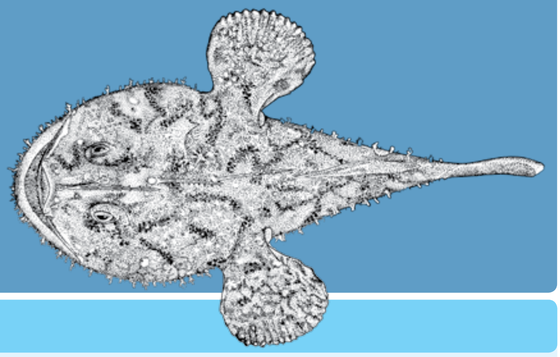
LOPHIIDAE

Lophius piscatorius **Linnaeus, 1758**

En: Angler(=Monk) – **Fr:** Baudroie commune – **Sp:** Rape

Habitat: Benthic, from shallow, inshore waters down to 500 m depth

Spawning season: Between February and July



EGGS

Habitat: pelagic
Shape: slightly oval, embedded in a gelatinous ribbon
Size: 2.3–3.1 mm wide, 0.62–0.70 mm high
Chorion: smooth
Oil globules: 1–9 oil globules, the largest 0.51–0.88 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE Figs. A, B

Hatch size: may be about 4.5 mm
Distinctive characters: yolk sac very large and globular; rudiments of pelvic fins apparent; at end of yolk sac stage, dorsal fin shows 3 rays and pelvic fins, formed by a single ray, are strongly developed
Pigmentation: large and branched melanophores on head and shoulder region, on gut, yolk sac and oil globules; pelvic fins heavily pigmented; postanal region unpigmented

LARVAE Figs. C–F

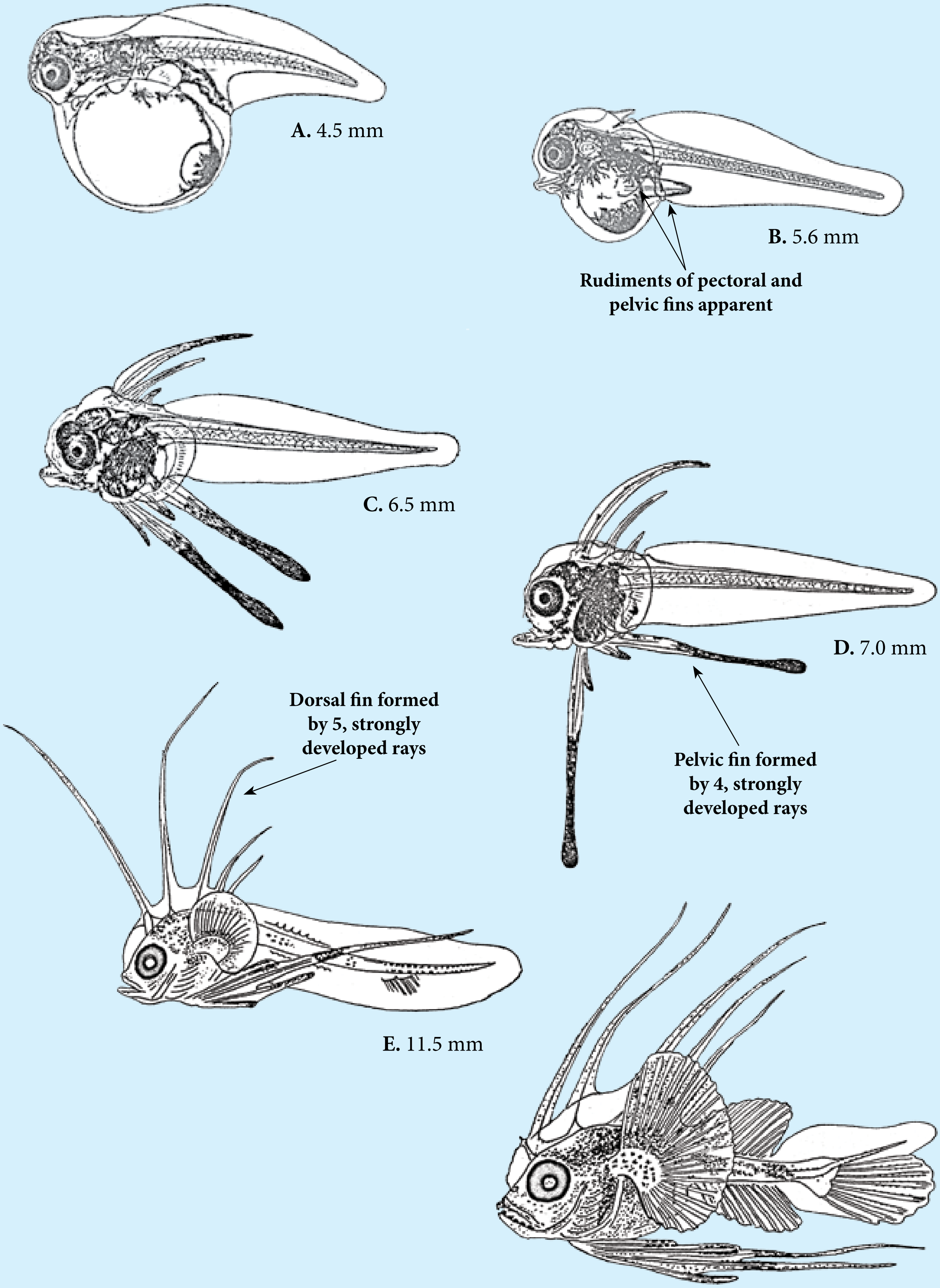
Distinctive characters: body head and trunk globose; dorsal fin formed by 5 rays and pelvic fin formed by 4 rays, strongly developed
Preanus length: about 50% SL
Pigmentation: early larvae similar to yolk–sac larvae; larvae of more than 11.0–12.0 mm in length develop two postanal bars of melanophores
Length at flexion: unknown

PHOTOS

Not available

Literature: Caruso (1986), Lebour (1925), Padoa (1956i), Russell (1976), Täning (1923)

LOPHIIDAE *Lophius piscatorius* Linnaeus, 1758



A–D: Lebour (1925); **E, F:** Täning (1923)

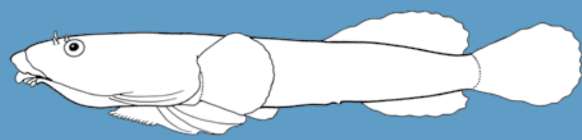
GOBIESOCIDAE

Diplecogaster bimaculata (Bonnaterre, 1788)

En: Two–spotted clingfish – **Sp:** Chafarrocas

Habitat: Benthic, attached to substratum with a thoracic sucker

Spawning season: No information



Gobiesocidae

EGGS

Fig. A

Habitat: demersal
Shape: flattened, oval in shape
Size: 1.37–1.54 mm long, 1.08–1.24 mm wide, 0.62–0.70 mm high, attached to empty shells
Chorion: smooth
Oil globules: single, 0.24–0.28 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: may be about 4.26 mm
Pigmentation: rounded stellate melanophores arranged in fairly regular lines along sides of body; no melanophores on head; caudal region free of pigment

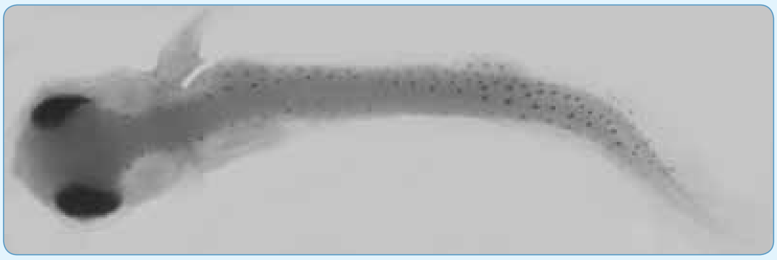
LARVAE

Figs. C–E

Distinctive characters: body relatively elongate and slender; sucker is developed in larvae of about 6.0 mm in length.
Preanus length: more than 70% SL
Pigmentation: similar to yolk–sac larvae, melanophores extend backwards on caudal region
Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

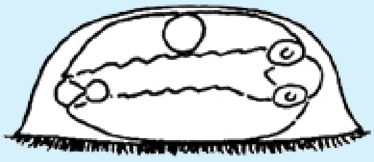


3.6 mm SL

4.9 mm SL

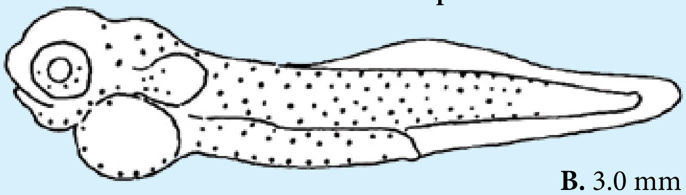
Literature: Briggs (1986), Russell (1976)

GOBIESOCIDAE — ***Diplecogaster bimaculata*** (Bonnaterre, 1788)

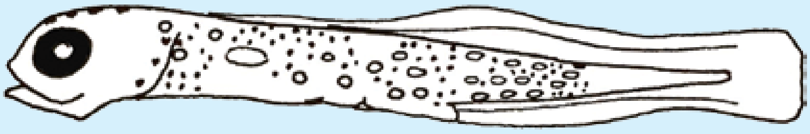


A.

Body covered with rounded stellate melanophores



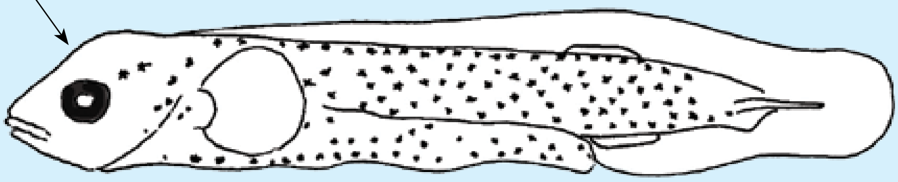
B. 3.0 mm



C. 4.5 mm

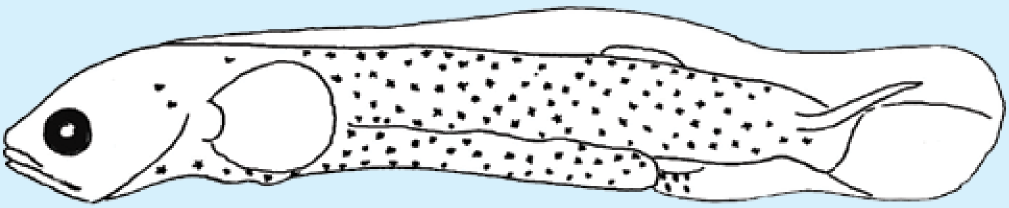
Body relatively elongate and slender

No melanophores on head



D. 6.5 mm

Preanus length more than 70% SL



E. 8.0 mm

A–E: Russell (1976)

BELONIDAE

Belone belone (Linnaeus, 1761)

En: Garfish – **Fr:** Orphie – **Sp:** Aguja

Habitat: Epipelagic (neustonic), neritic

Spawning season: February to May (Algeria)

EGGS

Fig. A

Habitat: demersal
Shape: spherical
Diameter: 3.0–3.5 mm
Chorion: filamentous
Oil globules: no oil globule
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 9.0 mm, in an advanced stage of development
Distinctive characters: lower jaw projects slightly beyond upper jaw
Pigmentation: body covered with melanophores; yolk sac barely visible due to the abundant pigmentation

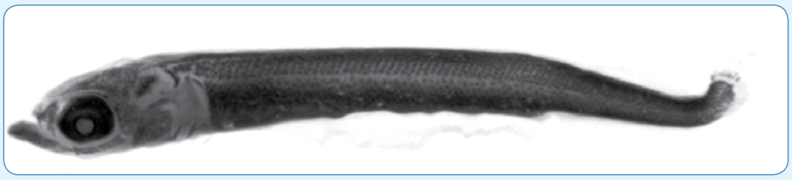
LARVAE

Figs. C–E

Distinctive characters: body relatively elongate and slender, very similar to that of yolk–sac larvae; the only apparent change that occurs during development is the lengthening of the lower jaw
Preanus length: about 45% SL
Pigmentation: strongly pigmented; melanophores arranged along myomeres in dorsal half of body
Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

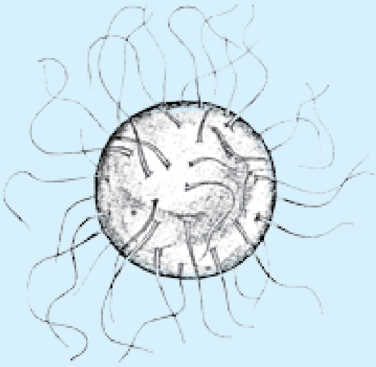


13.0 mm SL

Not sized

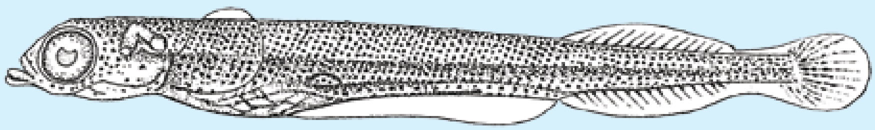
Literature: Alemany (1997), Collette and Parin (1986), D'Ancona (1931e), Russell (1976)

BELONIDAE **_Belone belone_** (Linnaeus, 1761)

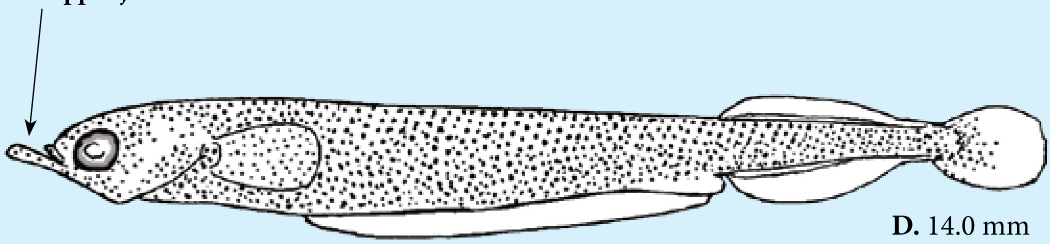


A.

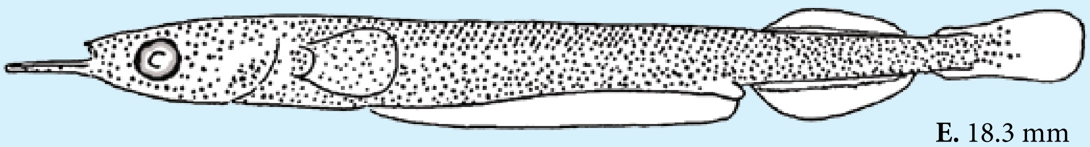
B. 9.0 mm



C. 13.5 mm



D. 14.0 mm



E. 18.3 mm

A, C: D'Ancona (1931e); **B, D, E:** Russell (1976)

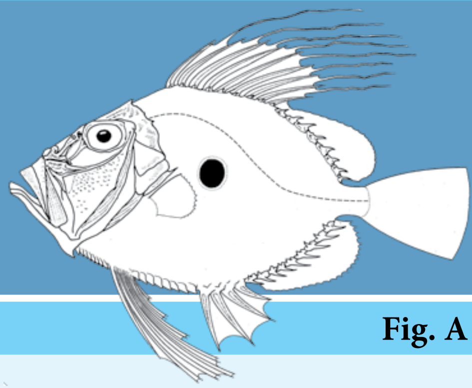
ZEIDAE

Zeus faber **Linnaeus, 1758**

En: **John dory** – **Fr:** **Saint Pierre** – **Sp:** **Pez de San Pedro**

Habitat: Near the bottom or in midwater, from close to shore down to 400 m depth, mainly between 50 and 150 m depth

Spawning season: Spring, in the South Mediterranean



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.96–2.0 mm
Chorion: smooth
Oil globules: single, 0.35–0.40 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: 4.3 mm
Pigmentation: body, except caudal peduncle, covered with stellate melanophores; dorsal and ventral group of melanophores on finfold in postanal region

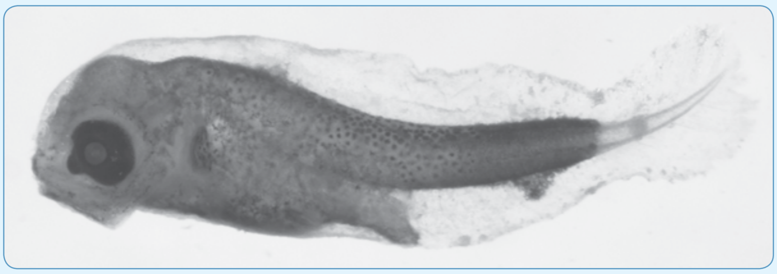
LARVAE

Figs. C–E

Distinctive characters: body rhomboid–shaped; pelvic fins, well developed from young larvae on, have 6 rays; no spines on body
Preanus length: less than 50% SL in young larvae, increases with development
Pigmentation: similar to yolk–sac larvae; pelvic fins pigmented
Length at flexion: 6 mm

PHOTOS

by J.M. Rodriguez

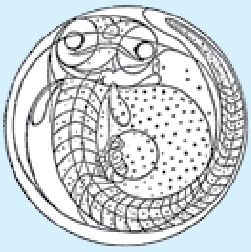


4.3 mm SL

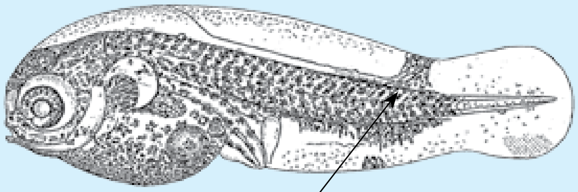
Literature: Alemany (1997), Quero (1986b), Sanzo (1956a)

ZEIDAE

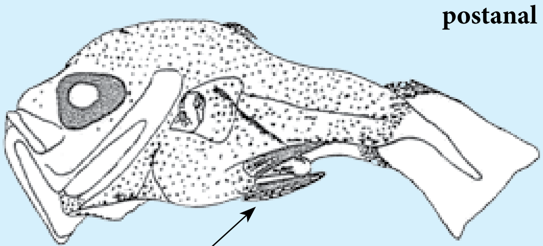
Zeus faber Linnaeus, 1758



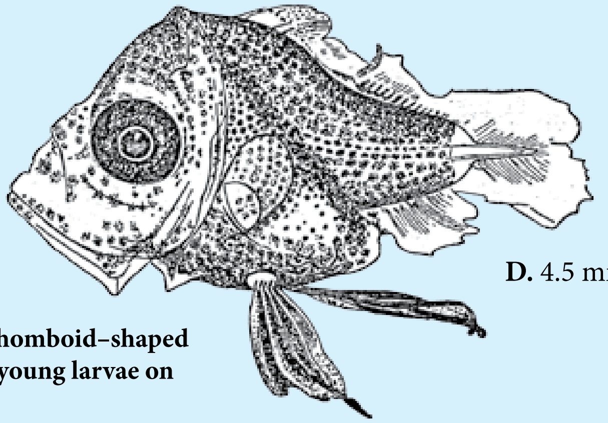
A.



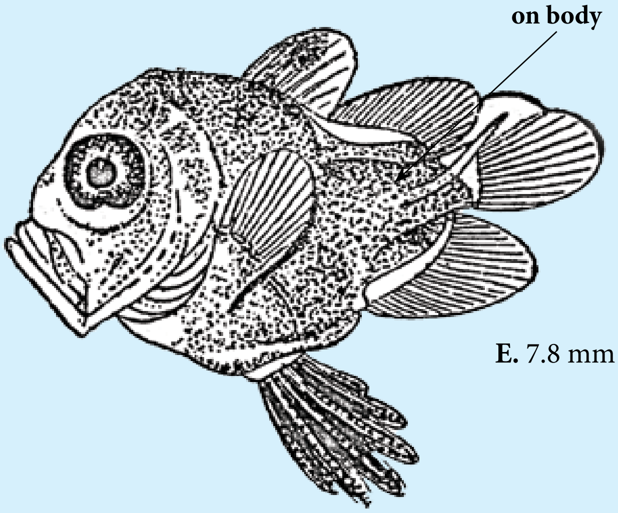
B. 4.3 mm



C. 2.5 mm SL



D. 4.5 mm

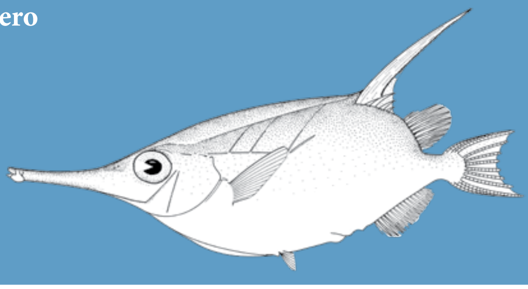


E. 7.8 mm

A, B, D, E: Sanzo (1931d); **C:** Alemany (1997)

CENTRISCIDAE *Macroramphosus scolopax* (Linnaeus, 1758)

En: Longspine snipefish – **Fr:** Bécasse de mer – **Sp:** Trompetero



Habitat: Juveniles to 10 cm are epipelagic, oceanic; adults are benthic, between 50 and 150 m depth, occasionally down to 500 m

Spawning season: Between October and March (in the subtropical northeastern Atlantic)

EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0 mm
Chorion: smooth
Oil globules: single, 0.2 mm in diameter
Perivitelline space: small

YOLK–SAC LARVAE — Fig. B

Hatch size: 3.0 mm TL

Pigmentation: continuous line of melanophores along ventral surface of trunk and tail, from eye to caudal region; group of dorsal melanophores in postanal region; spots on top of head and snout

LARVAE — Figs. C–F

Distinctive characters: body moderately elongate; supraorbital and occipital crests develop in larvae of 4.0–6.0 mm in length; series of spines over preopercular edge; spinous scales develop along lateral line in larvae of about 4.2 mm in length and cover entire body by 6.2 mm

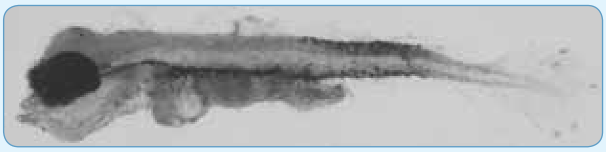
Preanus length: about 50% SL

Pigmentation: early larvae similar to yolk–sac larvae; later larvae show a lateral line of melanophores in postanal region; pigmentation increases with development spreading onto flanks, covering most of the body, except caudal peduncle

Length at flexion: about 4.0 mm TL

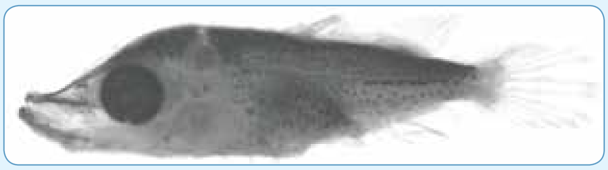
PHOTOS

by J.M. Rodriguez



3.7 mm SL

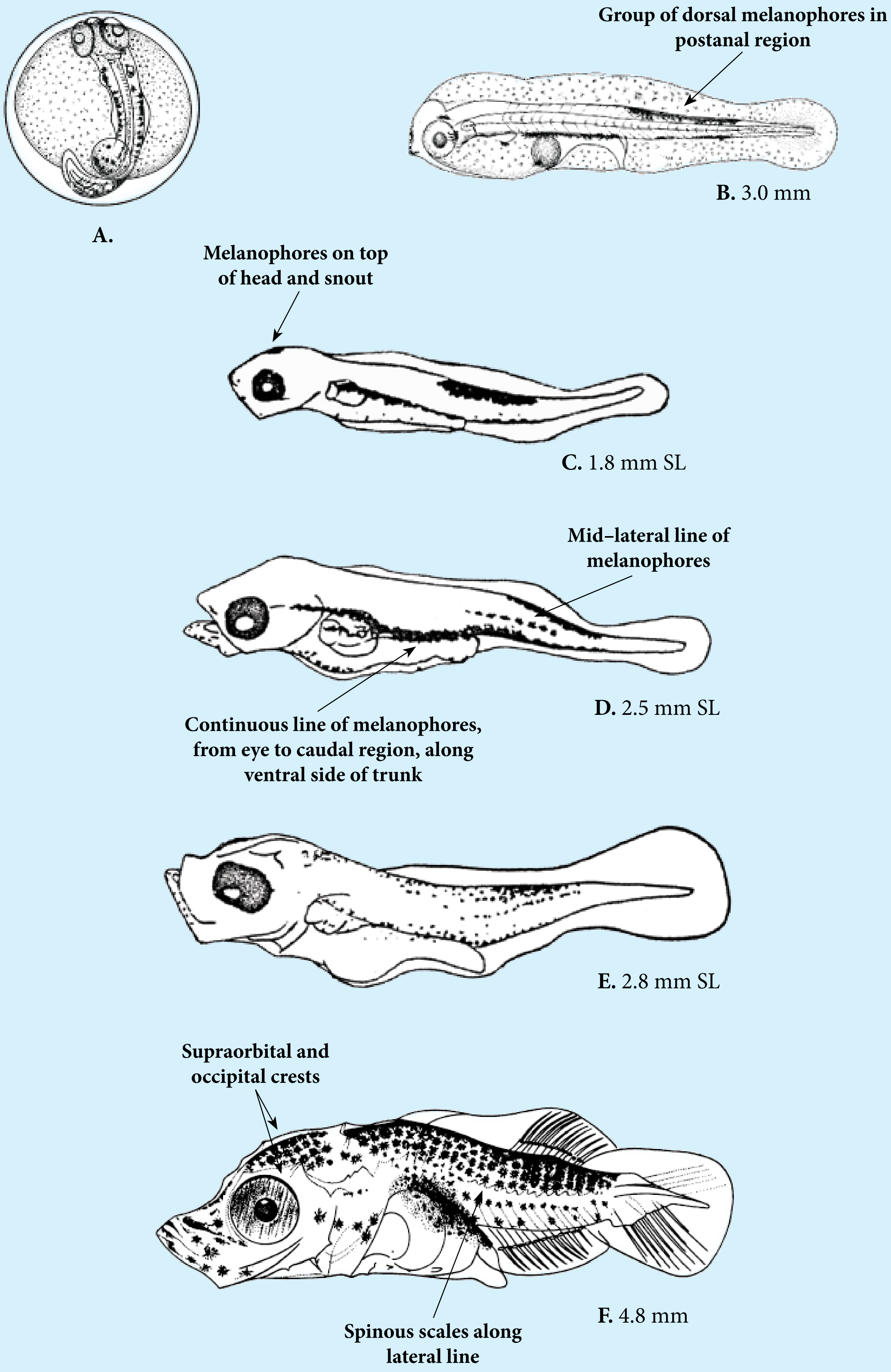
Not sized



5.7 mm SL

Literature: Alemany (1997), D'Ancona (1933b), Ehrich (1986), Sparta (1936)

CENTRISCIDAE *Macroramphosus scolopax* (Linnaeus, 1758)



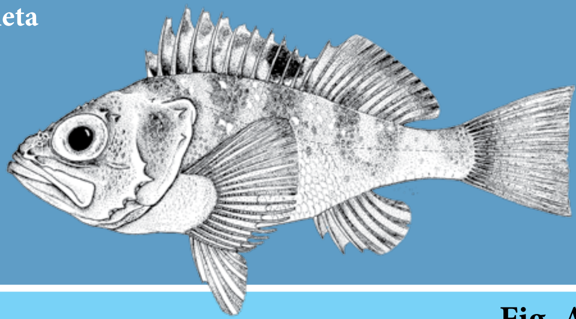
A, B, F: Sparta (1936); **C–E:** Alemany (1997)

SEBASTIDAE *Helicolenus dactylopterus* (Delaroche, 1809)

En: Blackbelly rosefish – **Fr:** Sébaste chèvre – **Sp:** Gallineta

Habitat: Benthic, on the continental slope between 200 and 1 000 m depth

Spawning season: February and March



EGGS Fig. A

Habitat: pelagic
Shape: ovoid
Size: 0.92–0.98 × 0.88–0.93 mm
Chorion: smooth
Oil globules: single, about 0.2 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE Fig. B

Hatch size: 1.9–2.6 mm
Distinctive characters: body moderately elongate
Pigmentation: oil globule, dorsum of body and finfold pigmented

LARVAE Figs. C–F

Distinctive characters: body moderately large with a large head; 3 or 4 stout preopercular spines; few small spines on lateral ridge; supraocular ridge with small, simple spines; parietal spine well developed with secondary serrations; in young larvae, primordial fin prolonged to snout

Preanus length: increases from about 45% to less than 60% SL with development

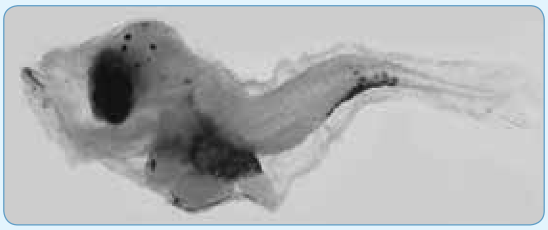
Pigmentation: peritoneum, ventral side of gut and tip of lower jaw pigmented; large ventral patch of pigment close to caudal region; some dotted melanophores on head and on pectoral–fin border

Length at flexion: 6.0–8.0 mm

PHOTOS

by J.M. Rodriguez

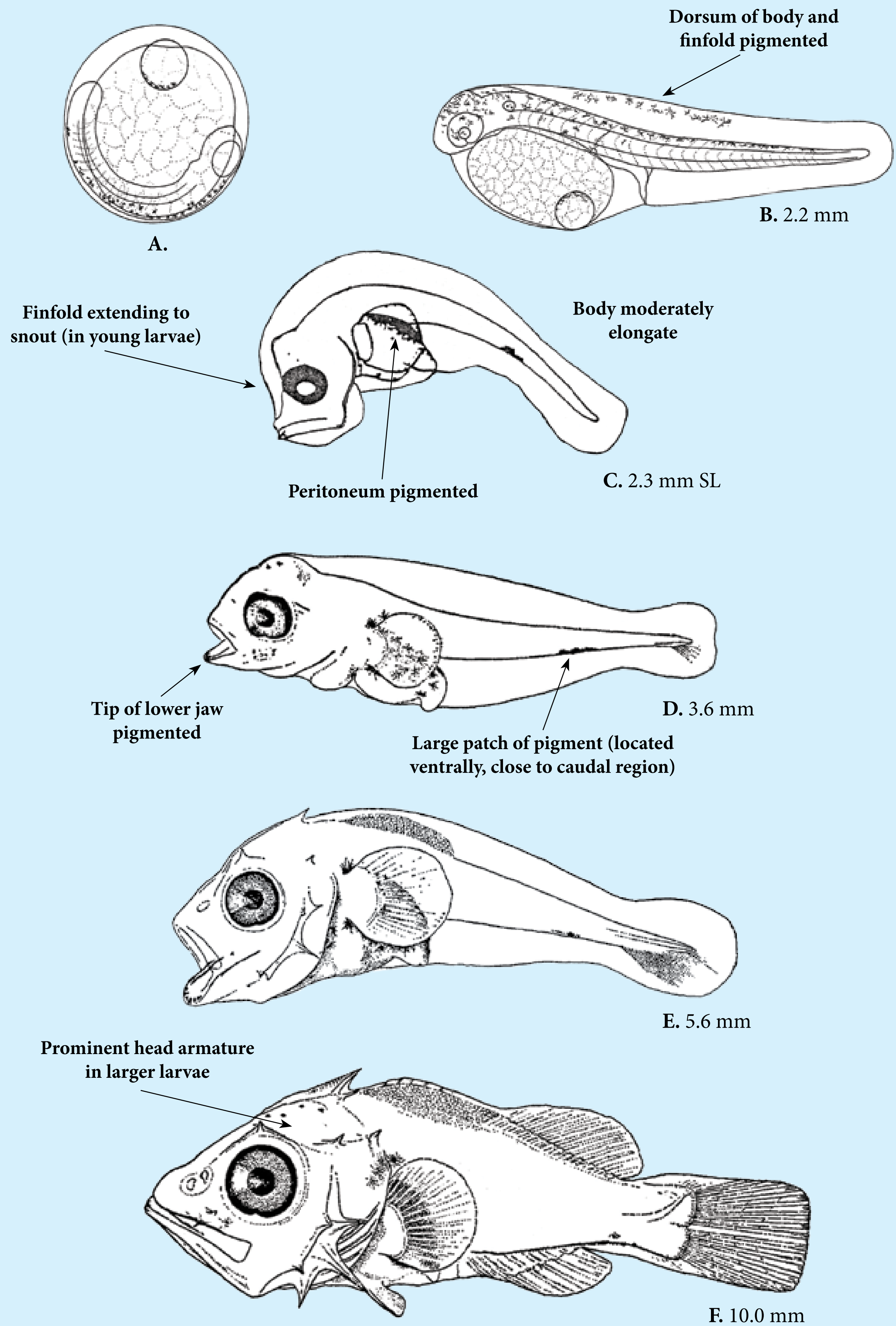
Not sized



3.0 mm SL

Literature: Alemany (1997), Brownell (1979), Fahay (2007), Hureau and Litvinenko (1986), Täning (1961)

SEBASTIDAE — ***Helicolenus dactylopterus*** (Delaroche, 1809)



A, B: Brownell (1979); **C:** Alemany (1997); **D–F:** Täning (1961)

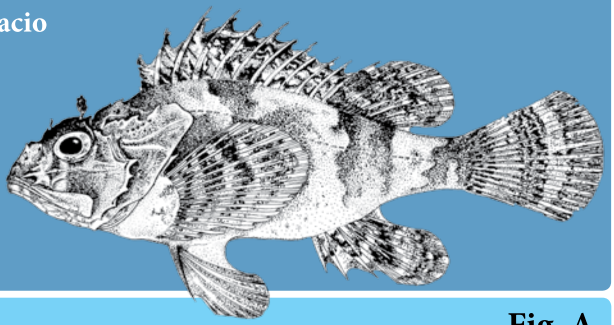
SCORPAENIDAE

Scorpaena porcus Linnaeus, 1758

En: Black scorpionfish – **Fr:** Rascasse brune – **Sp:** Rascacio

Habitat: Benthic, littoral, common among rocks and algae

Spawning season: Between June and August



EGGS

Fig. A

Habitat: pelagic
Shape: elliptical
Size: 0.92 mm x 0.84 mm
Chorion: smooth
Oil globules: single
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 1.7 mm
Distinctive characters: anus does not reach finfold border
Pigmentation: unpigmented

LARVAE

Figs. C–H

Distinctive characters: body short, increases in height with development; head relatively large and armed with spines and crests; pectoral fins strongly developed

Preanus length: about 50% SL

Pigmentation: peritoneum strongly pigmented; a row of postanal melanophores in young larvae, decreasing in number (to 2–4) with development; pectoral–fin edges pigmented

Length at flexion: completed at 3.4 mm SL

PHOTOS

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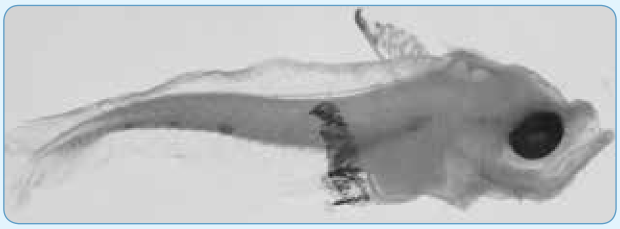
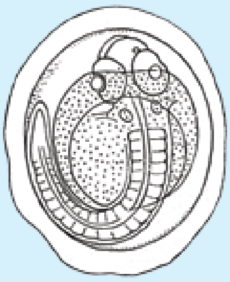


3.5 mm SL

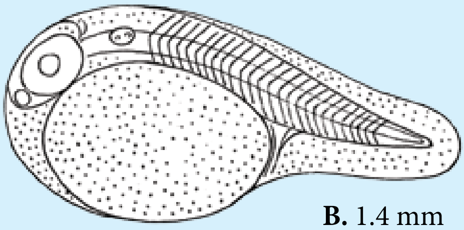
Not sized

Literature: Alemany (1997), Froese and Pauly (2016), Hureau and Litvinenko (1986), Sparta (1956b)

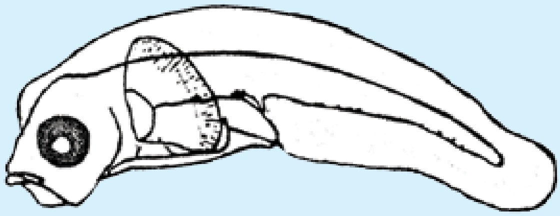
SCORPAENIDAE — ***Scorpaena porcus*** Linnaeus, 1758



A.

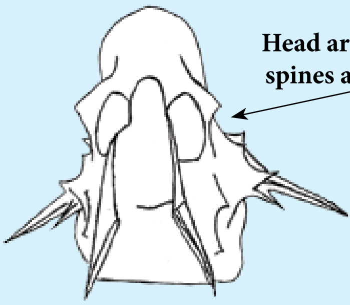


B. 1.4 mm

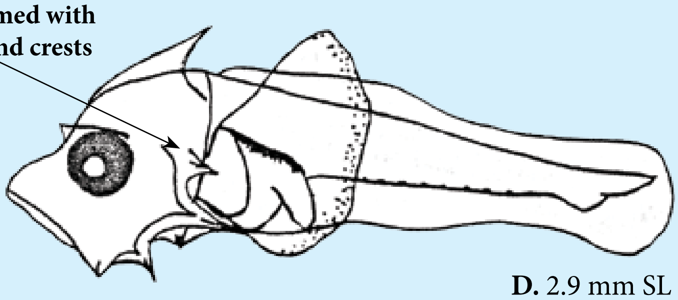


C. 1.8 mm SL

Head armed with spines and crests

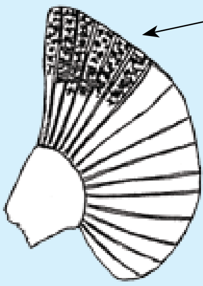


G. Dorsal view of head (3.4 mm SL individual)

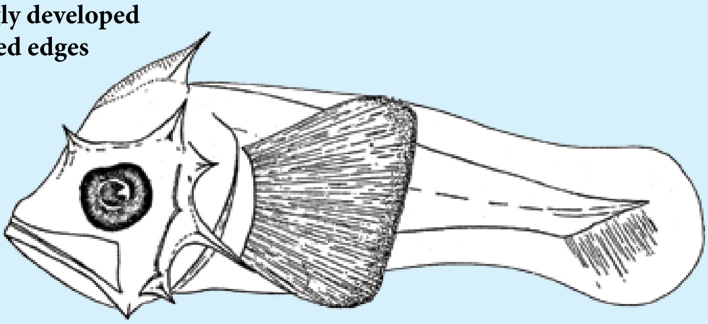


D. 2.9 mm SL

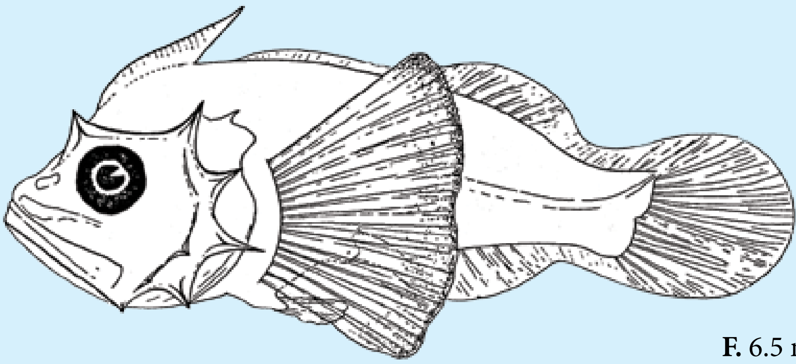
Pectoral fin strongly developed with pigmented edges



H. Detail of pigment pattern (4.4 mm individual)



E. 4.0 mm



F. 6.5 mm

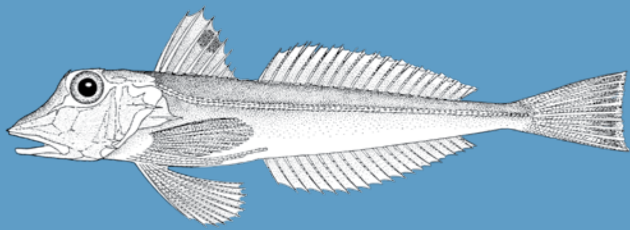
A, B: Sparta (1956b); **C, D, G, H:** Alemany (1997); **E, F:** Fage (1918)

TRIGLIDAE *Eutrigla gurnardus* (Linnaeus, 1758)

En: Grey gurnard – **Fr:** Grondin gris – **Sp:** Borracho

Habitat: Benthic, littoral, over muddy, sandy and rocky bottoms

Spawning season: Between January and June



EGGS

Habitat: pelagic
Shape: spherical
Diameter: 1.27–1.55 mm
Chorion: smooth
Oil globules: single, 0.25–0.33 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE Fig. A

Hatch size: 3.0–4.0 mm
Pigmentation: body, yolk and oil globule covered with cromatophores; during development, pigmentation decreases and black pigment predominates; postanal ventral row of melanophores

LARVAE Figs. B–E

Distinctive characters: body relatively large compared to other Triglidae species; head depressed and armed with a supraorbital and a double occipital crest, and three opercular spines; pectoral fins large
Preanus length: increases with development, from about 38% to about 50% TL
Pigmentation: peritoneum strongly pigmented; postanal ventral row of melanophores; several melanophores on head, upper jaw and ventral abdominal region; border of pectoral–fin rays pigmented
Length at flexion: unknown

PHOTOS

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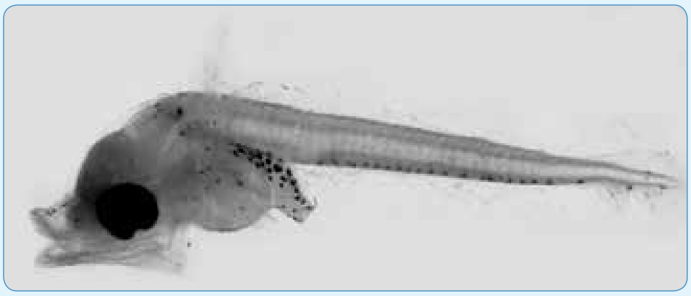
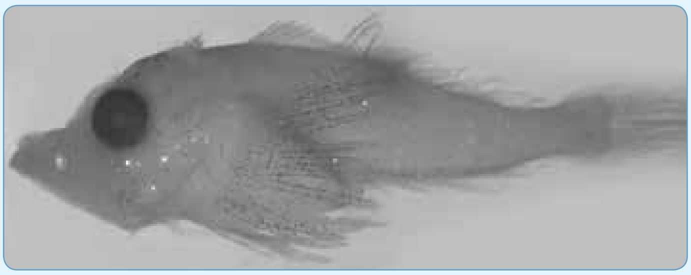


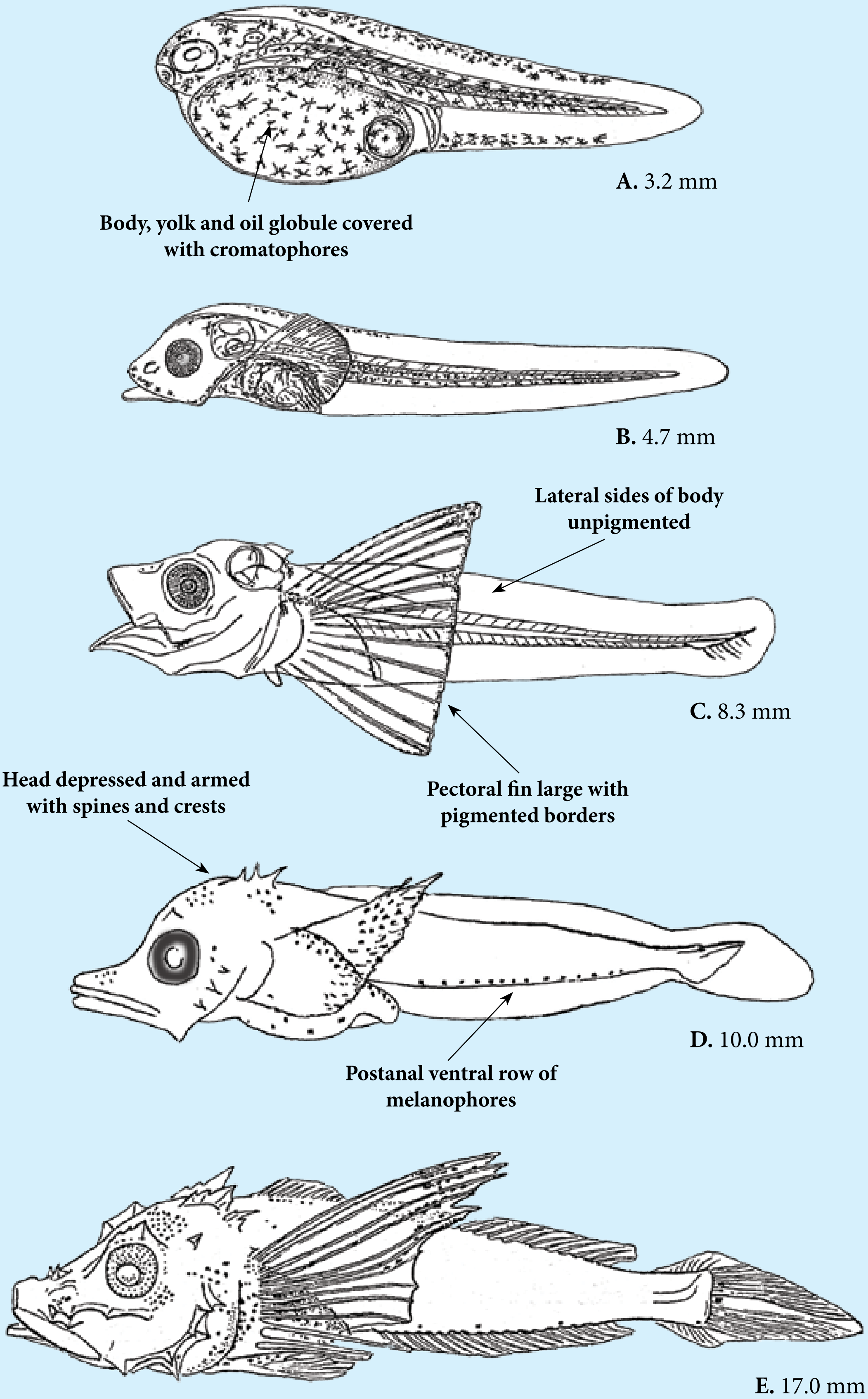
5.5 mm SL



Not sized

Literature: Alemany (1997), Hureau (1986b), Padoa (1956p), Russell (1976), Sabatés (1988)

TRIGLIDAE **_Eutrigla gurnardus_** (Linnaeus, 1758)



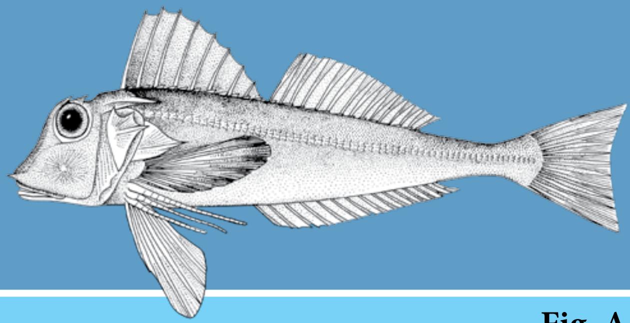
A–C, E: Padoa (1956p), **D:** Russell (1976)

TRIGLIDAE — ***Lepidotrigla cavillone*** (Lacepède, 1801)

En: Large–scaled gurnard

Habitat: Benthic, over mud, sand and gravel, between 30 and 450 m depth

Spawning season: Between May and July



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.16 mm
Chorion: smooth
Oil globules: single, 0.21–0.22 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: unknown
Distinctive characters: yolk sac ovoid; oil globule situated at posterior edge of yolk sac; anus reaches finfold border and opens a little bit behind yolk sac
Pigmentation: melanophores uniformly distributed over body, yolk sac and finfold

LARVAE — Figs. C–F

Distinctive characters: body relatively high; pectoral fins large; occipital and supraorbital crests and opercular spines are present
Preanus length: about 40% SL, increases with development
Pigmentation: peritoneum pigmented; dorsal and ventral melanophores at about mid–postanal region; dorsal melanophore disappears when larvae reach about 4.0 mm in length
Length at flexion: unknown

PHOTOS

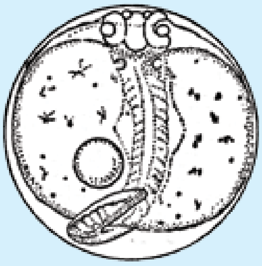
by J.M. Rodriguez

2.9 mm SL

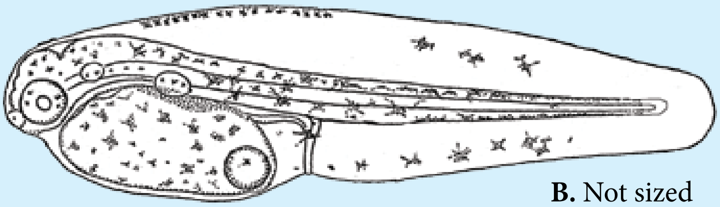
5.0 mm SL

Literature: Alemany (1997), Fage (1918), Hureau (1986b), Padoa (1956p)

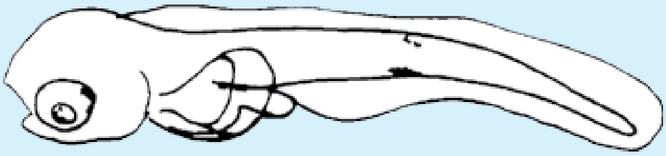
TRIGLIDAE — ***Lepidotrigla cavillone*** (Lacepède, 1801)



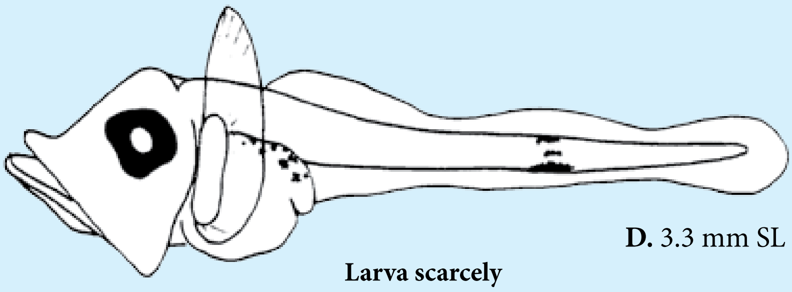
A.



B. Not sized

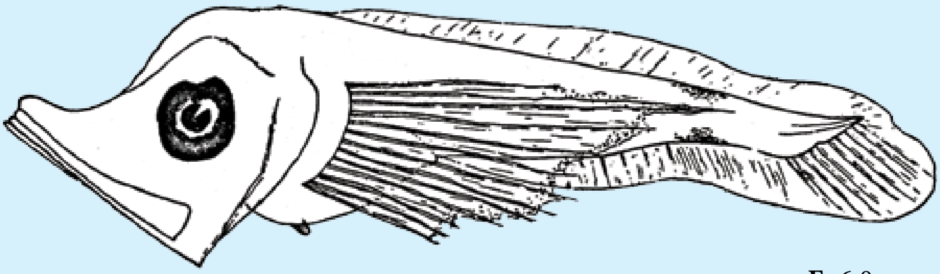


C. 2.1 mm NL

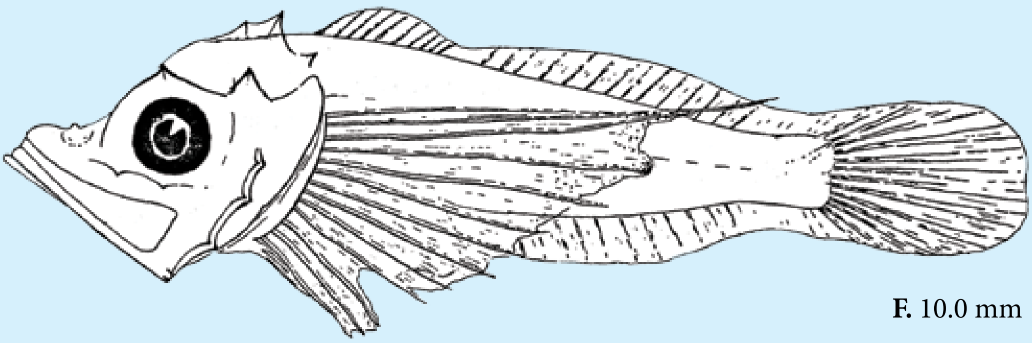


D. 3.3 mm SL

Larva scarcely pigmented



E. 6.0 mm



F. 10.0 mm

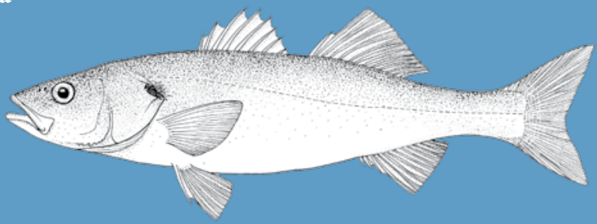
A, B: Padoa (1956p); **C, D:** Alemany (1997); **E, F:** Fage (1918)

MORONIDAE *Dicentrarchus labrax* (Linnaeus, 1758)

En: European seabass – **Fr:** Bar européen – **Sp:** Lubina

Habitat: Benthic, over the continental shelf

Spawning season: Between January and March



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.20–1.51 mm
Chorion: smooth
Oil globules: single, 0.36–0.46 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

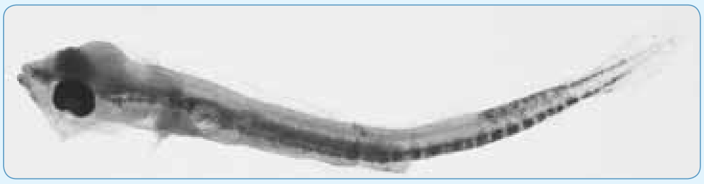
Hatch size: 3.61–4.05 mm
Distinctive characters: body elongate
Preanus length: more than 50% SL
Pigmentation: strongly pigmented with melanophores forming bands along body; yolk sac and oil globule pigmented

LARVAE Figs. C–G

Distinctive characters: body elongate and narrow
Preanus length: more than 50% SL
Pigmentation: continuous line of melanophores spreading from snout to caudal–fin base; dorsal melanophores restricted with development to tail end; tip of snout and lower jaw pigmented
Length at flexion: about 6 mm SL

PHOTOS

by J.M. Rodriguez

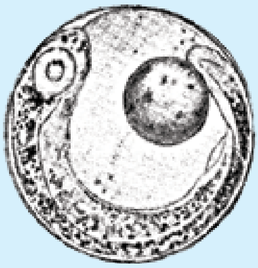


5.6 mm SL

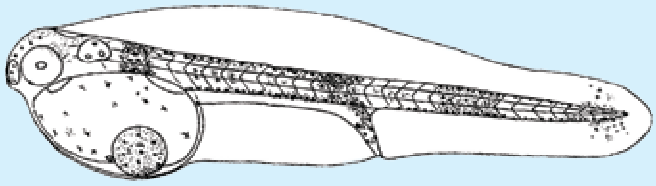
6.7 mm SL

Literature: Bertolini (1933b), Russell (1976), Sabatés (1988), Tortonese (1986d)

MORONIDAE *Dicentrarchus labrax* (Linnaeus, 1758)



A.



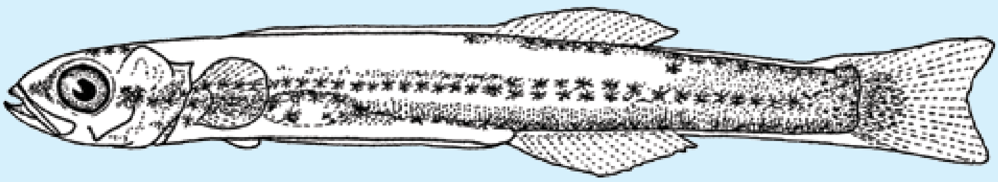
B. 4.5 mm

C. 5.0 mm

D. 6.0 mm

E. 9.0 mm

F. 11.0 mm



G. 17.0 mm

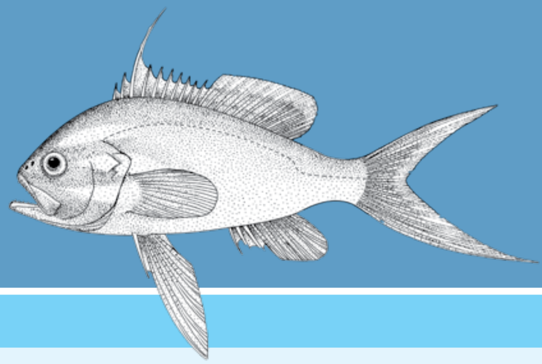
A, G: Bertolini (1933b); **B, C:** Kennedy & Fitzmaurice (1968); **D–F:** Russell (1976)

SERRANIDAE *Anthias anthias* (Linnaeus, 1758)

En: Swallowtail seaperch – **Sp:** Tres colas

Habitat: Benthic, on the continental shelf and upper slope, down to 200 m depth

Spawning season: Between March and August



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body, head and trunk height increases with development; a supraorbital crest, two series (inner and outer) of preopercular and a series of opercular spines are present; a spine of both the outer preopercular and opercular series is quite large; second ray of dorsal fin and first and second rays of pelvic fins are quite large

Preanus length: more than 50% SL

Pigmentation: some peritoneal melanophores; a relatively large spot over hindgut and another one opposite it in dorsal region; a series of melanophores between anus and caudal fin that decrease in number to 3 in late larval stages; a melanophore on caudal–fin base

Length at flexion: 3.3–6.0 mm SL

PHOTOS

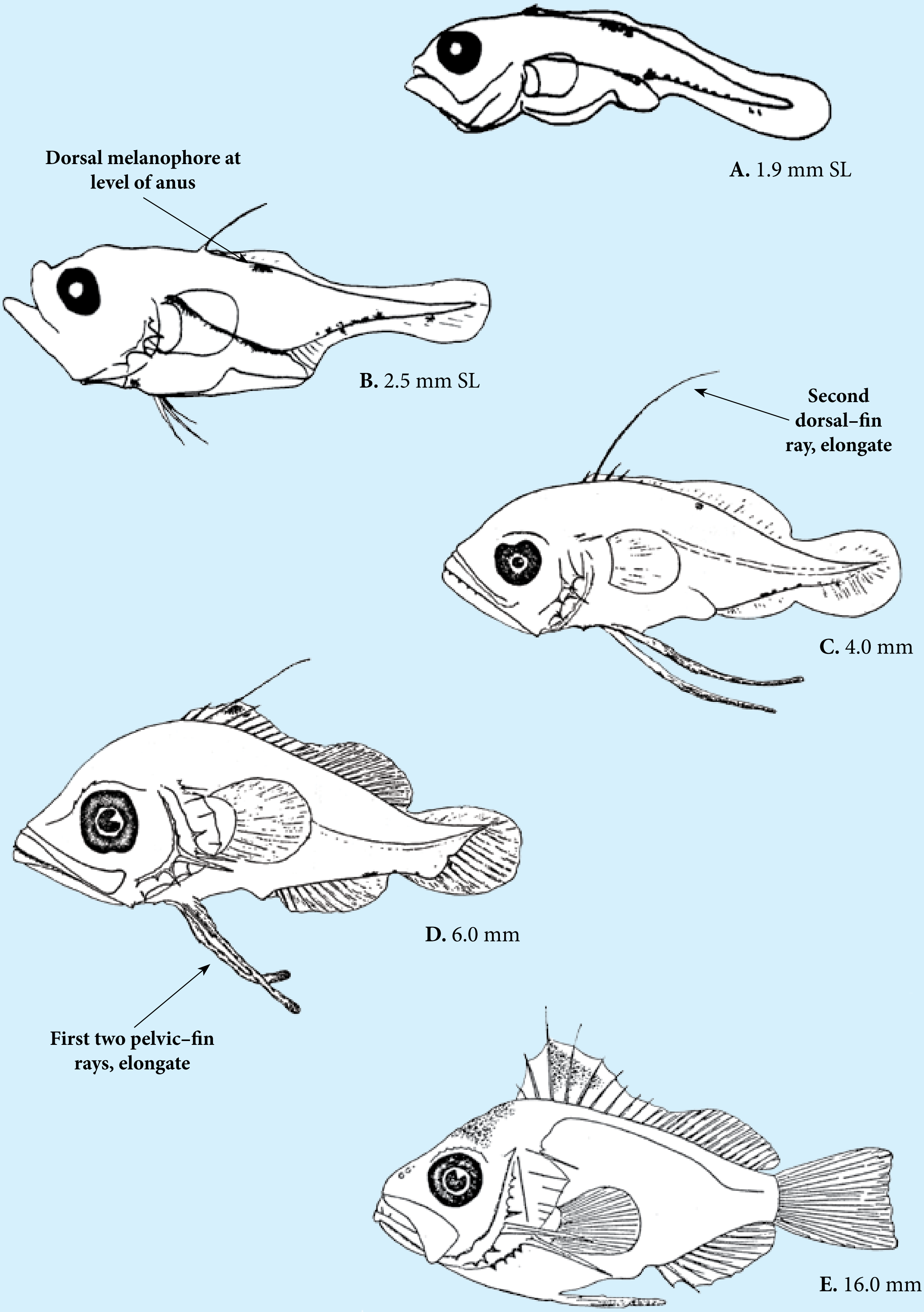
by J.M. Rodriguez

1.6 mm SL

3.6 mm SL

Literature: Alemany (1997), Bertolini (1933b), Froese and Pauly (2016), Sabatés (1988), Tortonese (1986d)

SERRANIDAE ***Anthias anthias*** (Linnaeus, 1758)



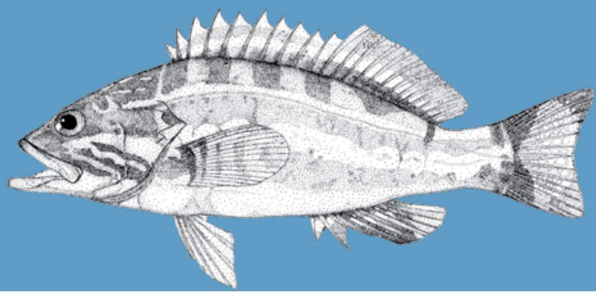
A, B: Alemany (1997); **C–E:** Fage (1918)

SERRANIDAE *Serranus cabrilla* (Linnaeus, 1758)

En: Comber – **Fr:** Serran-chèvre – **Sp:** Cabrilla

Habitat: Benthic, on the continental shelf and upper slope, down to 200 m depth

Spawning season: Between April and July



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.90–0.97 mm
Chorion: smooth
Oil globules: single, 0.14–0.15 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: 1.84–2.3 mm SL

Pigmentation: row of dorsal melanophores extending from head to level of anus; a large melanophore on hindgut and another opposite it in dorsal region; a dorsal and ventral melanophore situated at about midpoint of the postanal region

LARVAE Figs. C–F

Distinctive characters: body height increases with development; three series of preopercular spines, one of which goes beyond the edge of the operculum in older larvae; an opercular spine in upper part of operculum; pelvic fins and third spiny ray of dorsal fin very elongate

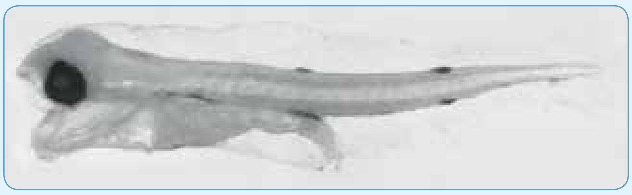
Preanus length: more than 50% SL

Pigmentation: ventral abdominal region pigmented in young larvae and several postanal ventral melanophores may be present; pair of opposing melanophores, one dorsal and another ventral, located at midway along postanal region; caudal–fin base pigmented; spot on hindgut and another opposite it in dorsal region in young larvae; pelvic fins pigmented

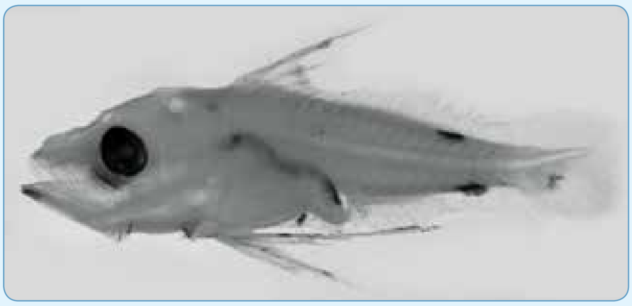
Length at flexion: flexion begins at about 4.8 mm SL and is completed at 9.7 mm SL

PHOTOS

by J.M. Rodriguez



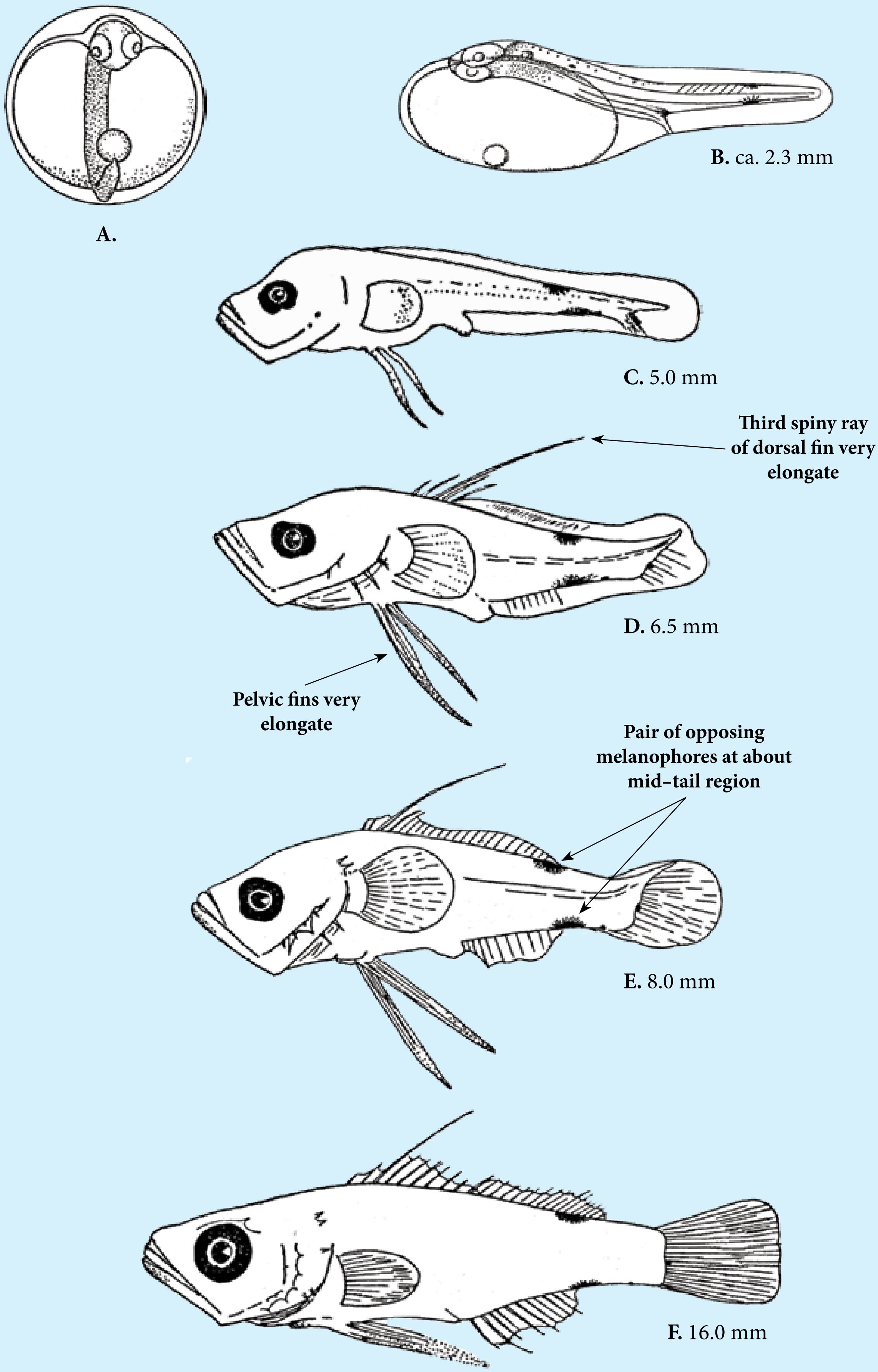
3.0 mm SL



6.2 mm SL

Literature: Bertolini (1933b), Fage (1918), Russell (1976), Sabatés (1988), Tortonese (1986d)

SERRANIDAE — *Serranus cabrilla* (Linnaeus, 1758)



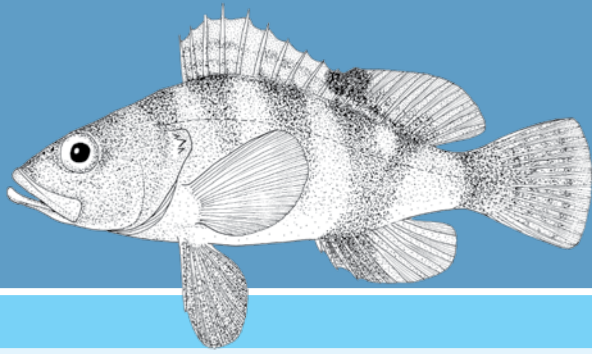
A, B: Bertolini (1933b); **C–F:** Fage: (1918)

SERRANIDAE *Serranus hepatus* (Linnaeus, 1758)

En: **Brown comber** – **Fr:** **Serran tambour** – **Sp:** **Merillo**

Habitat: Benthic, between 5 and 320 m depth over grasslands or sandy and muddy bottoms

Spawning season: Between March and August



EGGS

Habitat: pelagic
Shape: spherical
Diameter: 0.78 mm
Chorion: smooth
Oil globules: single, 0.14 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body very similar to that of *Serranus cabrilla*; differences lie on weakly developed pelvic fins in *S. hepatus* and on the pigmentation pattern

Preanus length: more than 50% SL

Pigmentation: early larvae with two dorsal and a single ventral melanophore over finfold; three regularly spaced postanal, ventral melanophores; a melanophore over hindgut and another on cleithral symphysis; peritoneum pigmented; some melanophores on ventral surface of gut; no dorsal melanophores

Length at flexion: almost completed at 5.7 mm SL

PHOTOS

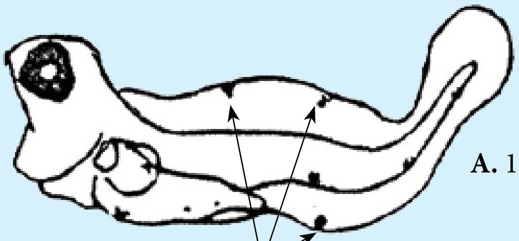
by J.M. Rodriguez

2.1 mm SL

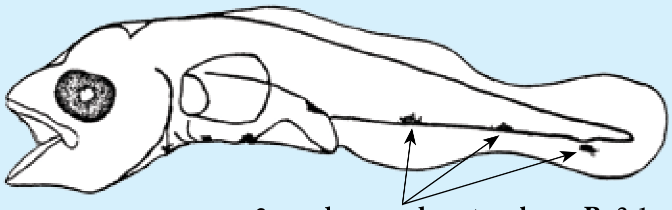
6.5 mm SL

Literature: Alemany (1997), Bertolini (1933b), Sabatés (1988), Tortonese (1986d)

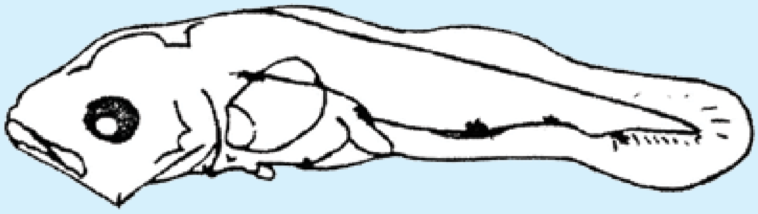
SERRANIDAE *Serranus hepatus* (Linnaeus, 1758)



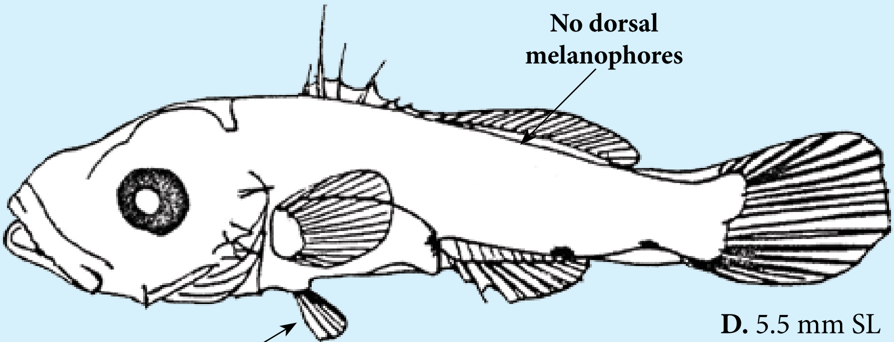
A. 1.5 mm SL



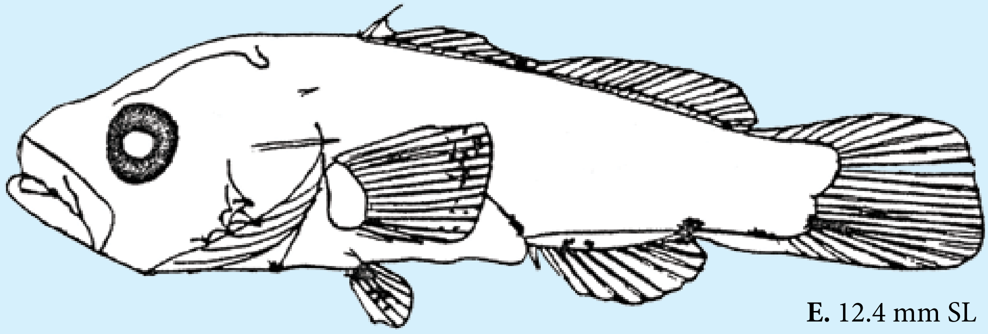
B. 3.1 mm SL



C. 4.1 mm SL



D. 5.5 mm SL



E. 12.4 mm SL

A–E: Alemany (1997)

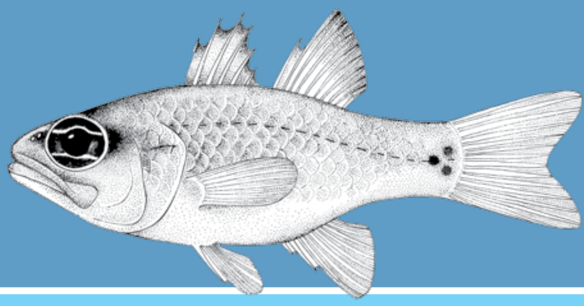
APOGONIDAE

Apogon imberbis (Linnaeus, 1758)

En: **Cardinal fish** – **Fr:** **Coq** – **Sp:** **Salmonete real**

Habitat: **Benthic, down to 320 m depth**

Spawning season: **Between June and September**



EGGS

Habitat: pelagic
Shape: quasi spherical
Diameter: 0.77 mm
Chorion: with filaments
Oil globules: single, 0.23 mm in diameter
Yolk: segmented

YOLK–SAC LARVAE

Hatch size: may be about 2.5 mm SL
Pigmentation: unpigmented

LARVAE

Figs. A–F

Distinctive characters: body relatively short and high; a series of preopercular spines in larvae of more than 2.4 mm SL; at 6.5 mm, larvae have a long preopercular and 3 shorter opercular spines; small supraorbital crest present; swimbladder apparent

Preanus length: 50% SL

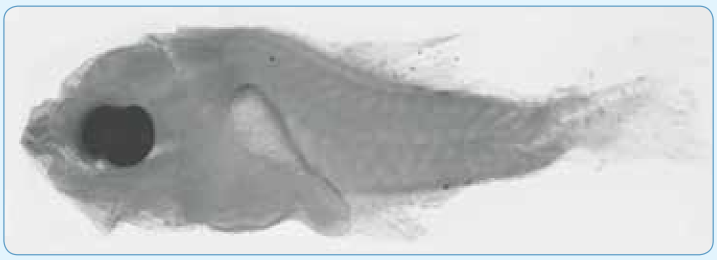
Pigmentation: ventral side of trunk and tail, from pectoral–fin base to mid–tail region, pigmented; group of dorsal melanophores in caudal region; two melanophores over head and some melanophores under gut; young larvae with postanal, dorsal group of melanophores; pigmentation diminishes with development

Length at flexion: flexion begins at 3.0 mm SL

PHOTOS

by J.M. Rodriguez

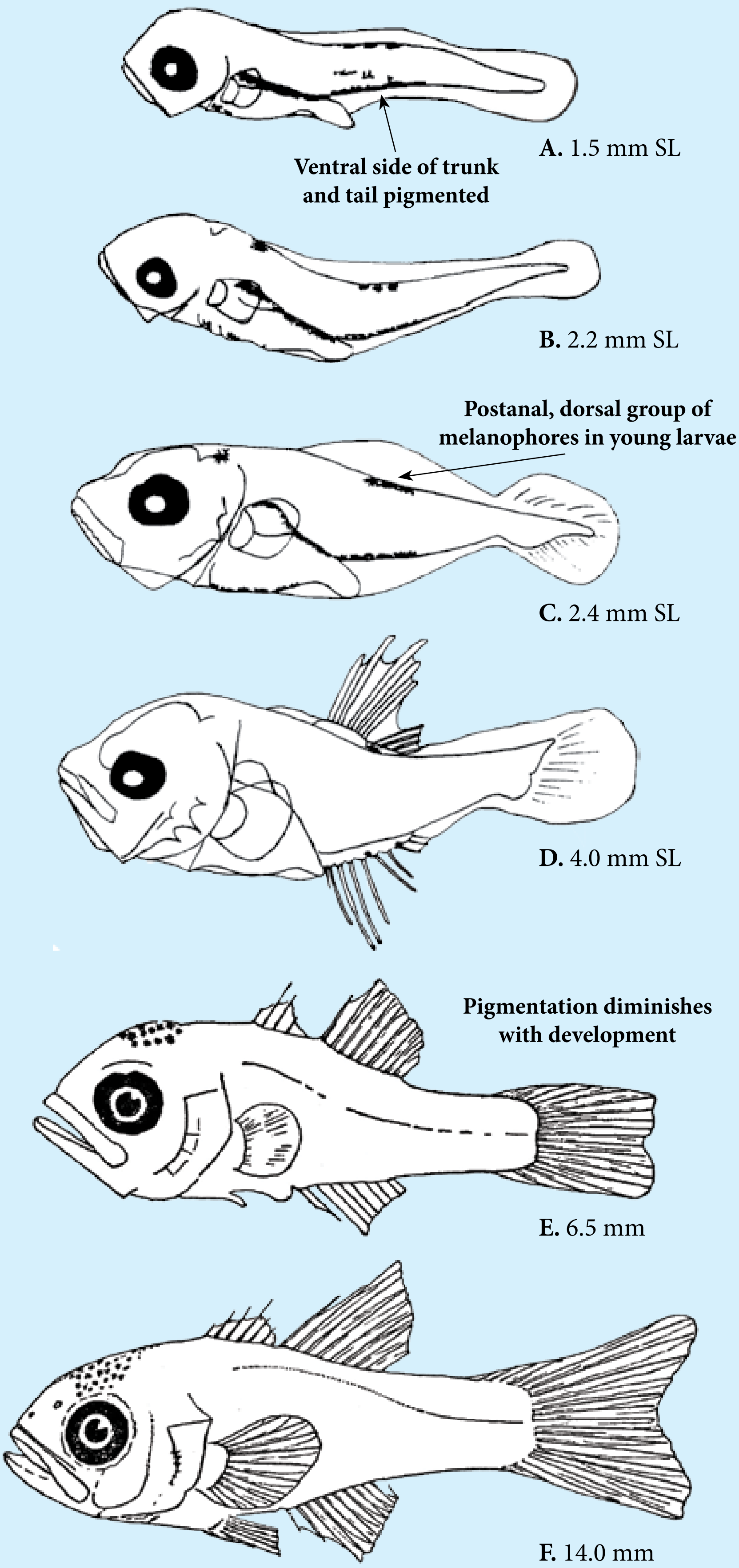
3.3 mm SL



3.5 mm SL

Literature: Alemany (1997), Bertolini (1933a), Tortonese (1986a)

APOGONIDAE — ***Apogon imberbis*** (Linnaeus, 1758)



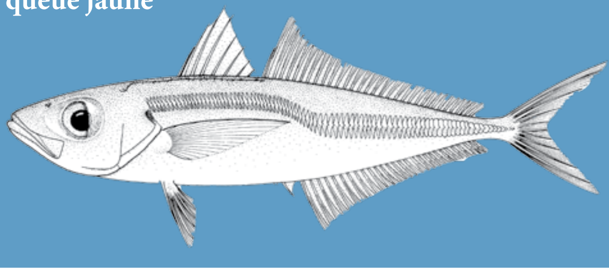
A–D: Alemany (1997); **E, F:** Bertolini (1933a)

CARANGIDAE *Trachurus mediterraneus* (Steindachner, 1868)

En: **Mediterranean horse mackerel** – **Fr:** **Chinchard à queue jaune**
Sp: **Jurel mediterráneo**

Habitat: Bentho–pelagic, between 40 and 500 m depth

Spawning season: No information



EGGS

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.04 mm
Chorion: smooth
Oil globules: single, about 0.24 mm in diameter
Yolk: segmented

YOLK–SAC LARVAE **Fig. A**

Hatch size: may be about 1.5 mm; oil globule situated at anterior region of yolk sac

Pigmentation: 3 or 4 dorsal melanophores in trunk region; melanophores over gut and hindgut; oil globule pigmented

LARVAE **Figs. B–F**

Distinctive characters: body height increases with development; an occipital crest and a series of preopercular spines are present; body very similar to that of *Trachurus trachurus* (differences between the two species mainly lie on the pigmentation pattern)

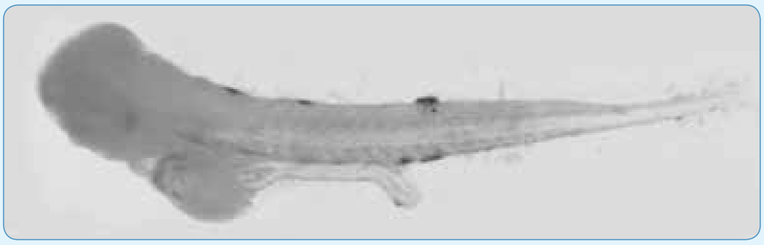
Preanus length: about 50% SL

Pigmentation: young larvae slightly pigmented, although melanophores are large; 3 or 4 dorsal preanal melanophores; melanophores over gut and hindgut; some postanal melanophores; melanophores over lateral body walls, over head, ventral tail region, under gut and lower jaw increases with development

Length at flexion: almost completed at 4.8 mm SL

PHOTOS

by J.M. Rodriguez



2.0 mm SL

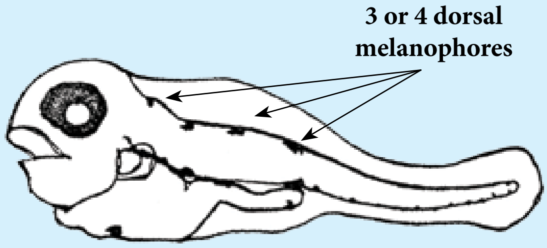
3.1 mm SL

Literature: Alemany (1997), Padoa (1956e), Sabatés (1988), Smith–Vaniz (1986)

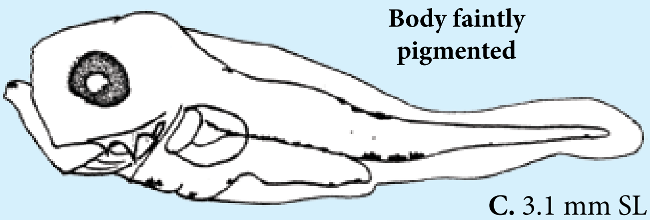
CARANGIDAE

Trachurus mediterraneus (Steindachner, 1868)

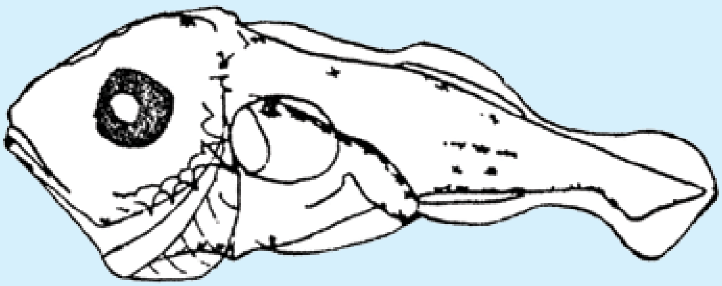
A. 1.7 mm SL



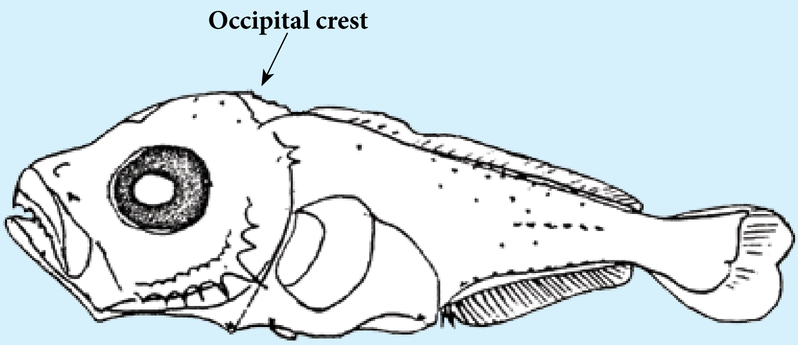
B. 1.9 mm SL



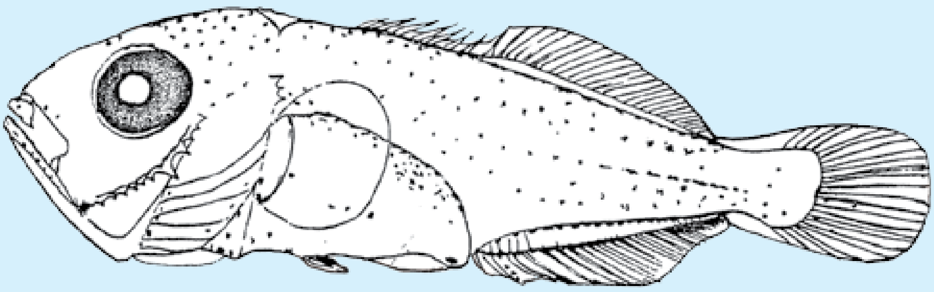
C. 3.1 mm SL



D. 4.6 mm SL



E. 6.1 mm SL

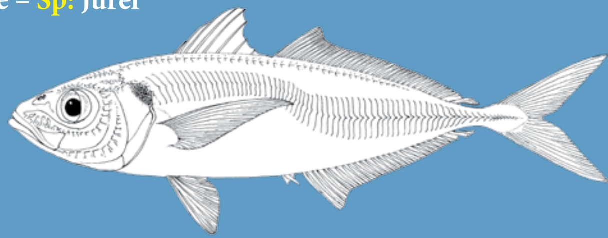


F. 8.3 mm SL

A–F: Alemany (1997)

CARANGIDAE *Trachurus trachurus* (Linnaeus, 1758)

En: Atlantic horse mackerel – **Fr:** Chinchard d'Europe – **Sp:** Jurel



Habitat: Benthic, over sandy bottoms between 100 and 200 m depth, occasionally down to 500 m

Spawning season: Between October and July (Greece)

EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.81–1.04 mm
Chorion: smooth
Oil globules: single, 0.19–0.28 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

Hatch size: about 2.5 mm

Distinctive characters: oil globule situated at anterior edge of yolk sac (similar to *T. mediterraneus*)

Pigmentation: melanophores are irregularly spread over body, except in caudal region; oil globule pigmented

LARVAE — Figs. C–G

Distinctive characters: body very similar to that of *Trachurus mediterraneus*, has preopercular spines and an occipital crest (differences between the two *Trachurus* species mainly lie on the pigmentation pattern)

Preanus length: about 50% SL

Pigmentation: dorsal and ventral body contours of melanophores; dorsal row of about 10 melanophores, ends at about mid–way between anus and caudal fin; ventral row consists of 4 or 5 large postanal melanophores, followed by small melanophores extending nearly to posterior end of notochord; numerous melanophores on lower jaw, along ventral surface of abdomen, upper surface of gut and on head

Length at flexion: may begin about 5.0 mm SL

PHOTOS

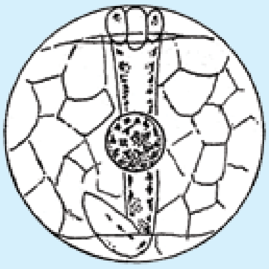
by J.M. Rodriguez

2.7 mm SL

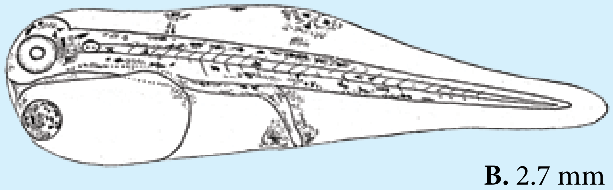
4.8 mm SL

Literature: Demir (1961), Froese and Pauly (2016), Padoa (1956e), Sabatés (1988), Smith–Vaniz (1986)

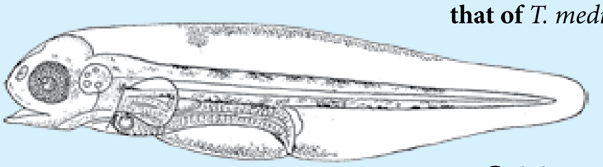
CARANGIDAE **_Trachurus trachurus_** (Linnaeus, 1758)



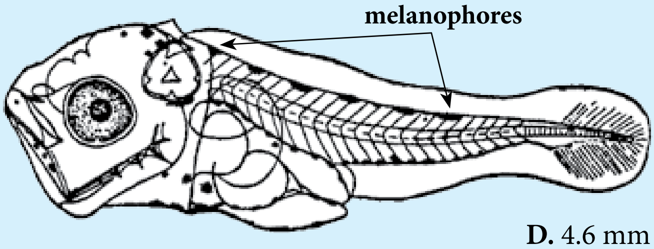
A.



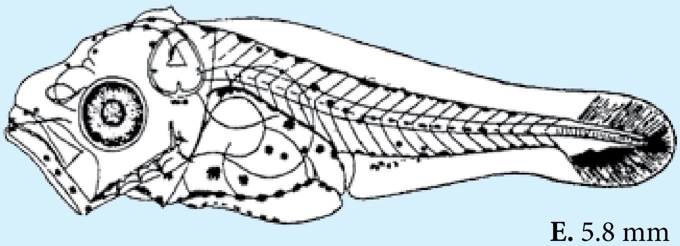
B. 2.7 mm



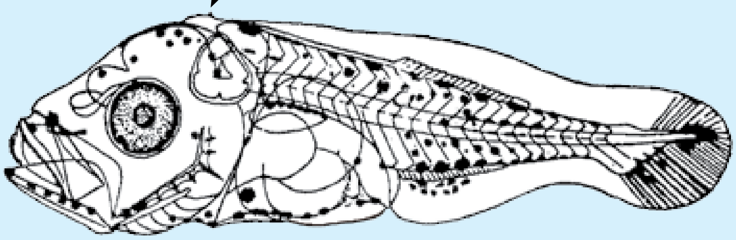
C. 3.2 mm



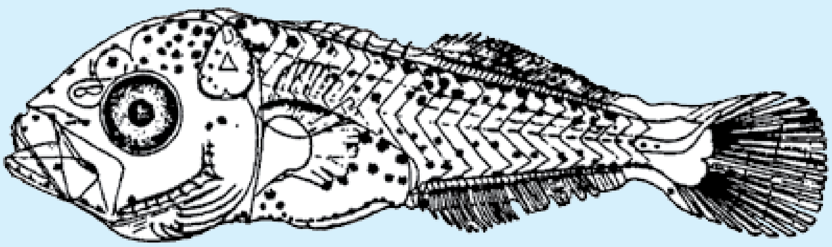
D. 4.6 mm



E. 5.8 mm



F. 7.0 mm



G. 10.5 mm

A–C: Padoa (1956e); **D–G:** Demir (1961)

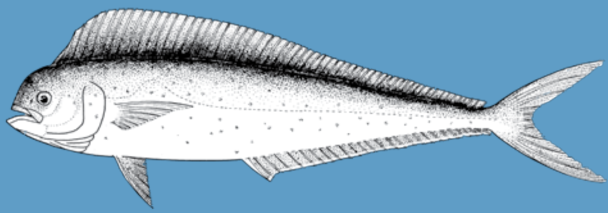
CORYPHAENIDAE

Coryphaena hippurus **Linnaeus, 1758**

En: Common dolphinfish – **Fr:** Coryphène commune – **Sp:** Lampuga

Habitat: Pelagic, oceanic but it also approaches the coast

Spawning season: Between May and September (in waters of Gran Canary Island)



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.3 mm
Chorion: smooth
Oil globules: single, 0.3–0.4 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

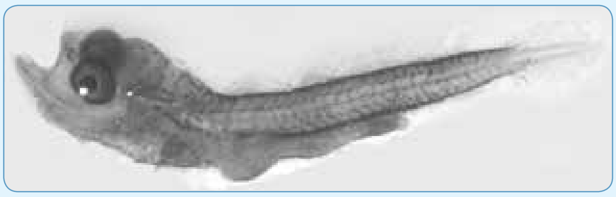
Hatch size: 3.0 mm
Distinctive characters: body elongate; anus located at about mid–body, reaches finfold border; oil globule located at posterior end of yolk–sac
Pigmentation: body, yolk–sac and oil globule strongly pigmented

LARVAE — Figs. C–G

Distinctive characters: body elongate with a moderately blunt head
Preanus length: about 60% SL
Pigmentation: body heavily pigmented, from head to about urostyle; melanophores arranged in bars in older larvae; stellate melanophores on preorbital region and on lower jaw; melanophores under gut
Length at flexion: 7.5–9.0 mm SL

PHOTOS

by J.M. Rodriguez



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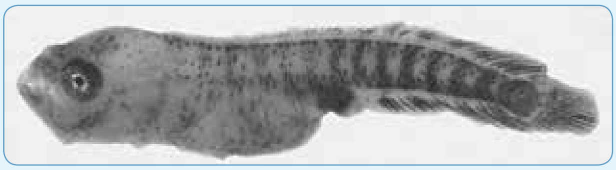

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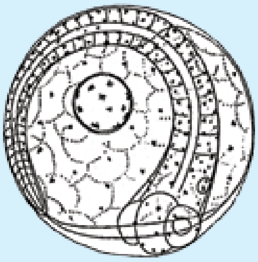
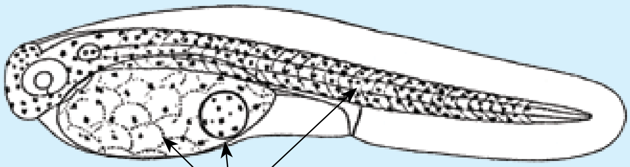
Literature: Collette (1986a), Fahay (2007), Froese and Pauly (2016), Mito (1960), Richards (2006)

CORYPHAENIDAE

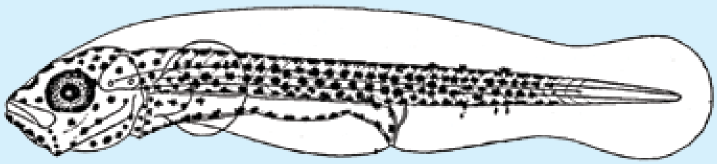
Coryphaena hippurus **Linnaeus, 1758**



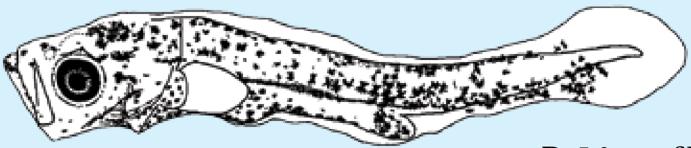
A.



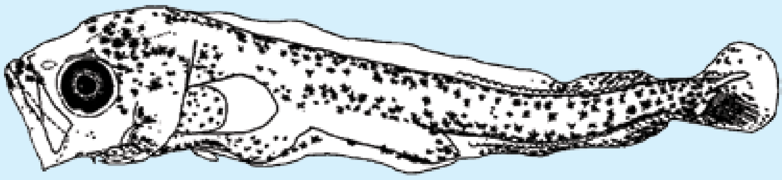
B. 4.0 mm TL



C. 5.7 mm SL

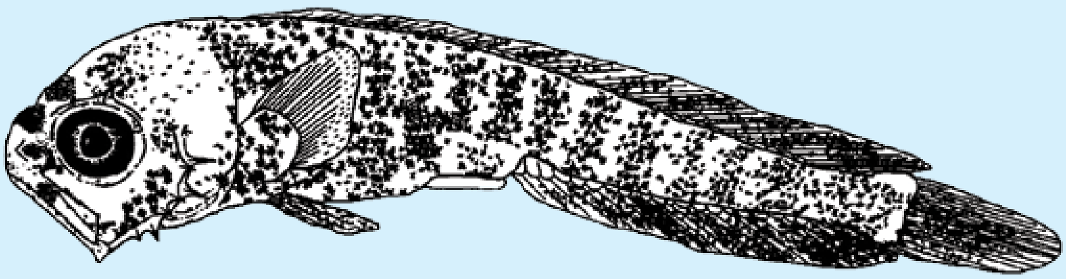


D. 5.0 mm SL



E. 7.1 mm SL

F. 9.5 mm SL



G. 11.0 mm SL

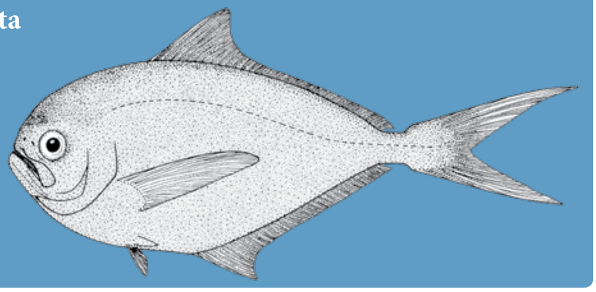
A–C: Mito (1960); **D–G:** Ditty *et al.* (1994)

BRAMIDAE *Brama brama* (Bonnaterre, 1788)

En: Atlantic pomfret – **Fr:** Grande castagnole – **Sp:** Japuta

Habitat: Pelagic, offshore

Spawning season: August and September



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.50–1.60 mm
Chorion: smooth
Oil globules: single, oval, 0.40 x 0.32 mm
Perivitelline space: reduced
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 4.8 mm

Distinctive characters: relatively large head, rounded gut and long tail

Pigmentation: head, yolk sac, pectoral and caudal fins pigmented; two prominent pigment patches in tail region, one dorsal and another ventral that extend on finfold

LARVAE Figs. C–G

Distinctive characters: body in early stages similar to that of yolk–sac larvae, although laterally compressed; during development, head and trunk, globose, increase in size and tail decreases in length; pectoral fins relatively large and rounded

Preanus length: about 30% SL in early larvae, increases with development

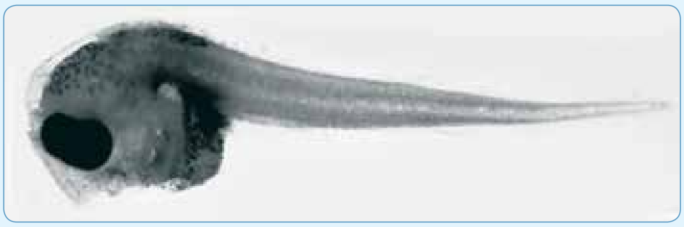
Pigmentation: head and gut heavily pigmented; tail region free of pigment; pectoral and caudal fins pigmented

Length at flexion: flexion completed at 4.9 mm

PHOTOS

by J.M. Rodriguez

3.3 mm SL

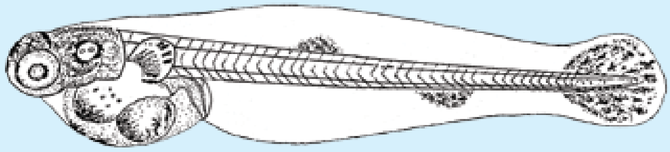


3.9 mm SL

Literature: Alemany (1997), Fahay (2007), Haedrich (1986), Padoa (1956d), Sabatés (1988), Schmidt (1918)

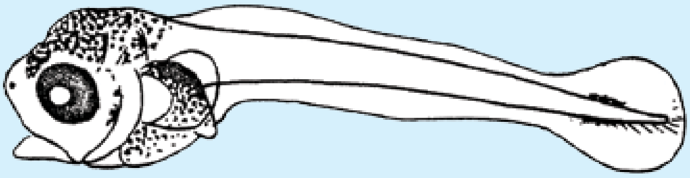
BRAMIDAE — ***Brama brama*** (Bonnaterre, 1788)

A.

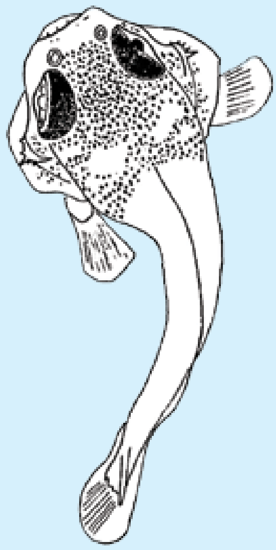


B. 4.8 mm

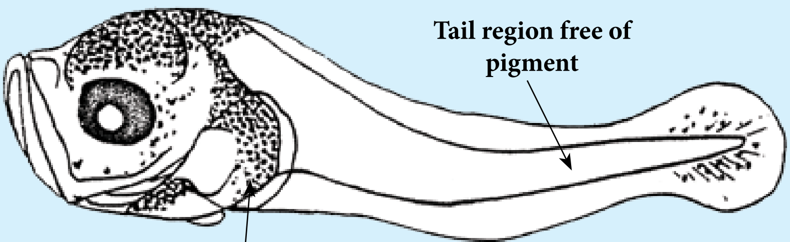
C. 3.0 mm SL



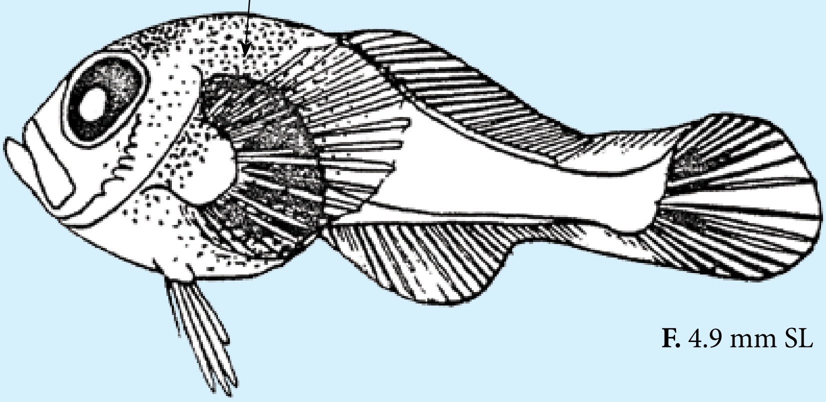
D. 3.0 mm SL



G. 5.5 mm
(dorsal view)



E. 3.3 mm SL



F. 4.9 mm SL

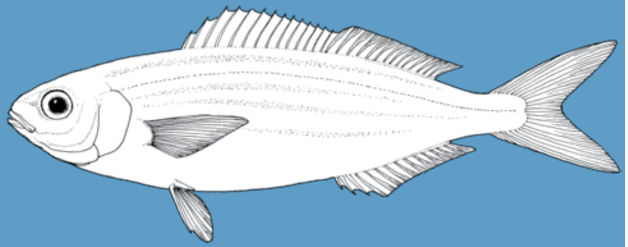
A, B: Padoa (1956d); **C–F:** Alemany (1997); **G:** Schmidt (1918)

SPARIDAE — *Boops boops* (Linnaeus, 1758)

En: Bogue – **Fr:** Bogue – **Sp:** Boga

Habitat: Benthic, down to 200 m, occasionally to 350 m depth

Spawning season: April and May



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.89 mm
Chorion: smooth
Oil globules: single, 0.2 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: less than 2 mm
Distinctive characters: body elongate, anus does not reach finfold edge; oil globule pigmented
Pigmentation: opposing dorsal and ventral bars of pigment at about mid–tail region; a series of postanal, ventral melanophores and one or two under urostyle

LARVAE — Figs. C–G

Distinctive characters: body elongate with a prominent swimbladder; two series of preopercular spines in older larvae
Preanus length: about 40% SL
Pigmentation: young larvae, same as yolk–sac larvae; in older larvae, postanal ventral bar of melanophores disappears; peritoneum pigmented; a single melanophore under hindgut; melanophores under gut and on head
Length at flexion: completed at 7.6 mm SL

PHOTOS

by J.M. Rodriguez

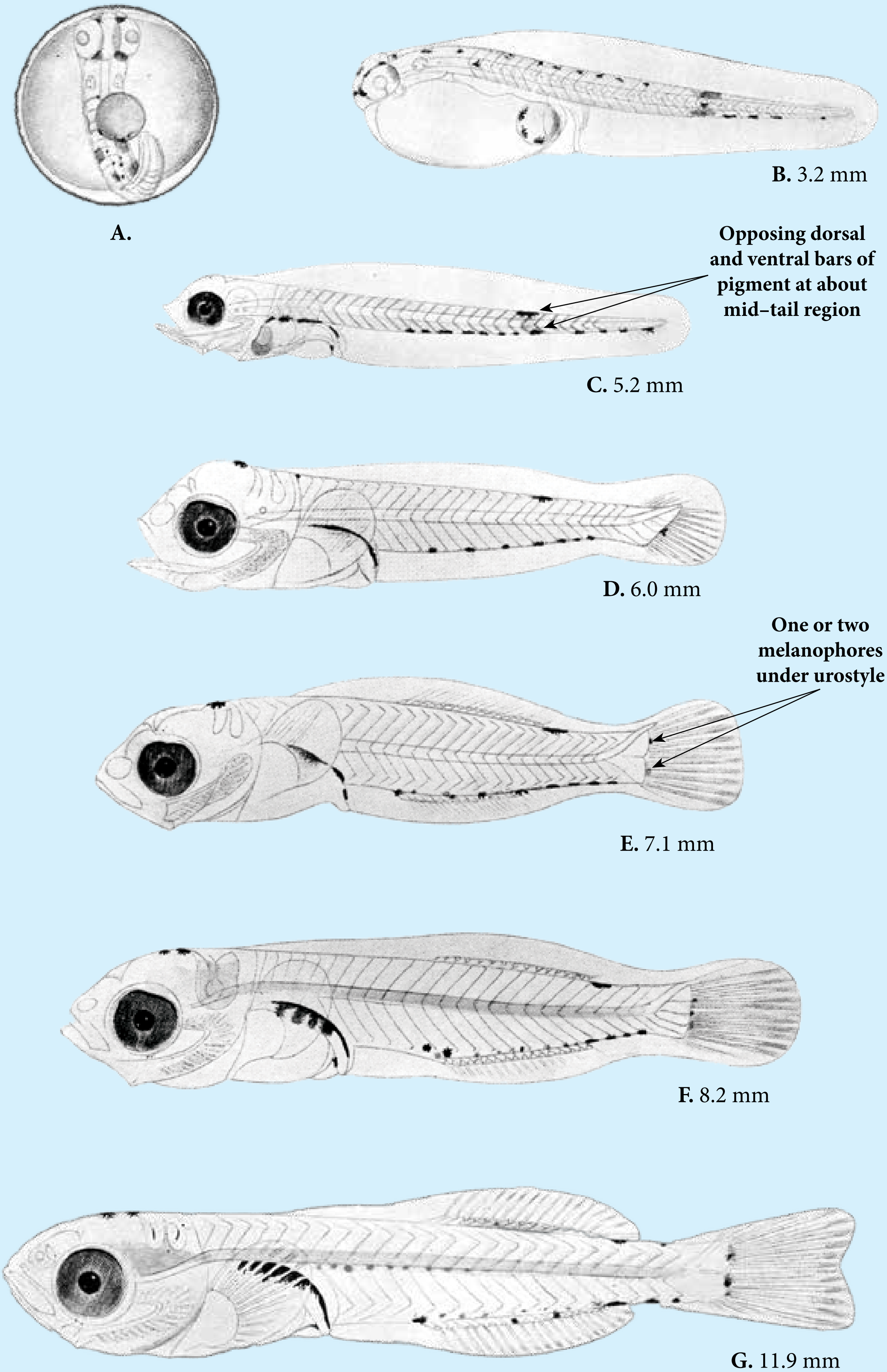
3.1 mm SL

6.1 mm SL

8.1 mm SL

Literature: Alemany (1997), Bauchot and Hureau (1986), De Gaetani (1937), Ranzi (1933), Sabatés (1988)

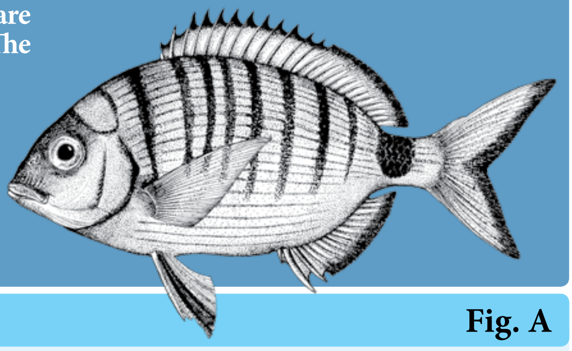
SPARIDAE — ***Boops boops*** (Linnaeus, 1758)



A–G: De Gaetani (1937)

SPARIDAE — *Diplodus sargus* (Linnaeus, 1758)

The genus *Diplodus* includes several species whose larvae are very similar, mainly during the first stages of development. The only species for which these stages are described is *D. sargus*.



En: White seabream – Fr: Sar commun – Sp: Sargo

Habitat: Benthic, down to 50 m depth

Spawning season: Between March and June

EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: about 0.90 mm
Chorion: smooth
Oil globules: single, about 0.2 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Figs. B, C

Hatch size: about 2.5 mm
Distinctive characters: body elongate, anus reaches finfold edge
Pigmentation: scattered melanophores over dorsum, no ventral melanophores; with development, dorsal melanophores disappear and ventral melanophores appear; oil globule pigmented

LARVAE — Figs. D–G

Distinctive characters: body elongate (the most among the species belonging to this genus); older larvae with two series of preopercular spines
Preanus length: about 30% SL in young larvae, increases with development
Pigmentation: postanal ventral row of melanophores; peritoneum, ventral region of gut, occipital and shoulder regions, pigmented
Length at flexion: about 5.6 mm

PHOTOS

by J.M. Rodriguez

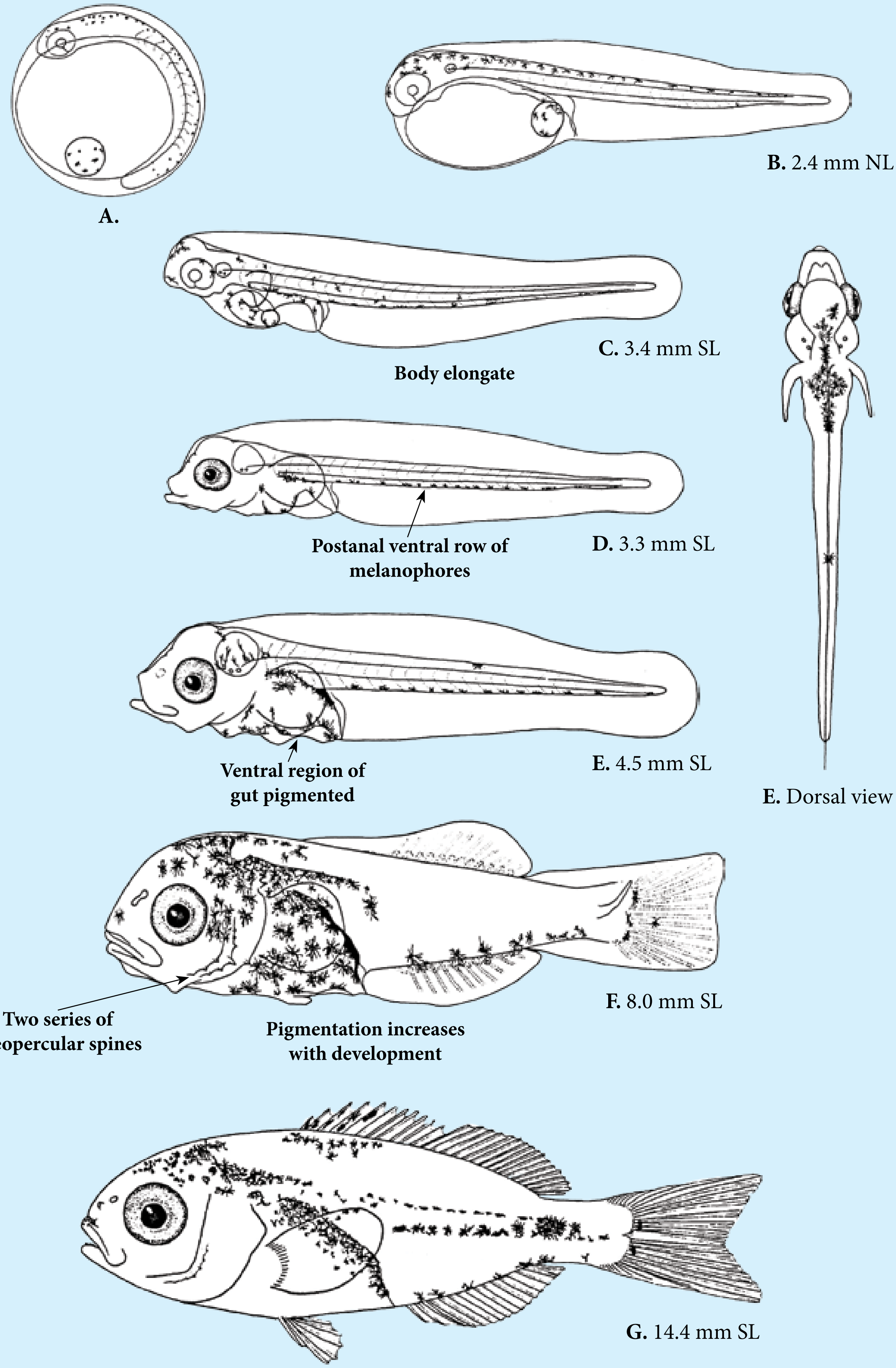
Diplodus sp.
4.5 mm SL

Diplodus sp.
5.4 mm SL

Literature: Alemany (1997), Bauchot and Hureau (1986), Brownell (1979), Sabatés (1988)

SPARIDAE

Diplodus sargus (Linnaeus, 1758)



A–G: Brownell (1979)

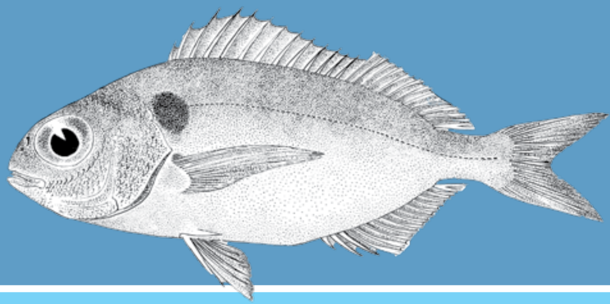
SPARIDAE *Pagellus bogaraveo* (Brünnich, 1768)

En: Blackspot(=red) seabream – **Fr:** Dorade rose

Sp: Besugo

Habitat: Benthic, down to 400 m depth

Spawning season: All year round, with a peak between January and May



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: about 1.2 mm
Chorion: smooth with a double capsule
Oil globules: single, about 0.28 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 3.8 mm

Distinctive characters: body elongate; anus reaches finfold edge; oil globule pigmented, situated at posterior edge of yolk sac

Pigmentation: dorsal melanophores between head and mid–trunk; two opposing groups of melanophores at posterior tail region

LARVAE Figs. C–G

Distinctive characters: body relatively elongate

Preanus length: about one third of SL, increases with development

Pigmentation: some occipital melanophores; peritoneum pigmented; at least two dorsal melanophores on tail; pre– and postanal melanophores on ventral side of body

Length at flexion: about 6.0 mm

PHOTOS

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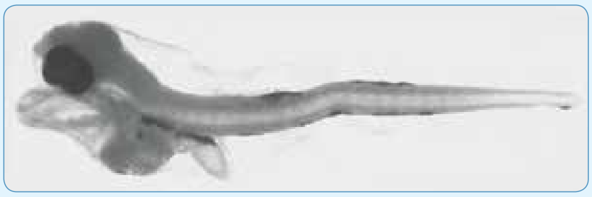


2.0 mm SL

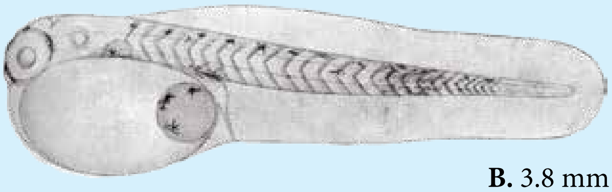
3.5 mm SL

6.2 mm SL

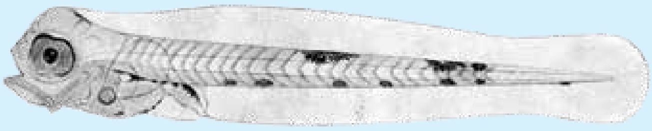
Literature: Alemany (1997), Bauchot and Hureau (1986), De Gaetani (1934)

SPARIDAE *Pagellus bogaraveo* (Brünnich, 1768)

A.

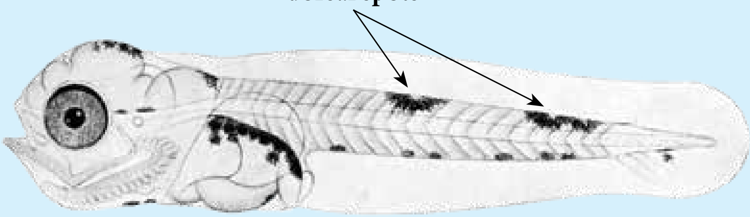


B. 3.8 mm

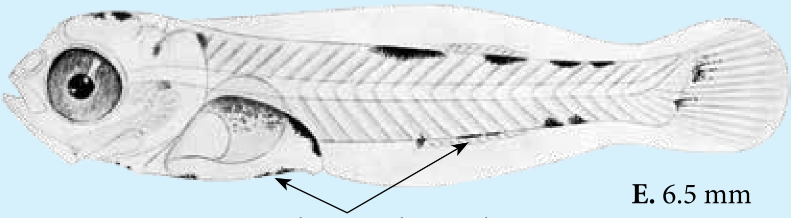


C. 3.5 mm

At least two postanal dorsal spots



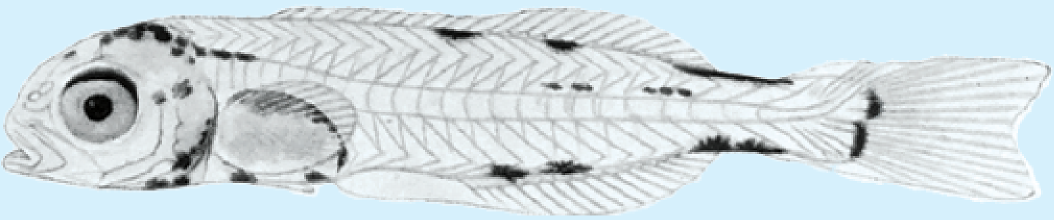
D. 6.0 mm



E. 6.5 mm

Pre– and postanal ventral melanophores

F. 7.7 mm



G. 13.0 mm

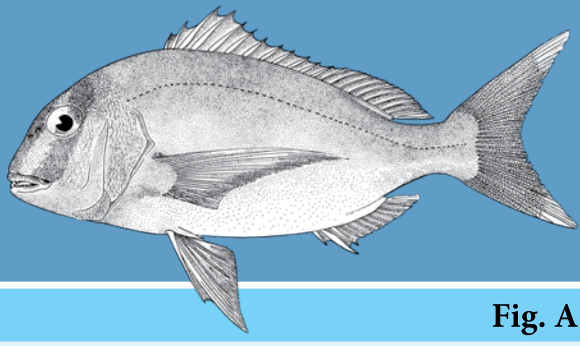
A–F: De Gaetani (1934); **G:** Ranzi (1933)

SPARIDAE *Pagrus pagrus* (Linnaeus, 1758)

En: Red porgy – **Fr:** Pagre rouge – **Sp:** Pargo

Habitat: Benthic, over sandy and rocky bottoms, down to 200 m depth

Spawning season: April to June



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.89–0.93 mm
Chorion: smooth
Oil globules: single, 0.18–0.20 mm in diameter
Perivitelline space: narrow
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: between 1.92 and 3.04 mm NL
Distinctive characters: body relatively elongate; anus does not reach finfold border; oil globule situated at posterior end of yolk sac
Pigmentation: melanophores along dorsal and ventral midlines of body; oil globule pigmented

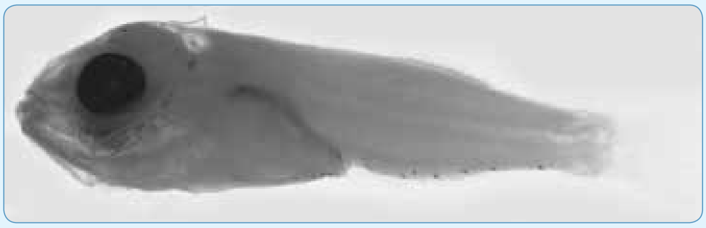
LARVAE Figs. C–F

Distinctive characters: body, head and trunk quite high; an occipital crest from young larvae on (specific character of this Sparidae species); preopercular spines well developed; older larvae show a supraorbital spinous arch
Preanus length: less than 50% SL
Pigmentation: scantily pigmented; peritoneum pigmented; about 6 postanal, ventral melanophores; a melanophore on head and another on hindgut
Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

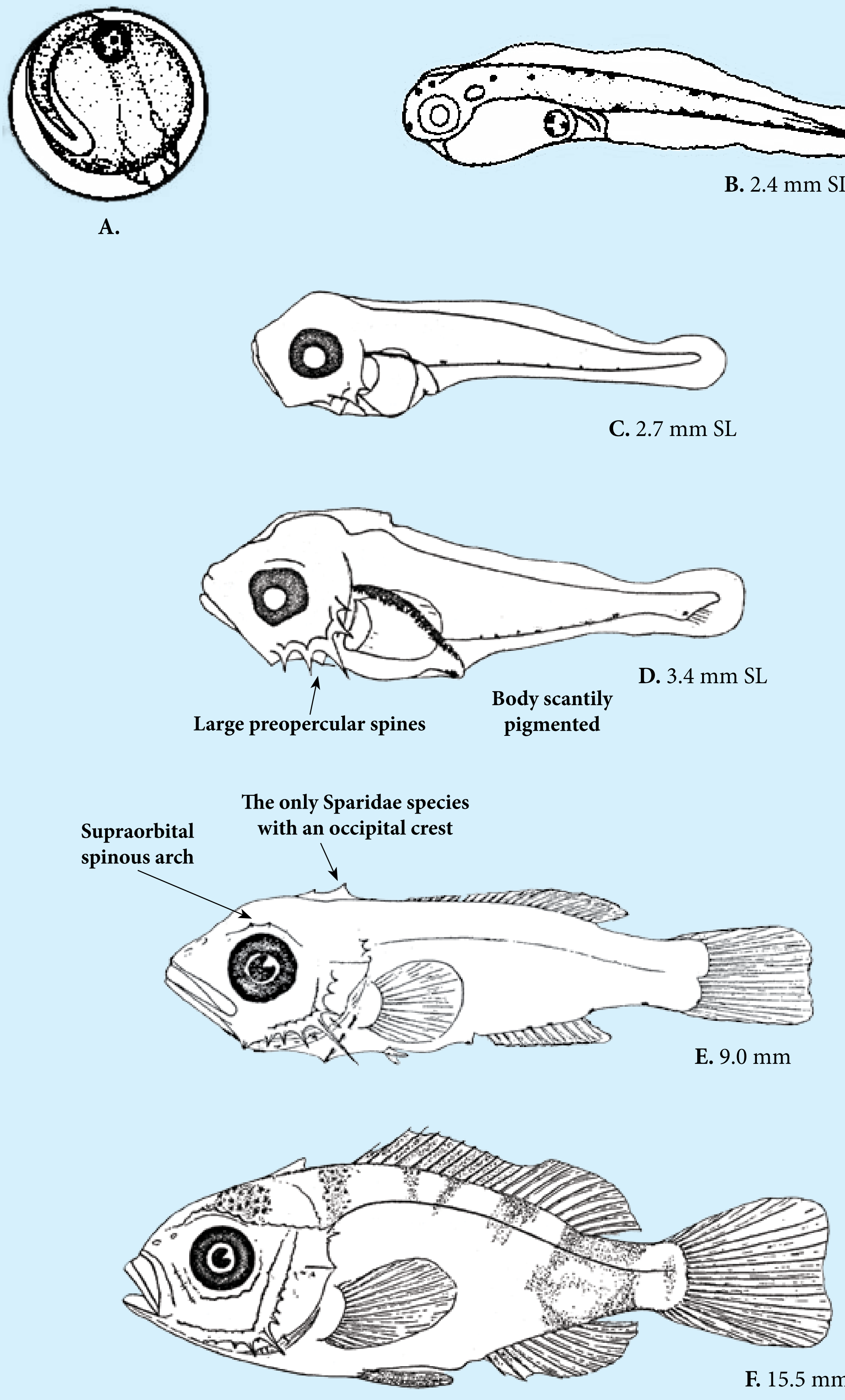
2.9 mm SL



7.0 mm SL

Literature: Alemany (1997), Bauchot and Hureau (1986), Machinandiarena *et al.* (2003), Ranzi (1933)

SPARIDAE — ***Pagrus pagrus*** (Linnaeus, 1758)



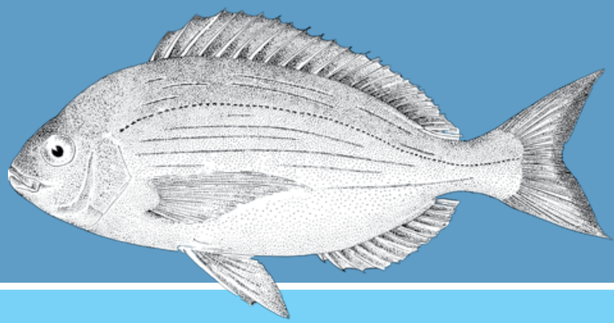
A, B: Machinandiarena *et al.* (2003); **C, D:** Alemany (1997); **E, F:** Fage (1918)

SPARIDAE *Spondyliosoma cantharus* (Linnaeus, 1758)

En: Black seabream – **Fr:** Dorade grise – **Sp:** Chopa

Habitat: Benthic, on rocky or sandy bottoms and *Posidonia* beds, down to 50 m (young) and 300 m (adults) depth

Spawning season: Between February and May



EGGS

Habitat: demersal
Shape: spherical
Diameter: 1.0–1.2 mm
Chorion: smooth
Oil globules: single, 0.20–0.25 mm in diameter
Perivitelline space: moderate
Yolk: unsegmented

YOLK–SAC LARVAE Figs. A, B

Hatch size: about 2.2 mm
Distinctive characters: oil globule situated at posterior edge of yolk sac
Pigmentation: yolk sac strongly pigmented; oil globule pigmented; row of ventral melanophores from anus to about mid–postanal region in early yolk–sac larvae, reaches caudal region later; melanophores on head

LARVAE Figs. C–E

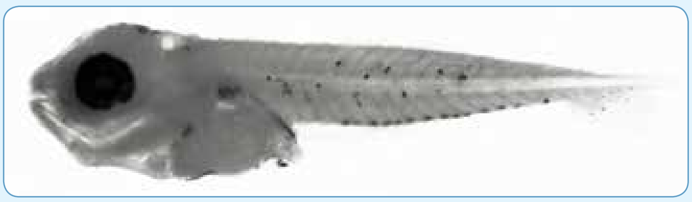
Distinctive characters: body relatively elongate and slender, becoming more robust with development; small preopercular spines appearing at about 5.0 mm SL
Preanus length: about 50% SL until after flexion
Pigmentation: early stages similar to yolk–sac larvae; melanophores extend to lateral sides in early larvae and posteriorly to dorsal sides of body; gut pigmented
Length at flexion: about 6.0 mm

PHOTOS

by J.M. Rodriguez

3.7 mm SL

4.8 mm SL



5.8 mm SL

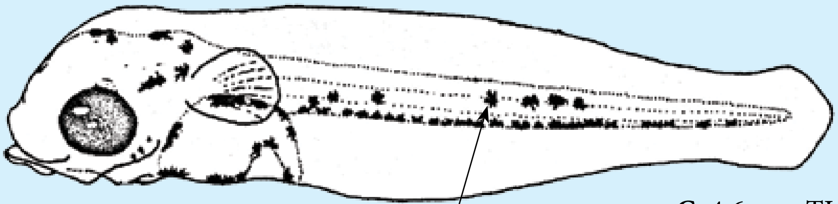
Literature: Bauchot and Hureau (1986), Camus and Besseau (1986), Fage (1918), Ranzi (1933), Russell (1976)

SPARIDAE — *Spondyliosoma cantharus* (Linnaeus, 1758)

A. 3.2 mm TL

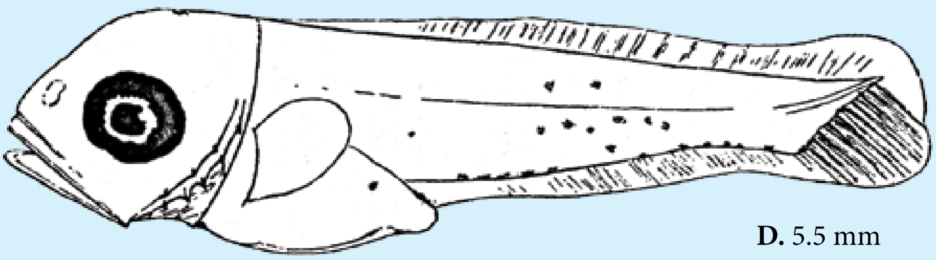
Yolk sac strongly pigmented

B. 3.9 mm TL

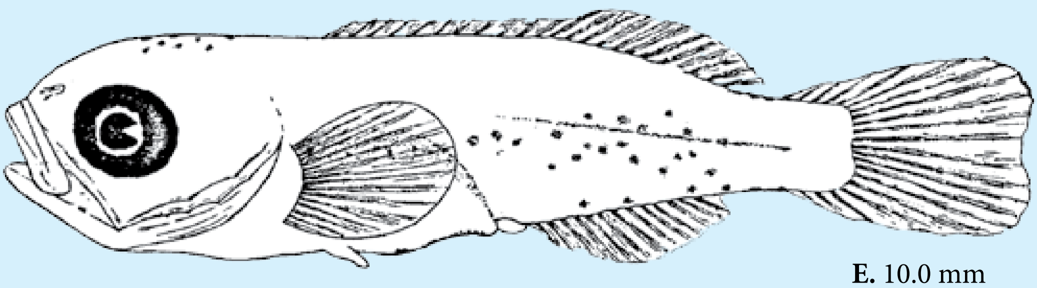


C. 4.6 mm TL

Melanophores on lateral sides of body from young stages on



D. 5.5 mm



E. 10.0 mm

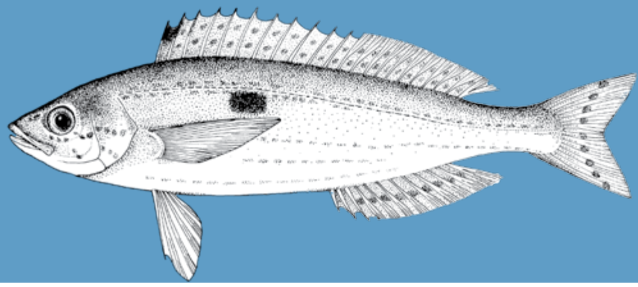
A–C: Camus and Besseau (1986); **D, E:** Fage (1918)

CENTRACANTHIDAE *Spicara smaris* (Linnaeus, 1758)

En: Picarel – **Fr:** Picarel – **Sp:** Caramel

Habitat: Benthic, on muddy and sandy bottoms, down to 130 m depth

Spawning season: Between February and May



EGGS Fig. A

Habitat: demersal, laid in nests excavated in detritic or sandy bottoms
Shape: assumes the form of a spherical cap
Size: about 0.89 mm in diameter by about 0.72 mm in height
Chorion: thick and resistant
Oil globules: single, 0.19–0.21 mm in diameter
Perivitelline space: no information
Yolk: transparent

YOLK–SAC LARVAE Fig. B

Hatch size: not known
Distinctive characters: body elongate; short preanus length; oil globule situated at center of yolk sac
Pigmentation: unpigmented

LARVAE Figs. C–G

Distinctive characters: body elongate and slender becoming more robust with development; small preopercular and opercular spines appear with development
Preanus length: increases with development from about 30% to more than 40% SL
Pigmentation: dotted occipital melanophore; two peritoneal pigment patches; about 15 postanal ventral melanophores; 1–3 dotted melanophores under urostyle that move to caudal–fin base in later larvae; two melanophores between dorsal and caudal fins in later larvae
Length at flexion: flexion almost completed at 6.5 mm SL

PHOTOS

by J.M. Rodriguez

3.4 mm SL

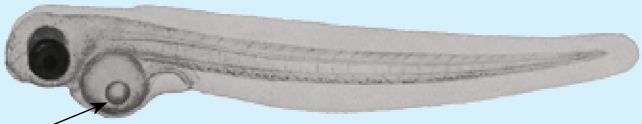
6.8 mm SL

Literature: Alemany (1997), Froese and Pauly (2016), Montalenti (1937b), Tortonese (1986b)

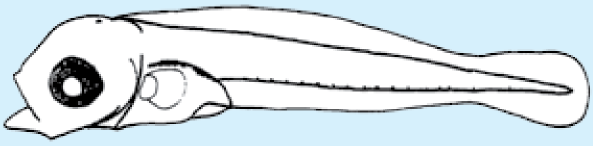
CENTRACANTHIDAE

Spicara smaris (Linnaeus, 1758)

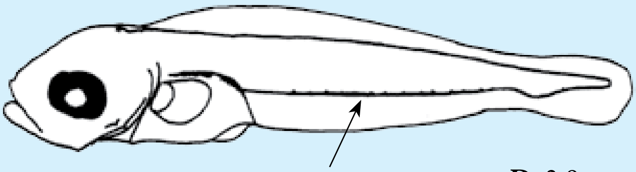
A.



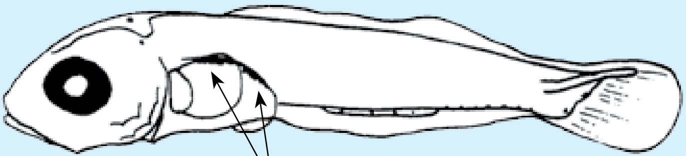
B. Not sized



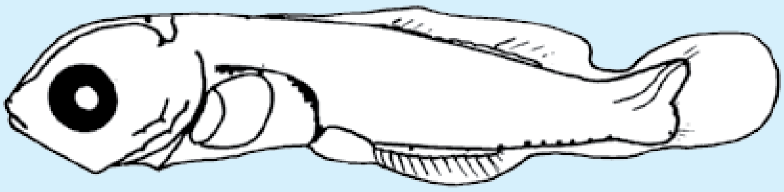
C. 3.3 mm SL



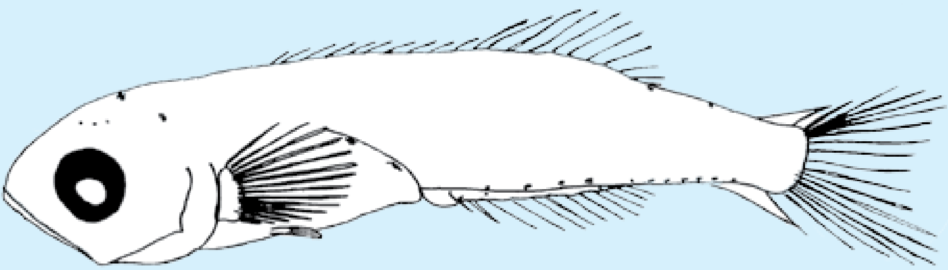
D. 3.9 mm SL



E. 5.3 mm SL



F. 6.5 mm SL

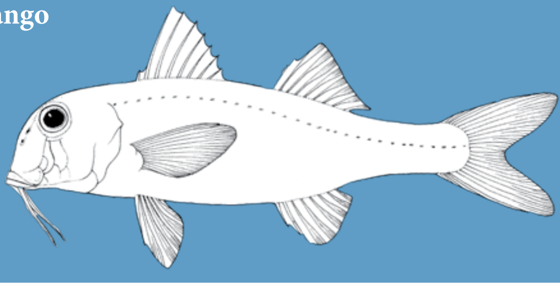


G. 8.3 mm SL

A, B: Montalenti (1937b); **C–G:** Alemany (1997)

MULLIDAE *Mullus barbatus* Linnaeus, 1758

En: Red mullet – **Fr:** Rouget de vase – **Sp:** Salmonete de fango



Habitat: Benthic, on muddy bottoms of the continental shelf, between 10 and 500 m depth

Spawning season: Between April and August

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body relatively elongate

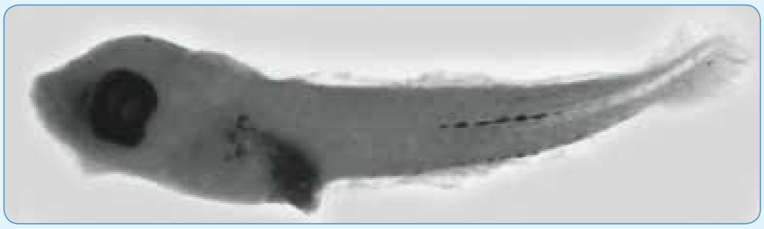
Preanus length: about 37% SL

Pigmentation: increases with development; early larvae show an occipital melanophore, peritoneum strongly pigmented, a row of postanal ventral melanophores, from anus to about two–thirds of tail region, a short series of mid–lateral melanophores and a single melanophore under urostyle; later larvae with several melanophores over head and on dorsal region of trunk: entire surface of gut, except its ventral side, pigmented

Length at flexion: flexion occurs between about 3.5 and 5.2 mm SL

PHOTOS

by J.M. Rodriguez



3.3 mm SL

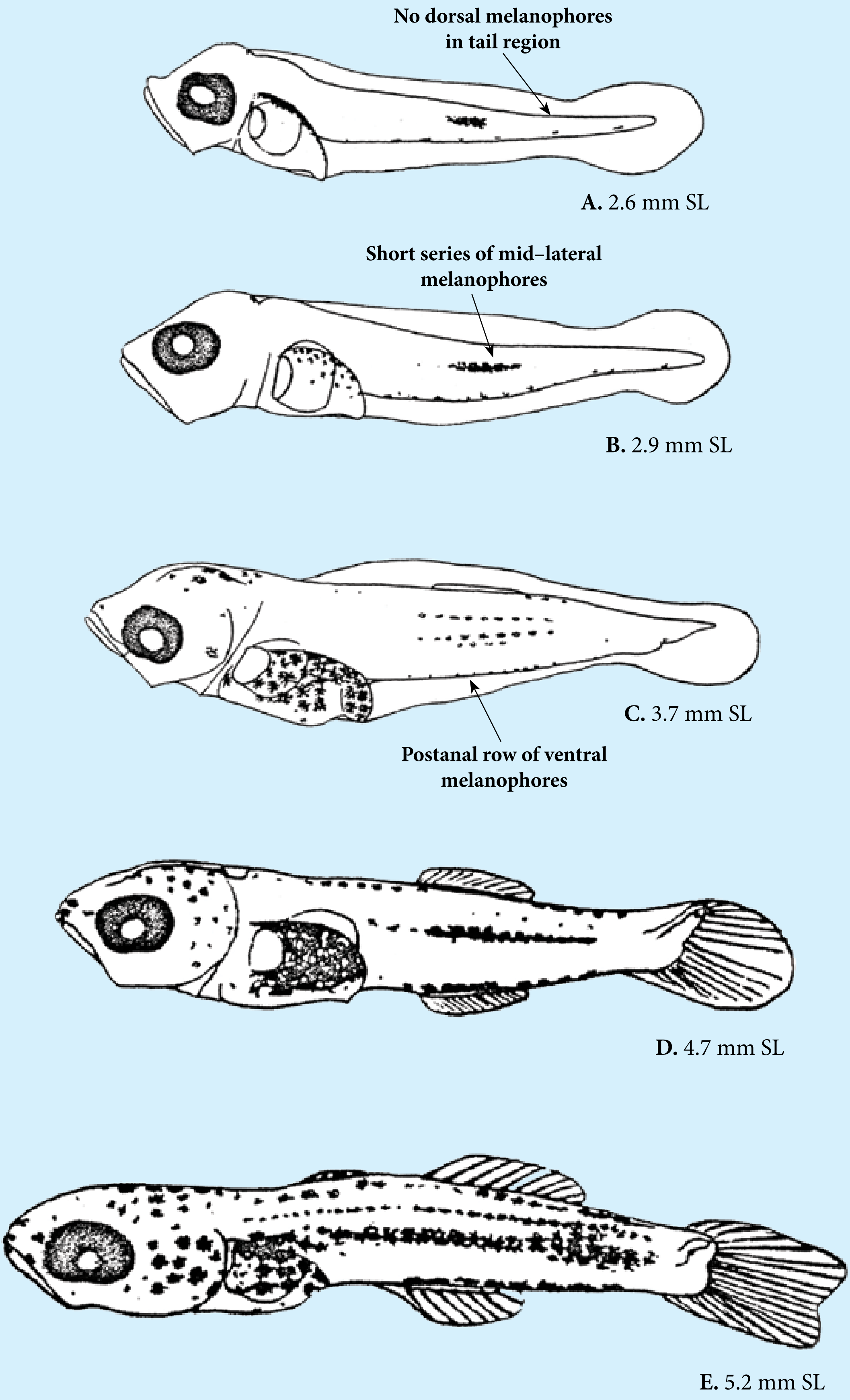
5.5 mm SL

8.3 mm SL

Literature: Alemany (1997), Hureau (1986a), Montalenti (1937a), Sabatés (1988)

MULLIDAE

Mullus barbatus **Linnaeus, 1758**



A–E: Alemany (1997)

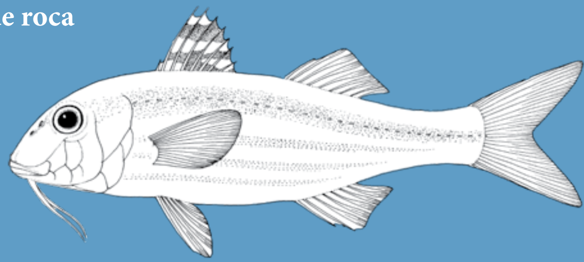
MULLIDAE

Mullus surmuletus Linnaeus, 1758

En: Surmullet – **Fr:** Rouget de roche – **Sp:** Salmonete de roca

Habitat: Benthic, over rocky bottoms, down to 400 m depth

Spawning season: Between May and July



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.81–0.91 mm
Chorion: smooth
Oil globules: single, 0.23–0.25 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

Hatch size: about 2.83 mm
Distinctive characters: yolk sac projected beyond snout; oil globule located at anterior edge of yolk sac; anus situated close behind to posterior edge of yolk sac
Pigmentation: melanophores scattered over body; oil globule strongly pigmented

LARVAE — Figs. C–F

Distinctive characters: body relatively elongate
Preanus length: about 30% SL
Pigmentation: at about 4.0 mm SL shows a ventral row of 10–12 postanal melanophores extending from anus to about two–thirds of tail region; 2 or 3 melanophores over and below urostyle; mid–lateral line of melanophores; peritoneum pigmented; later larvae develop dorsal and dorsolateral rows of melanophores
Length at flexion: it occurs between less than 4.0 and 7.6 mm SL

PHOTOS

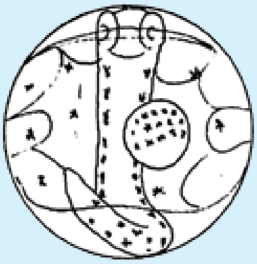
by J.M. Rodriguez

2.8 mm SL

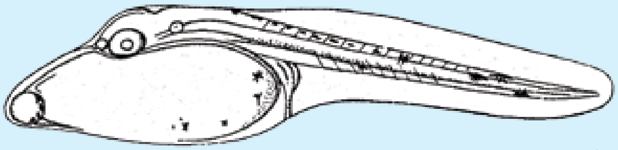
5.4 mm SL

Literature: Alemany (1997), Hureau (1986a), Montalenti (1937a), Russell (1976)

MULLIDAE *Mullus surmuletus* Linnaeus, 1758

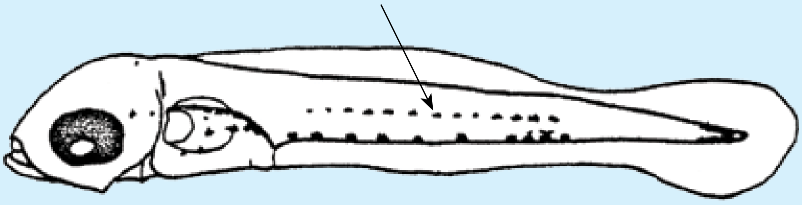


A.

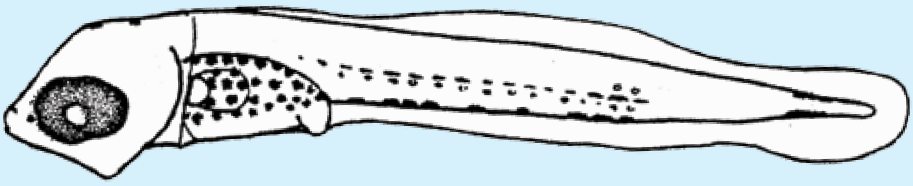


B. Not sized

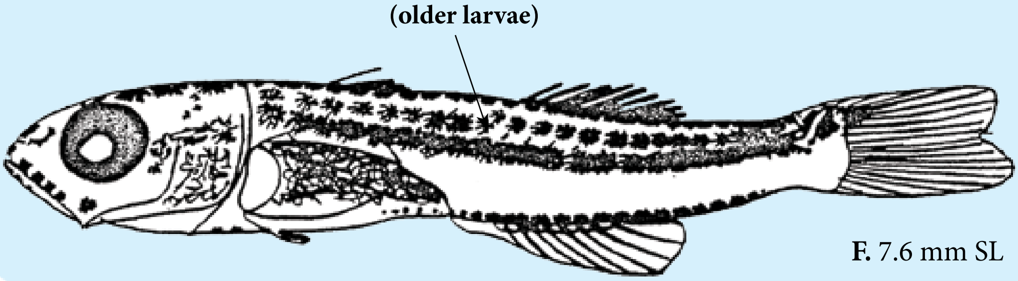
C. 2.3 mm SL



D. 3.1 mm SL



E. 3.6 mm SL



F. 7.6 mm SL

A, B: Montalenti (1937a); **C–F:** Alemany (1997)

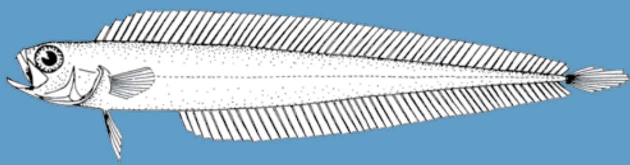
CEPOLIDAE

Cepola macrophthalma (Linnaeus, 1758)

En: Cardinal fish – **Fr:** Coq – **Sp:** Salmonete real

Habitat: Benthic, down to 320 m depth

Spawning season: Spring to autumn



EGGS

Habitat: pelagic
Shape: quasi spherical
Diameter: 0.77 mm
Chorion: with filaments
Oil globules: single, 0.23 mm in diameter
Yolk: segmented

YOLK–SAC LARVAE

Undescribed

LARVAE — Figs. A–D

Distinctive characters: body relatively short and high; a series of preopercular spines in larvae more than 2.4 mm SL; at 6.5 mm, larvae have a long preopercular spine, 3 shorter opercular spines and a small supraorbital crest; swimbladder apparent

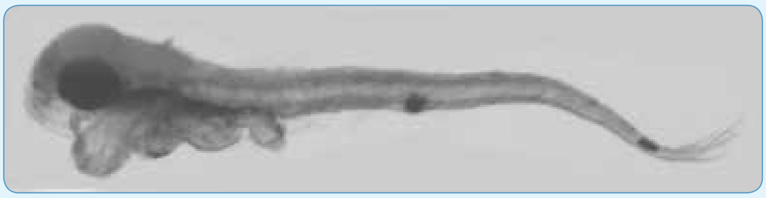
Preanus length: 50% SL

Pigmentation: ventral side of trunk pigmented, from pectoral–fin base to mid–tail region; group of dorsal melanophores in caudal region; two melanophores over head and some melanophores under gut; pigmentation diminishes with development

Length at flexion: flexion begins at 3.0 mm SL

PHOTOS

by J.M. Rodriguez

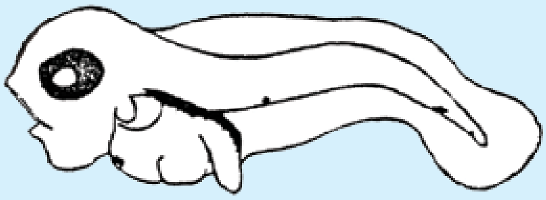


2.0 mm SL

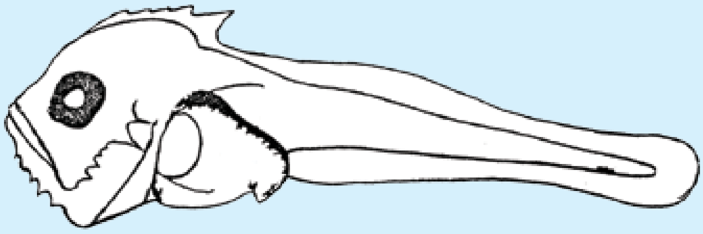
3.5 mm SL

Literature: Alemany (1997), Russell (1976), Tortonese (1986c)

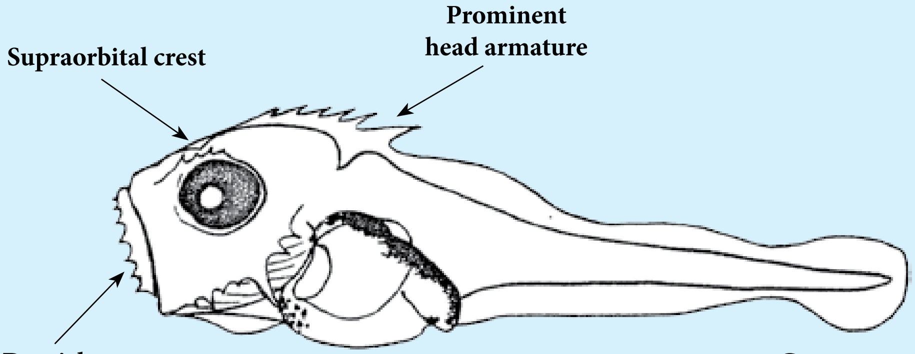
CEPOLIDAE *Cepola macrophthalma* (Linnaeus, 1758)



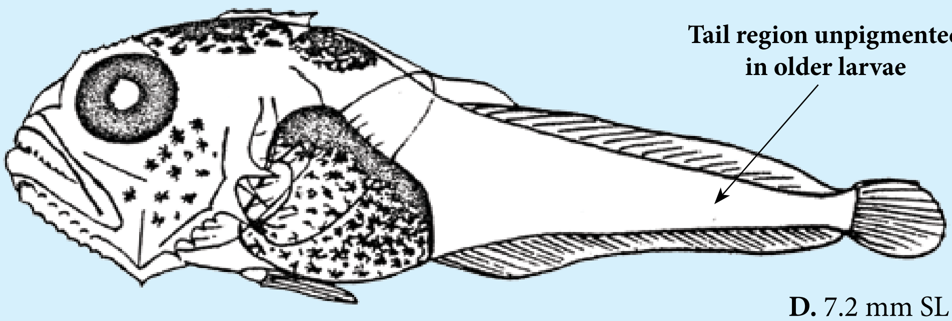
A. 1.7 mm SL



B. 3.0 mm



C. 3.9 mm



D. 7.2 mm SL

A–D: Alemany (1997)

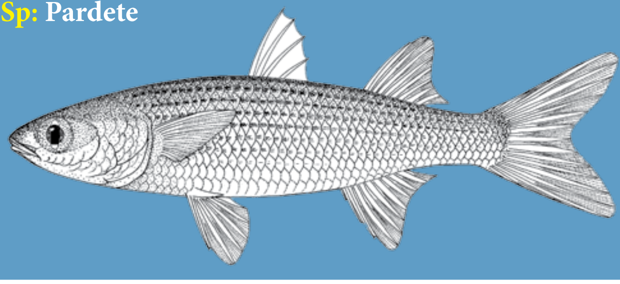
MUGILIDAE

Mugil cephalus Linnaeus, 1758

En: **Flathead grey mullet** – **Fr:** **Mulet à grosse tête** – **Sp:** **Pardete**

Habitat: Pelagic, inshore, entering lagoons and estuaries

Spawning season: Between July and October



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.72 mm
Chorion: smooth, fine raised striations
Oil globules: single, 0.28 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: about 2.5 mm

Pigmentation: heavily pigmented, except caudal region; a dorsal and another ventral row of about 4 dotted melanophores each at caudal region; oil globule strongly pigmented

LARVAE — Fig. C–F

Distinctive characters: body relatively stubby with a large, bulky gut, moderate head and small mouth; no swimbladder

Preanus length: up to 70% SL

Pigmentation: strongly pigmented, except lateral sides of head and caudal region where dotted melanophores persist; pigment is heaviest on dorsum, dorsal surface of gut and on postanal ventral region; apparent mid–lateral row of melanophores

Length at flexion: 4.0–5.0 mm SL

PHOTOS

by J.M. Rodriguez

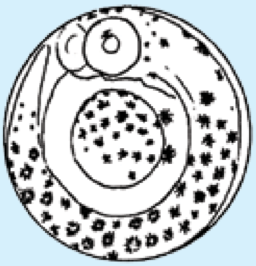
2.4 mm SL

2.5 mm SL

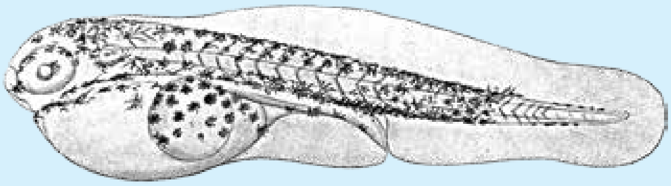
7.5 mm SL

Literature: Alemany (1997), Ben–Tuvia (1986), Fahay (1983), Froese and Pauly (2016), Sanzo (1936)

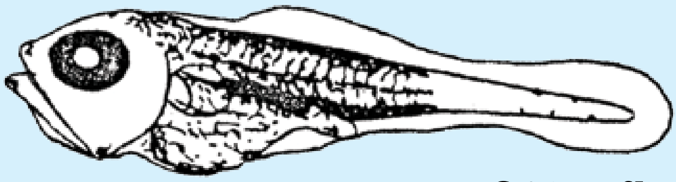
MUGILIDAE *Mugil cephalus* Linnaeus, 1758



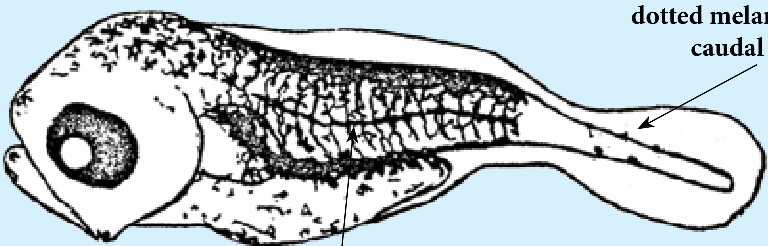
A.



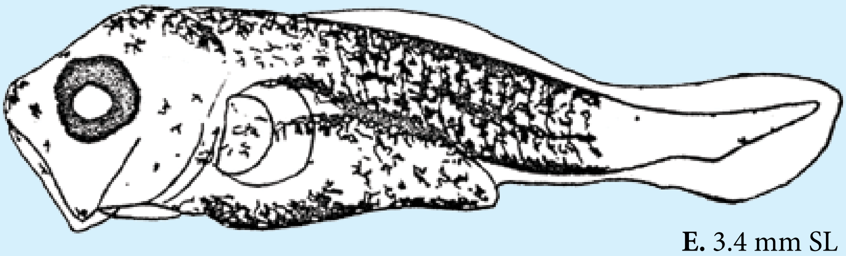
B. ca. 2.5 mm



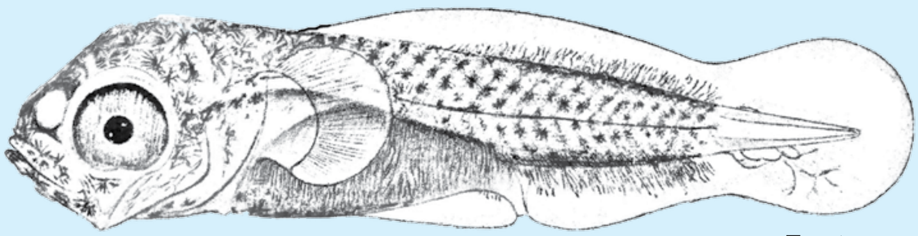
C. 2.1 mm SL



D. 2.3 mm SL



E. 3.4 mm SL



F. 5.1 mm

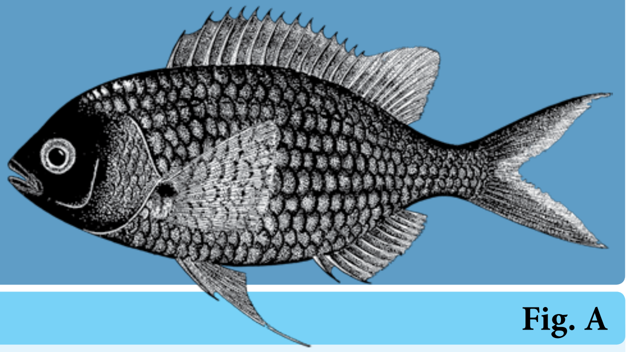
A, B, F: Sanzo (1936); **C–E:** Alemany (1997)

POMACENTRIDAE *Chromis chromis* (Linnaeus, 1758)

En: Damselfish

Habitat: Littoral, mainly in rocky areas, between 3 and 35 m depth

Spawning season: Between May and August



EGGS Fig. A

Habitat: demersal

Shape: ovoid, attached to substrate with filaments

Size: 0.85–0.90 x 0.70–0.72 mm

Oil globules: single, 0.20 mm in diameter

Perivitelline space: small

Yolk: segmented

YOLK–SAC LARVAE Fig. B

Hatch size: 2.6 mm SL

Distinctive characters: body relatively slender; oil globule situated ventrally in yolk sac

Preanus length: about 33% SL

Pigmentation: yolk sac pigmented; row of postanal ventral melanophores; occipital melanophores; melanophores dorsal and ventral to urostyle

LARVAE Fig. C–F

Distinctive characters: body of early larvae similar to that of yolk–sac larvae, becoming short and robust with development; gut triangular–shaped

Preanus length: slightly less than 50% SL

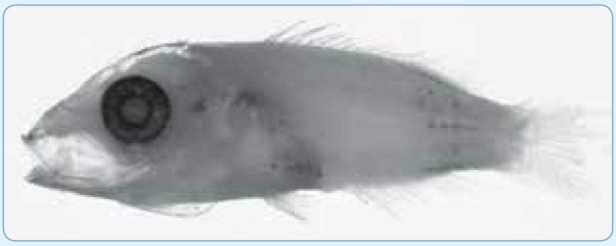
Pigmentation: similar to yolk–sac larvae in earlier larvae; with development, postanal pigmentation reduces to a transversal band located around mid–tail region; posteriorly, melanophores appear on mid–lateral line and on dorsum, at same level of ventral group; peritoneum pigmented; melanophores on head

Length at flexion: begins at 3.60 mm and is completed at 4.75 mm SL

PHOTOS

by J.M. Rodriguez

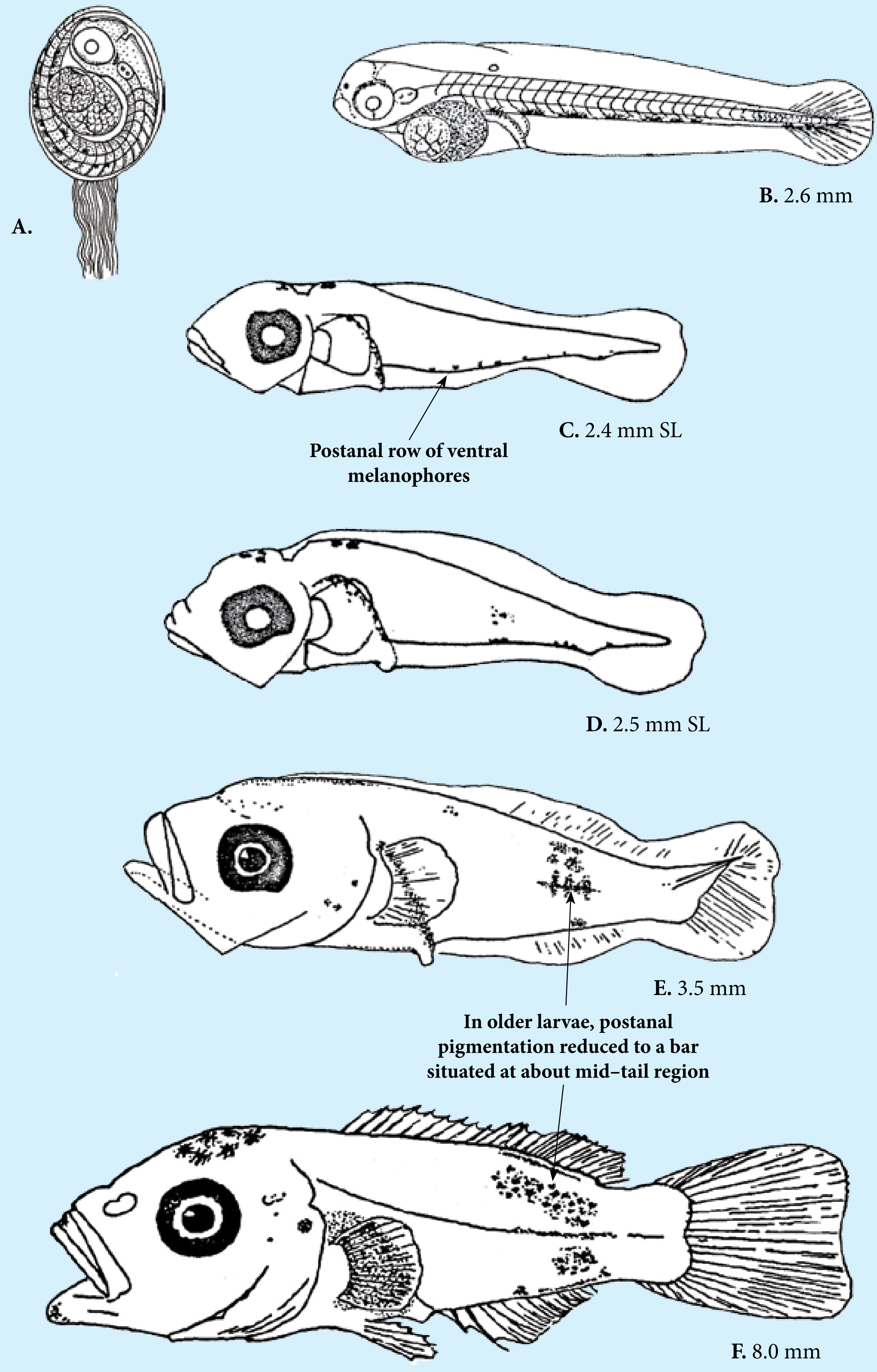
1.9 mm SL



7.1 mm SL

Literature: Alemany (1997), Fage (1918), Froese and Pauly (2016), Padoa (1956k), Quignard and Pras (1986b)

POMACENTRIDAE — ***Chromis chromis*** (Linnaeus, 1758)



A, B: Padoa (1956k); **C, D:** Alemany (1997); **E, F:** Fage (1918)

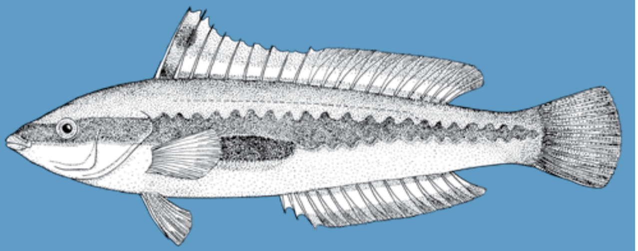
LABRIDAE

Coris julis (Linnaeus, 1758)

En: Rainbow wrasse – **Fr:** Girelle – **Sp:** Julia

Habitat: Benthic, littoral, over rocky bottoms or eelgrass beds, down to 120 m depth

Spawning season: Between April and August



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.60–0.67 mm
Chorion: smooth
Oil globules: single, 0.12–0.16 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 2.2 mm
Distinctive characters: oil globule situated at anterior edge of yolk sac
Pigmentation: several dorsal melanophores decrease in number to 2 and migrate to finfold with development; row of ventral melanophores along ventral side of trunk and tail, ending in a large melanophore

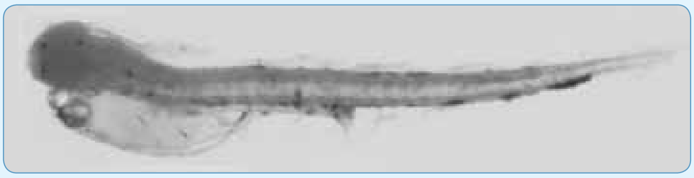
LARVAE

Figs. C–G

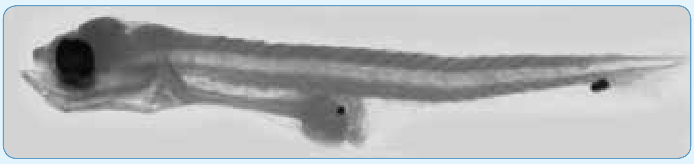
Distinctive characters: body elongate; gut with a prominent loop
Preanus length: about 50% SL
Pigmentation: in young larvae, 2 dorsal melanophores on finfold which, in older larvae, remain on dorsal fin; two large ventral melanophores, one over gut, close to gut loop and another in caudal region
Length at flexion: completed at 9.8 mm

PHOTOS

by J.M. Rodriguez



2.2 mm SL

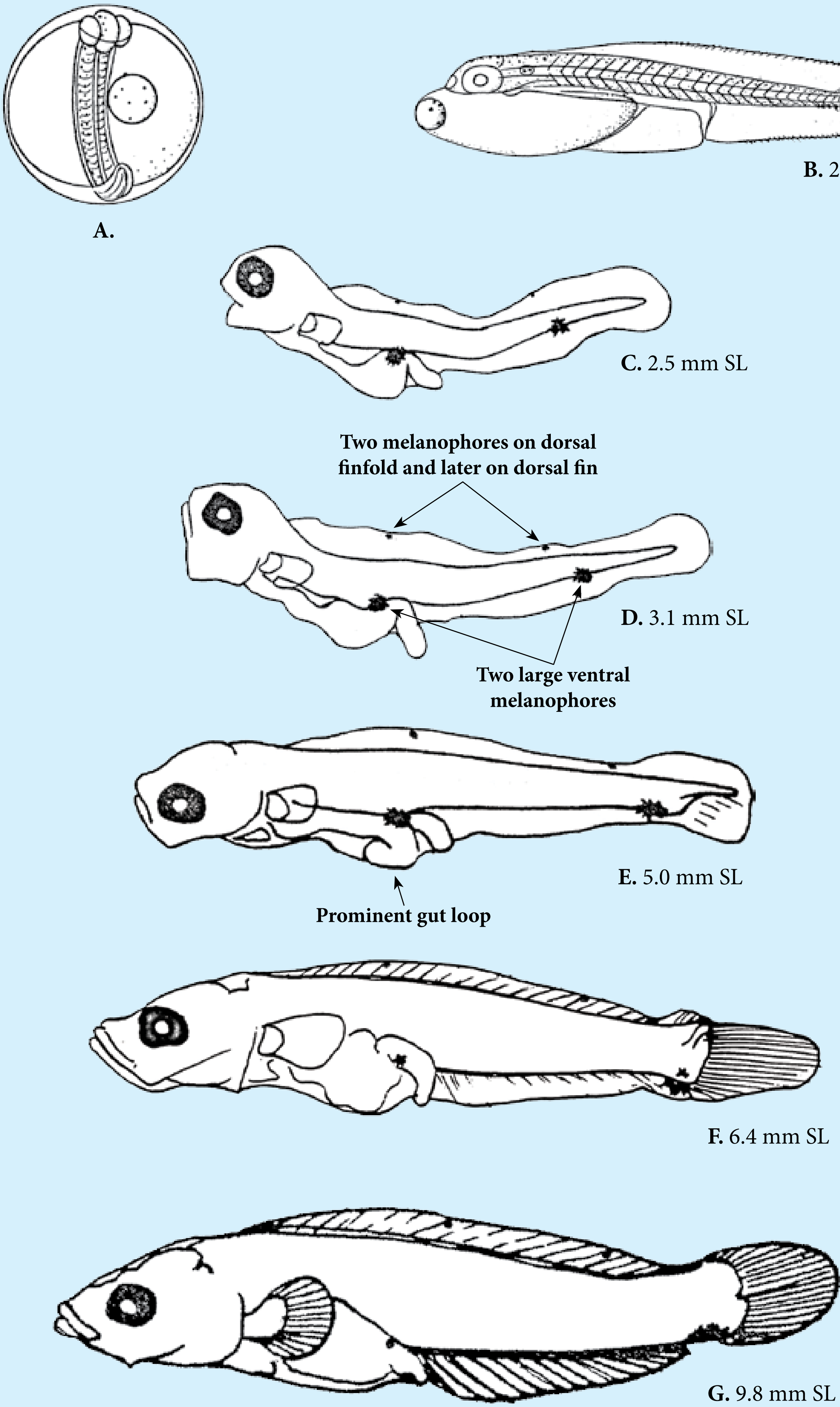


2.7 mm SL

5.6 mm SL

Literature: Alemany (1997), Quignard and Pras (1986a), Sabatés (1988)

LABRIDAE — ***Coris julis*** (Linnaeus, 1758)



A, B: Sparta (1956a); **C–G:** Alemany (1997)

LABRIDAE *Ctenolabrus rupestris* (Linnaeus, 1758)

En: Goldsinny–wrasse – **Fr:** Rouquié – **Sp:** Tabernero

Habitat: Benthic, on rocky, weed–covered shores, from 1 to 50 m depth

Spawning season: Between January and July

EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.72–1.01 mm
Chorion: smooth
Oil globules: none
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: 1.95–2.19 mm SL

Distinctive characters: anus located some distance behind yolk sac

Pigmentation: in newly hatched larvae, melanophores scattered over most of the body; during yolk–sac larval development, all melanophores from dorsal side of body disappear, while on ventral side, only 4 melanophores remain: over gut, hindgut, mid–tail and caudal region

LARVAE Figs. C–H

Distinctive characters: body relatively elongate and slender, becoming more robust with development

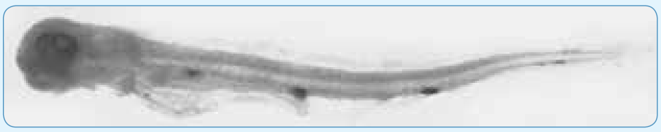
Preanus length: about 50% SL

Pigmentation: similar to yolk–sac larvae in earlier larvae; later, two melanophores appear under gut increasing in number with development; peritoneal pigment also develops

Length at flexion: at less than 4.82 mm SL

PHOTOS

by J.M. Rodriguez



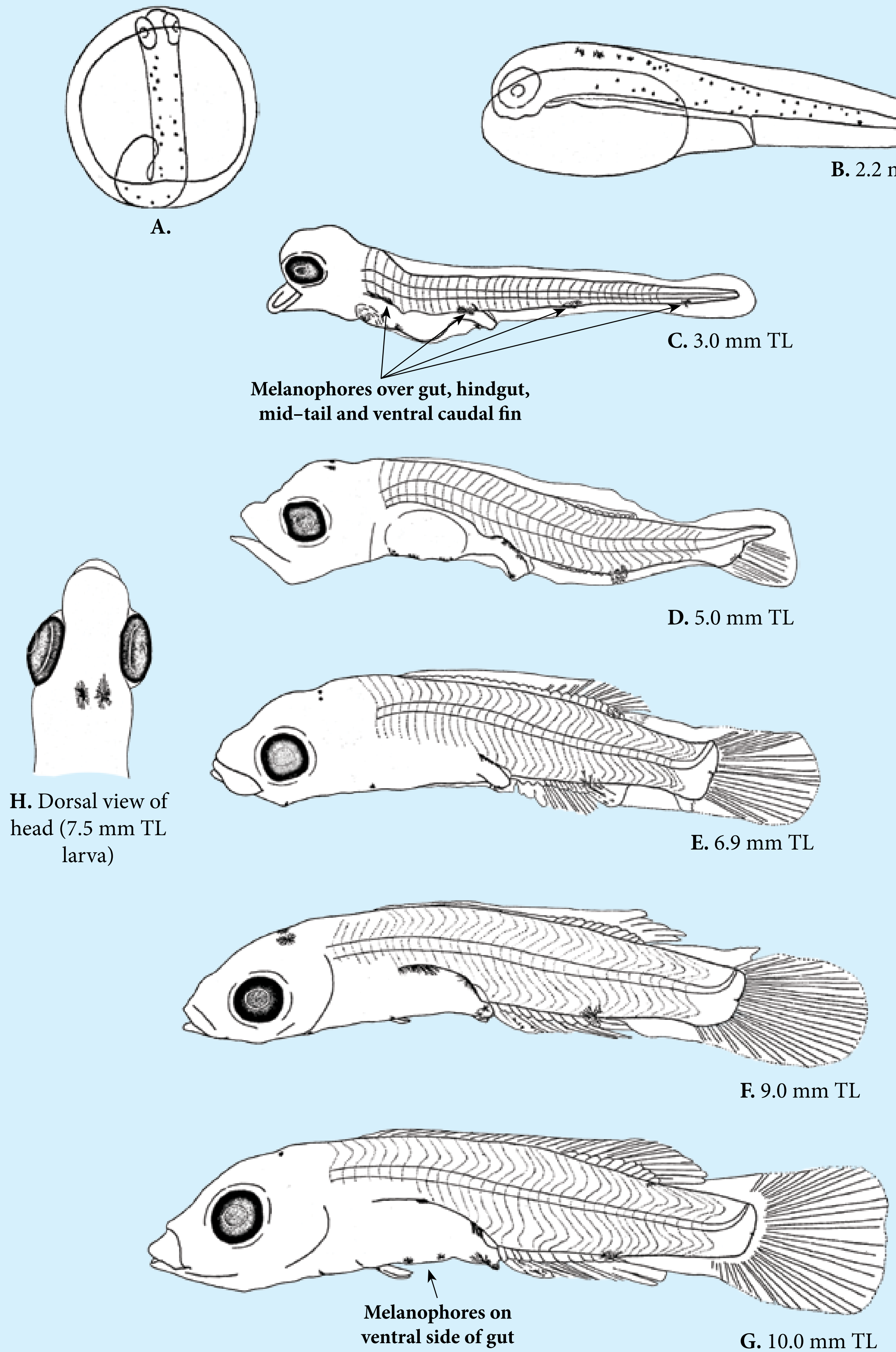
2.6 mm SL

4.4 mm SL

7.1 mm SL

Literature: Fives (1976), Quignard and Pras (1986a), Russell (1976), Sabatés (1988), Sparta (1956a)

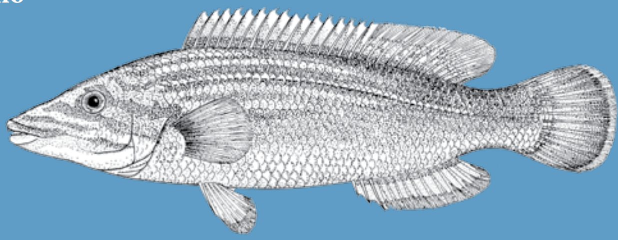
LABRIDAE *Ctenolabrus rupestris* (Linnaeus, 1758)



A, B: Sparta (1956a); **C–H:** Fives (1976)

LABRIDAE *Labrus mixtus* Linnaeus, 1758

En: Cuckoo wrasse – **Fr:** Vieille coquette – **Sp:** Gallano



Habitat: Benthic, on algal zones of rocky, weed-covered shores, from 2 to 200 m depth

Spawning season: Between March and June

EGGS

Undescribed

YOLK-SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body relatively elongate and slender, becoming more robust with development

Preanus length: about 50% SL

Pigmentation: five evenly spaced melanophores along dorsal contour of body, three along ventral postanal region, one on caudal fin, several on lower jaw and along dorsal and ventral contours of abdomen; a single melanophore on head

Length at flexion: unknown

PHOTOS

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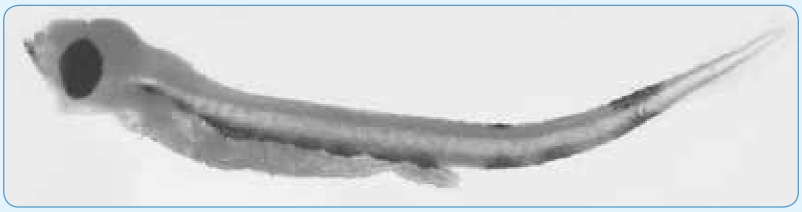
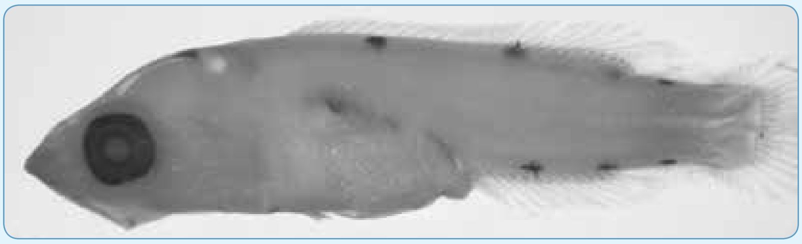
3.6 mm SL



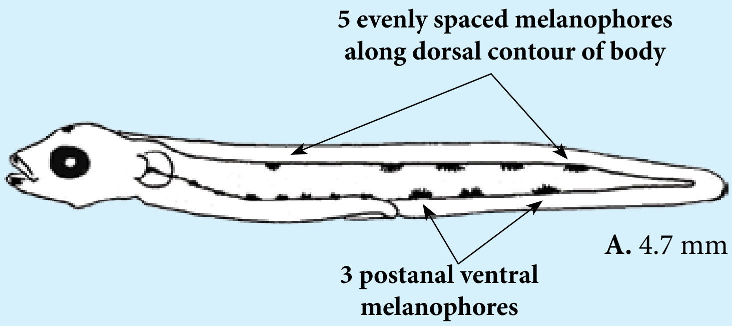
4.3 mm SL



8.8 mm SL

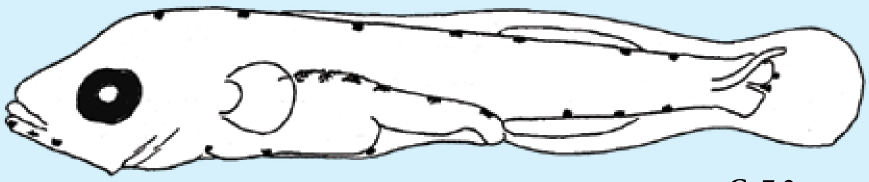
Literature: Froese and Pauly (2016), Fives (1976), Quignard and Pras (1986a), Russell (1976)

LABRIDAE — *Labrus mixtus* Linnaeus, 1758

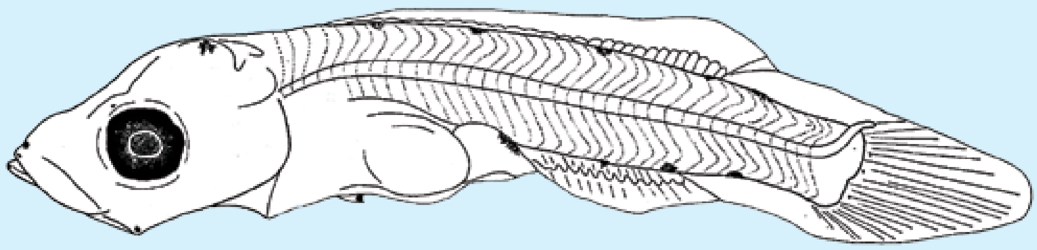


A. 4.7 mm

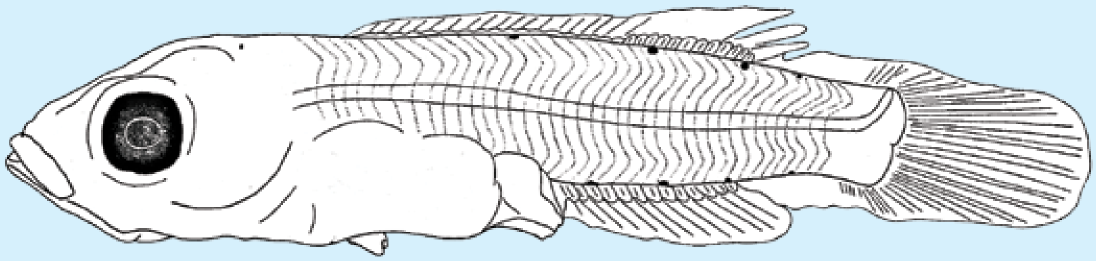
B. 6.5 mm



C. 7.2 mm



D. 9.0 mm TL



E. 10.0 mm TL

A–C: Russell (1976); **D, E:** Fives (1976)

LABRIDAE

Symphodus melops (Linnaeus, 1758)

En: Corkwing wrasse – **Fr:** Crénilabre mélops – **Sp:** Porredana

Habitat: Benthic, littoral, near rocks and eelgrass beds, from 1 to 50 m depth

Spawning season: Between March and May (possibly June)

EGGS

Habitat: demersal, attached to weed in nests
Shape: spherical
Diameter: 0.75–0.80 mm
Oil globules: none
Yolk: unsegmented

YOLK–SAC LARVAE Fig. A

Hatch size: 2.4–2.85 mm SL
Distinctive characters: body relatively elongate
Preanus length: about 50% SL
Pigmentation: two rows of dorsal melanophores from behind eye to about midway along tail region; three postanal ventral melanophores

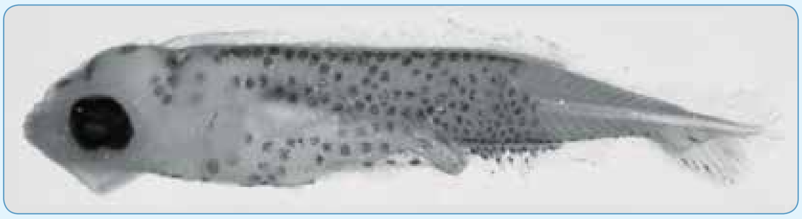
LARVAE Figs. B–D

Distinctive characters: body relatively elongate and slender, becoming more robust with development
Preanus length: about 50% SL
Pigmentation: a small number of melanophores on head; two parallel rows of dorsal melanophores; lower jaw pigmented; lateral sides of body, except caudal region, and anal fin pigmented; 3 or 4 melanophores between caudal and anal fins; melanophore on caudal–fin base
Length at flexion: probably begins at about 4.0 mm SL

PHOTOS

by J.M. Rodriguez

2.2 mm SL

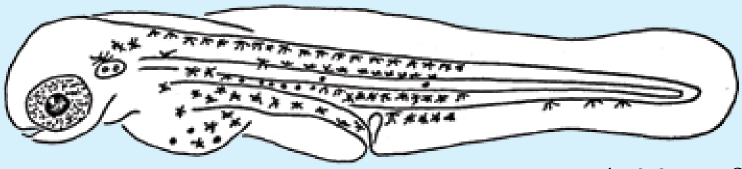


4.6 mm SL

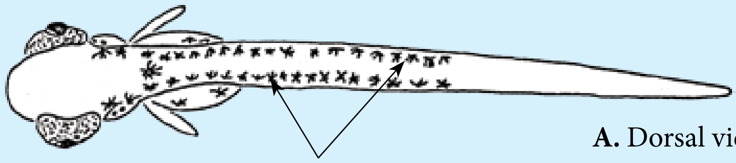
Literature: Fives (1976), Quignard (1967), Quignard and Pras (1986a), Russell (1976)

LABRIDAE

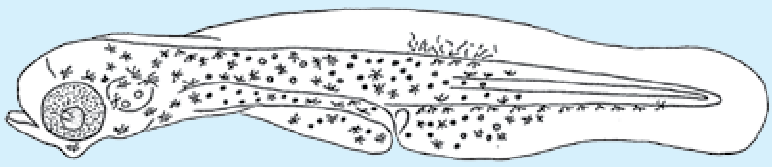
Symphodus melops **(Linnaeus, 1758)**



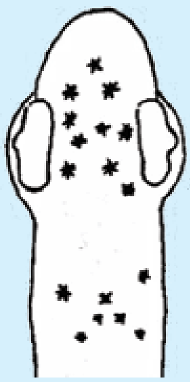
A. 2.9 mm SL



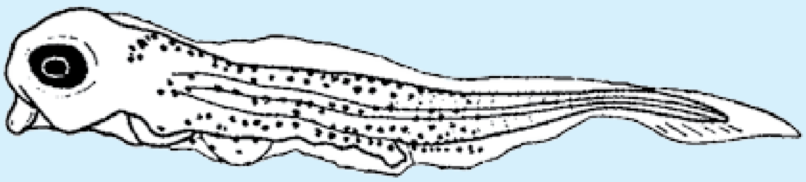
A. Dorsal view



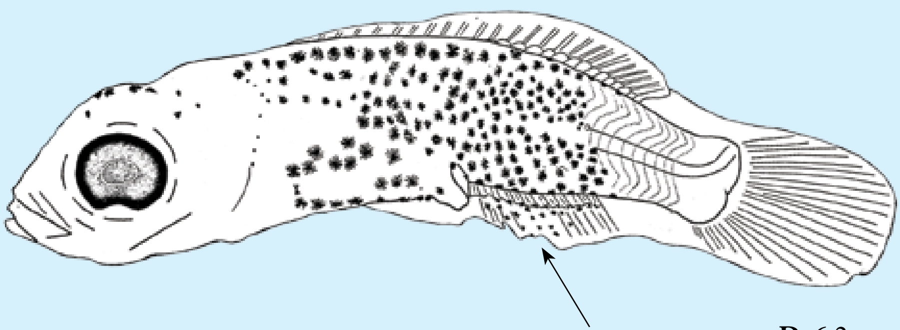
B. 3.2 mm SL



C. Dorsal view of head



C. 4.5 mm TL



D. 6.2 mm TL

A, B: Quignard (1967); **C, D:** Fives (1976)

AMMODYTIDAE

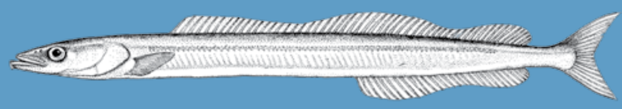
Gymnammodytes cicerelus (Rafinesque, 1810)

En: Mediterranean sand eel – Fr: Cicerelle de Méditerranée

Sp: Barrinaire

Habitat: Littoral, benthic, on sandy bottoms

Spawning season: Between November and January



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–F

Distinctive characters: body elongate and slender in all larval stages

Preanus length: more than 60% SL

Pigmentation: 8 dorsal melanophores evenly distributed along body; several melanophores on dorsal side of gut; 2 or 3 postanal ventral melanophores; pigmentation diminishes with development

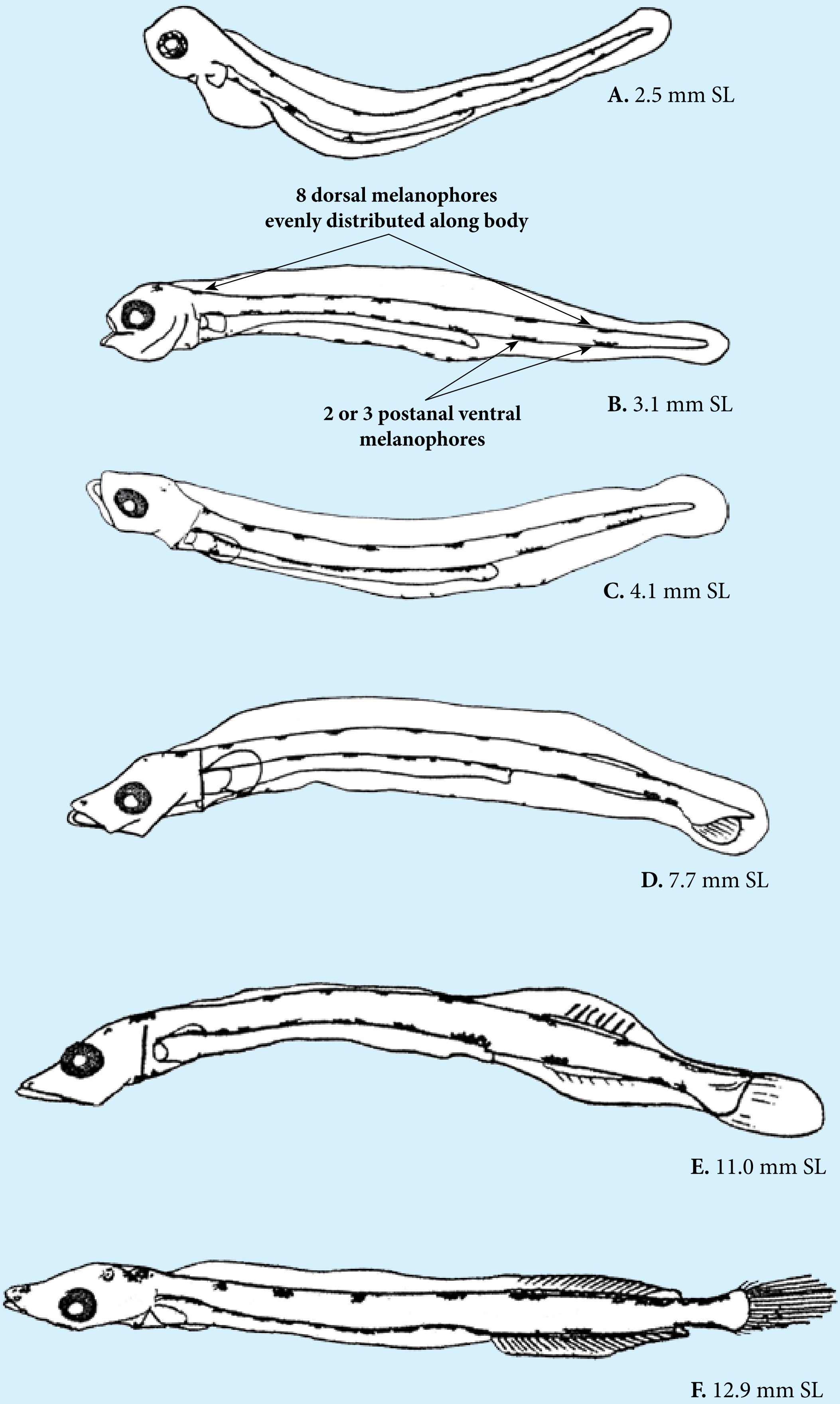
Length at flexion: almost completed at 11.0 mm SL

PHOTOS

Not available

Literature: Aboussouan (1964), Alemany (1997), Froese and Pauly (2016), Reay (1986), Sabatés *et al.* (1990)

AMMODYTIDAE — ***Gymnammodytes cicerelus*** (Rafinesque, 1810)



A–F: Alemany (1997)

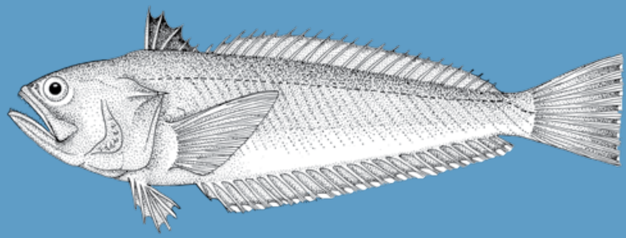
TRACHINIDAE

Echiichthys vipera (Cuvier, 1829)

En: Lesser weever

Habitat: Littoral and benthic, on sandy, muddy or gravelly bottoms, from a few meters to about 150 m depth

Spawning season: No information



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.37 mm
Chorion: smooth
Oil globules: multiple, 6–30
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 3.3 mm

Distinctive characters: body relatively elongate; anus situated close behind yolk sac; oil globules situated ventrally in yolk sac; pelvic fins well developed

Pigmentation: dorsal and ventral rows of melanophores extending posteriorly a little beyond mid–tail region in newly hatched larvae; pigmentation soon becomes characteristic with melanophores on snout, head, peritoneum and two bars of pigment, one in the anal region and another midway along postanal region

LARVAE

Figs. C–F

Distinctive characters: body relatively elongate and slender, becoming stout and deep with development; a series of preopercular and opercular spines; pelvic fins well developed from young larvae on

Preanus length: about 45% SL

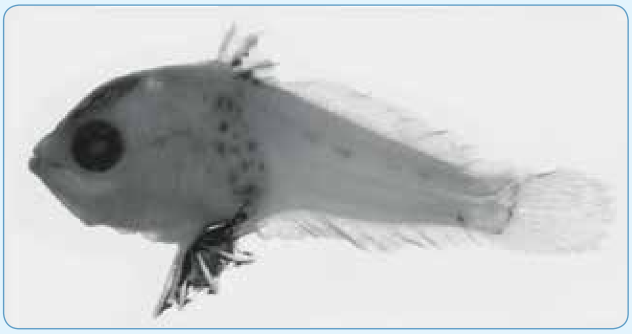
Pigmentation: anal bars of pigment disappear in larvae of about 4.5 mm SL, with only a group of melanophores remaining; melanophores on head and on shoulder; pelvic fins and peritoneum strongly pigmented

Length at flexion: flexion begins at about 6 mm SL

PHOTOS

by J.M. Rodriguez

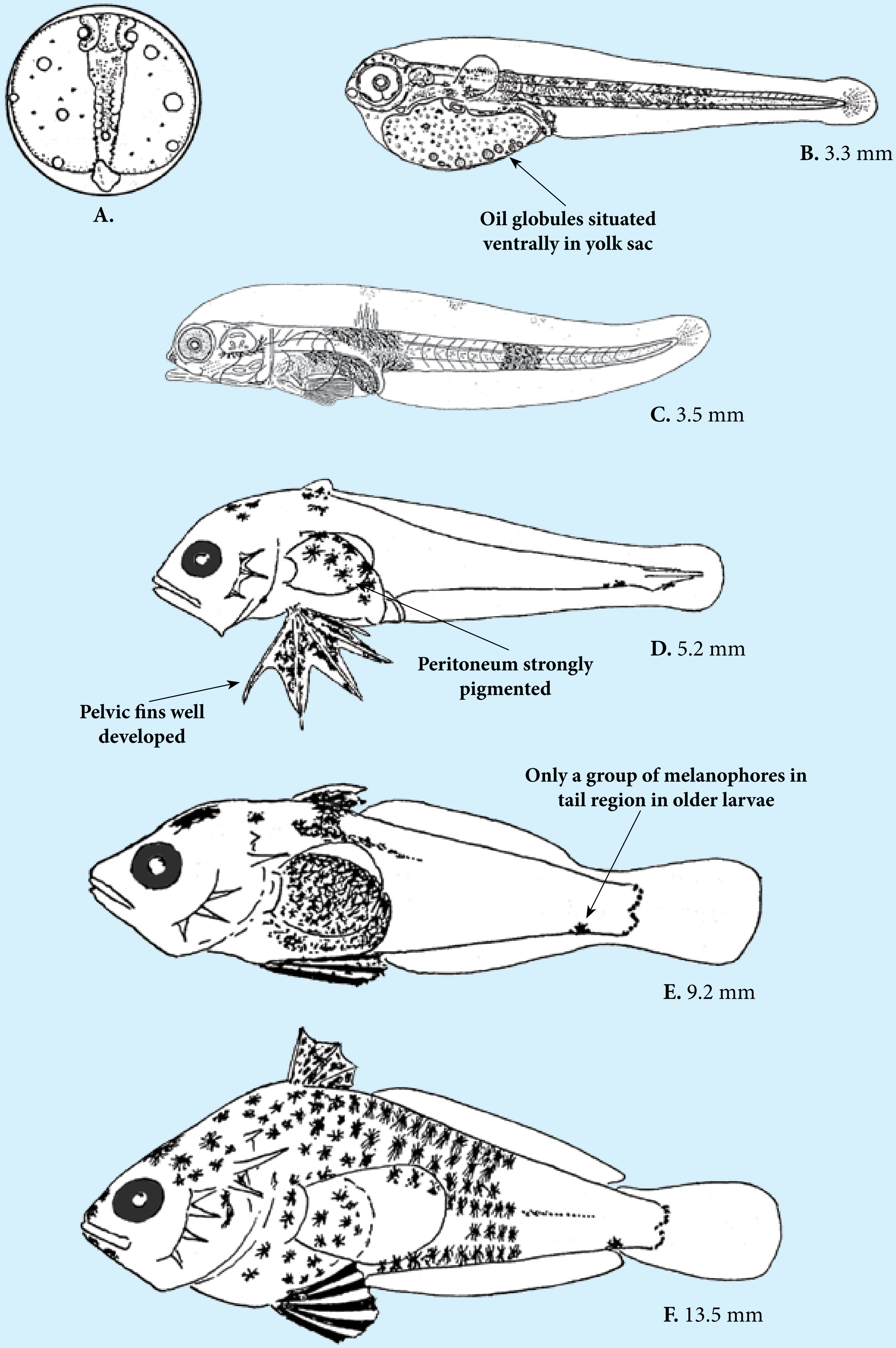
2.7 mm SL



7.7 mm SL

Literature: Alemany (1997), Froese and Pauly (2016), Padoa (1956a), Russell (1976)

TRACHINIDAE *Echiichthys vipera* (Cuvier, 1829)



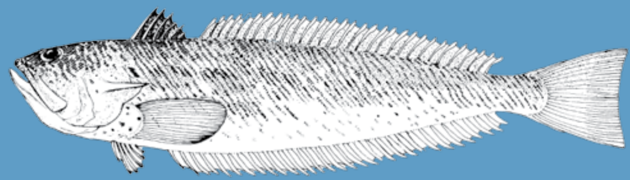
A–C: Padoa (1956a); **D–F:** Russell (1976)

TRACHINIDAE *Trachinus draco* Linnaeus, 1758

En: Greater weever – **Fr:** Grande vive – **Sp:** Escorpión

Habitat: Benthic, littoral, over muddy, sandy or gravel bottoms, down to 150 m depth

Spawning season: No information



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.96–1.11 mm
Chorion: smooth
Oil globules: single, 0.19–0.23 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 3.2 mm

Distinctive characters: oil globule and anus situated at anterior and posterior edges of yolk sac, respectively; primordial fin globose reaching the snout

Pigmentation: melanophores on snout, two behind eye, on dorsal anterior part of body, and near anus; row of melanophores on postanal ventral region with a postanal bar at midway between anus and tail end

LARVAE Figs. C–F

Distinctive characters: body relatively elongate and slender, becoming more robust with development; pelvic fins appear at about 4 mm SL; young larvae, with primordial fin globose, reaching the snout; older larvae have 5 preopercular spines

Preanus length: about 40% SL

Pigmentation: early stages similar to yolk–sac larvae; with development, the origin of ventral postanal row of melanophores moves backwards and melanophores decrease in number; postanal bar of melanophores disappears and peritoneal pigment increases; pelvic fins strongly pigmented

Length at flexion: almost completed at 5.1 mm

PHOTOS

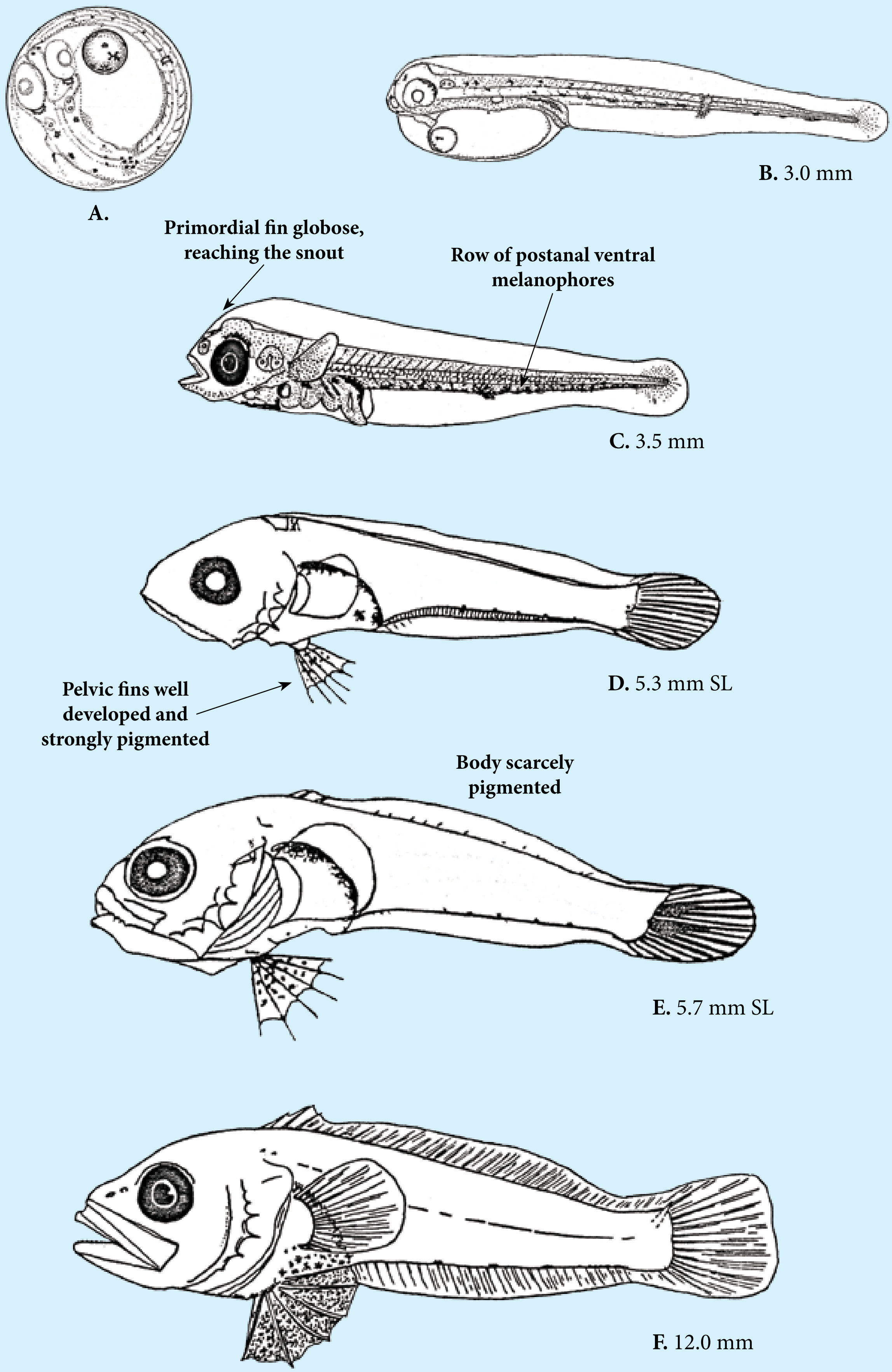
by J.M. Rodriguez

3.3 mm SL

7.0 mm SL

Literature: Alemany (1997), Munk and Nielsen (2005), Padoa (1956n), Russell (1976), Sabatés (1988)

TRACHINIDAE *Trachinus draco* Linnaeus, 1758



A–C: Padoa (1956n); **D, E:** Alemany (1997); **F:** Fage (1918)

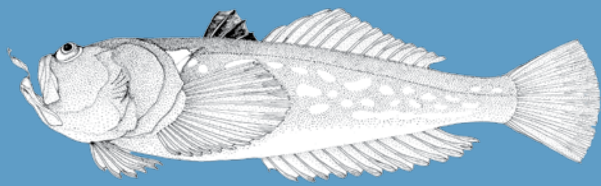
URANOSCOPIDAE

Uranoscopus scaber **Linnaeus, 1758**

En: Stargazer – **Fr:** Uranoscope – **Sp:** Rata

Habitat: Benthic on sandy or muddy bottoms, burrowing in sediment, on the continental shelf and upper slope, between 15 and 400 m depth

Spawning season: Between April and August



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.6–2.0 mm
Chorion: sculptured with hexagonal reticules
Oil globules: none
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

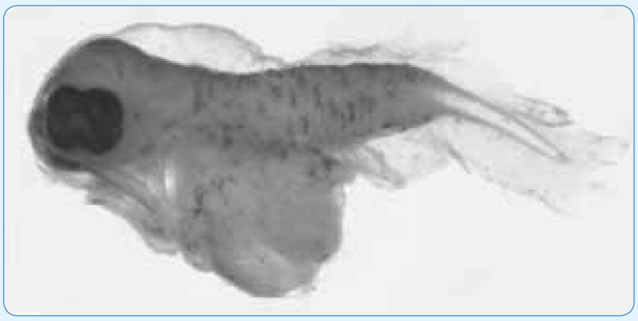
Hatch size: about 4.0 mm
Pigmentation: trunk heavily pigmented, only caudal peduncle unpigmented

LARVAE — Figs. C–E

Distinctive characters: body short with an extremely high preanus region
Preanus length: more than 50% SL
Pigmentation: body, except caudal peduncle, covered with small melanophores
Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

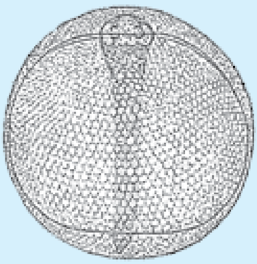


2.4 mm SL

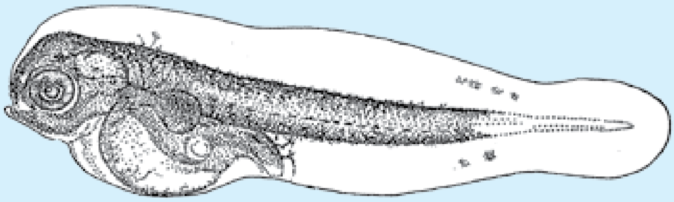
4.8 mm SL

Literature: Fage (1918), Hureau (1986c), Padoa (1956q), Sabatés (1988)

URANOSCOPIDAE *Uranoscopus scaber* Linnaeus, 1758

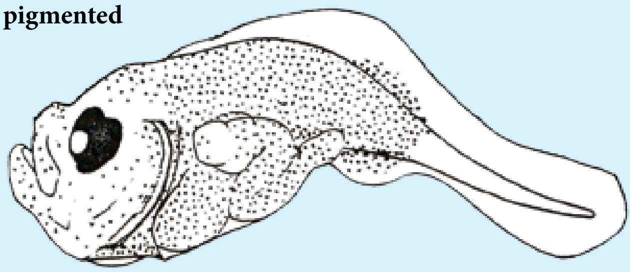


A.



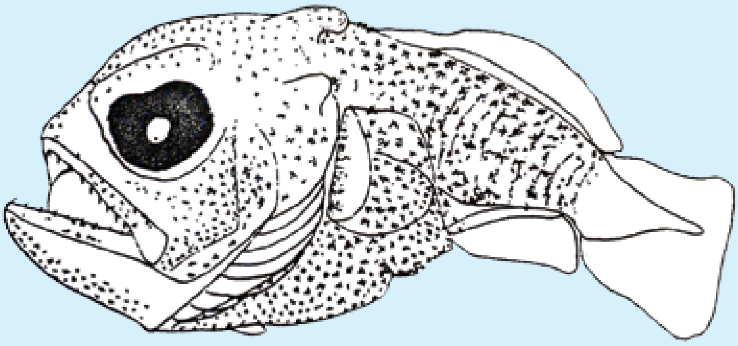
B. ca. 4.0 mm

Body strongly pigmented

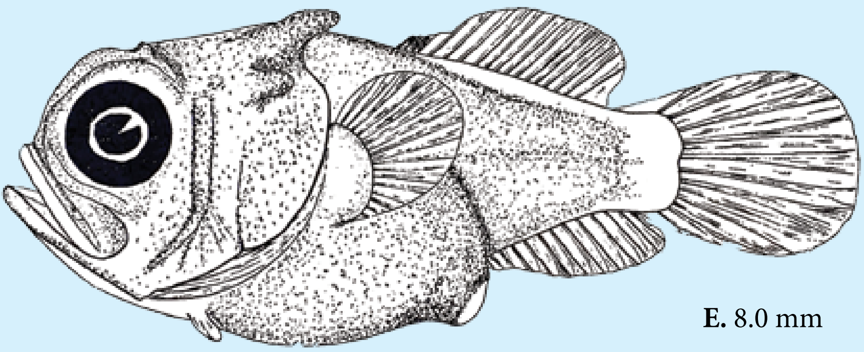


C. 3.2 mm SL

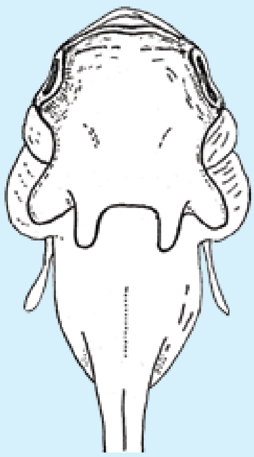
Body short with extremely high preanus region



D. 3.3 mm SL



E. 8.0 mm



E. Dorsal view

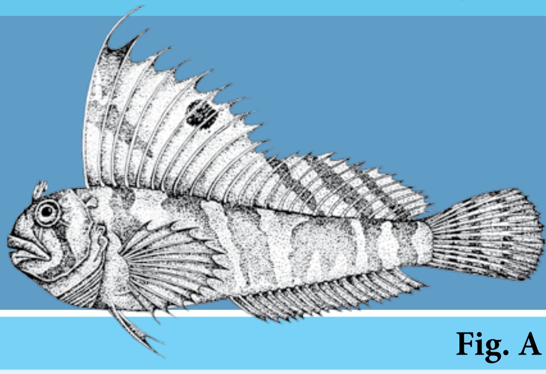
A, B: Padoa (1956q); **C, D:** Alemany (1997); **E:** Fage (1918)

BLENNIIDAE *Blennius ocellaris* Linnaeus, 1758

En: Butterfly blenny – **Sp:** Torillo

Habitat: Benthic, on hard bottoms, between 30 and 100 m depth

Spawning season: April (Marseille, France)



EGGS

Fig. A

Habitat: demersal, attached to shells and hollow objects
Shape: sub–spherical
Diameter: 1.12–1.20 mm
Oil globules: some
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Hatch size: about 4.5 mm
Distinctive characters: pectoral fin apparent
Pigmentation: melanophores on head, snout and peritoneum; pectoral fin strongly pigmented with melanophores arranged in longitudinal rows between incipient rays; row of melanophores on ventral tail end region

LARVAE

Figs. B–F

Distinctive characters: body relatively elongate and slender becomes more robust with development; pectoral fin large (reaching beyond anus) and rounded in shape, with 12 rays
Preanus length: about 33% SL
Pigmentation: pectoral fin heavily pigmented with melanophores located between fin rays; some melanophores on head; 5 or 6 postanal ventral melanophores at posterior half of postanal region; peritoneum heavily pigmented
Length at flexion: unknown

PHOTOS

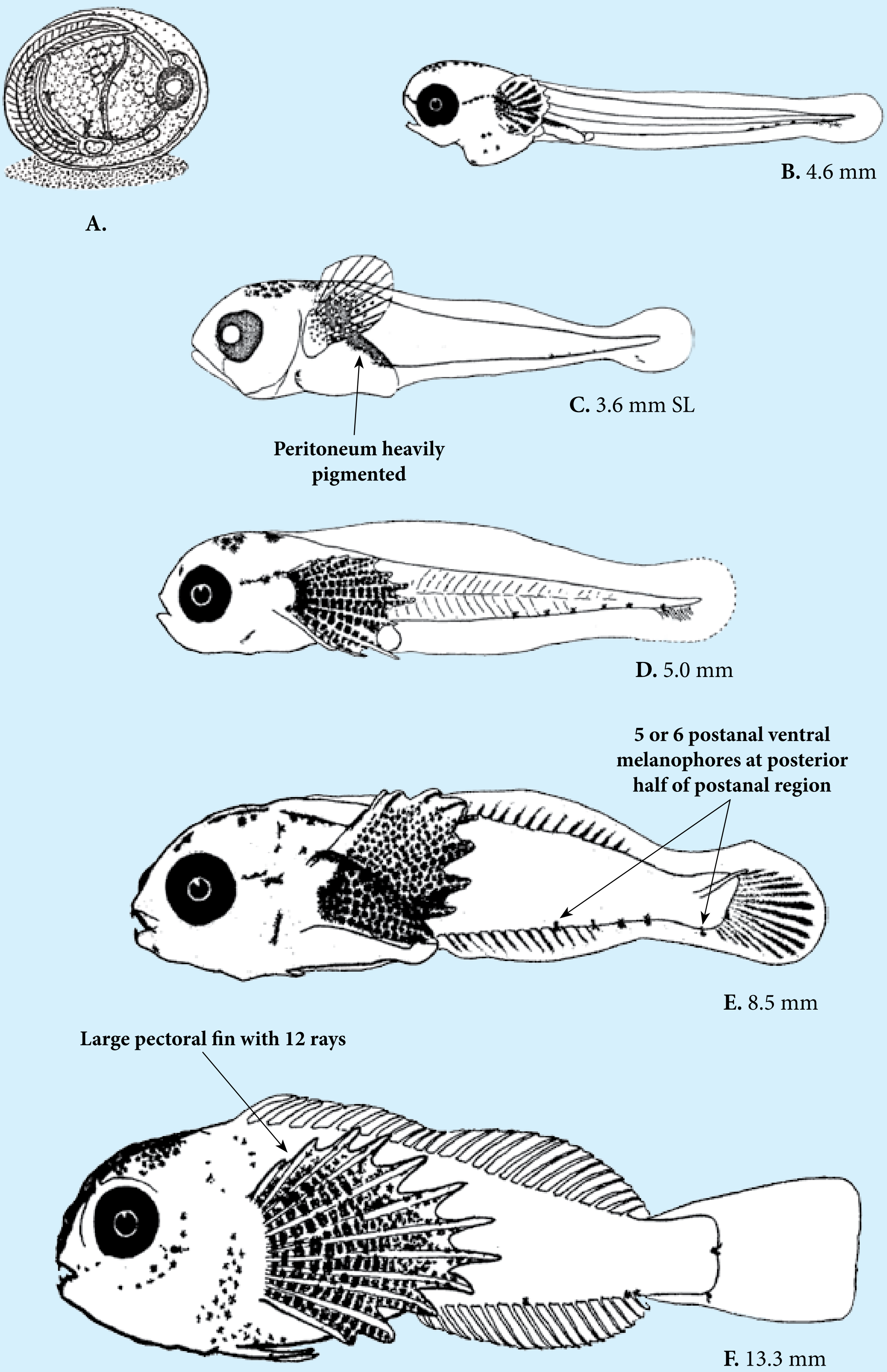
by J.M. Rodriguez

3.6 mm SL

3.9 mm SL

Literature: Fives (1986), Ford (1922), Padoa (1956b), Russell (1976), Zander (1986)

BLENNIIDAE — ***Blennius ocellaris*** Linnaeus, 1758



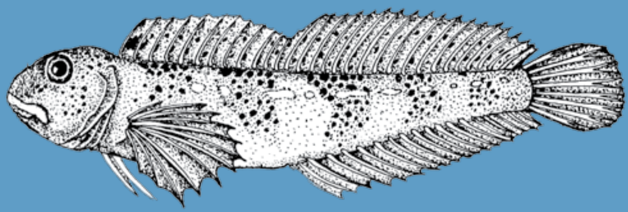
A: Padoa (1956b); **B, D–F:** Ford (1922); **C:** Alemany (1997)

BLENNIIDAE *Lipophrys pholis* (Linnaeus, 1758)

En: Shanny

Habitat: Benthic, in shallow waters of rocky coasts, often in rock–pools, sometimes among algae

Spawning season: Between April and August



EGGS

Habitat: demersal
Shape: hemispherical
Diameter: 1.18–1.6 mm
Chorion: smooth
Oil globules: several
Yolk: unsegmented

YOLK–SAC LARVAE Fig. A

Hatch size: about 4.4 mm

Pigmentation: pectoral fins heavily pigmented; melanophores on head and snout; peritoneum pigmented; postanal region unpigmented

LARVAE Figs. B–E

Distinctive characters: body relatively elongate; pectoral fins very large with 13 rays; apparent teeth in older larvae

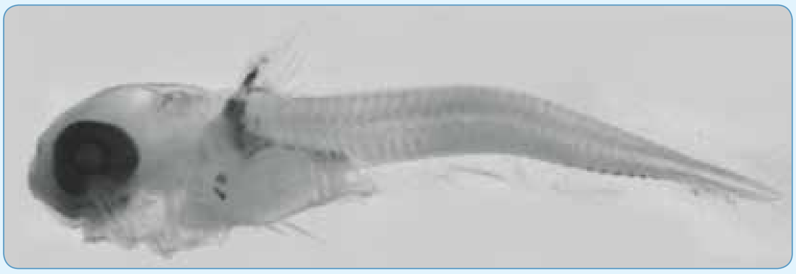
Preanus length: less than 50% SL

Pigmentation: pectoral fins heavily pigmented; melanophores on head and close to operculum; peritoneum and base of caudal fin pigmented; row of melanophores on ventral tail end region

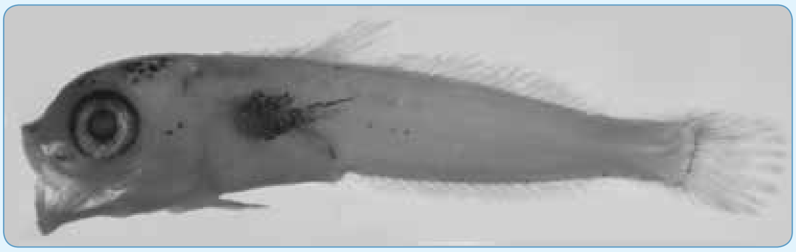
Length at flexion: unknown

PHOTOS

by J.M. Rodriguez



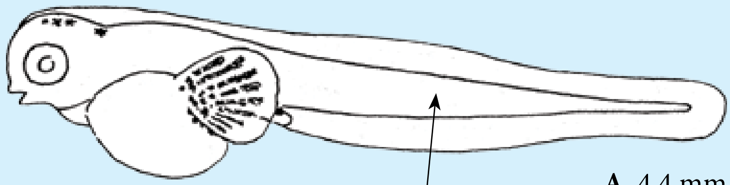
4.6 mm SL



9.0 mm SL

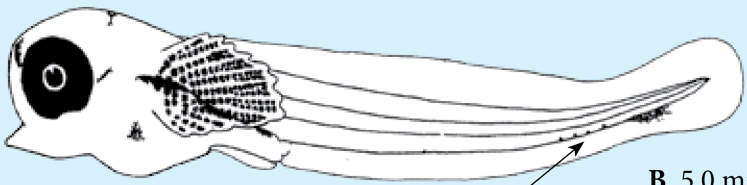
Literature: Alemany (1997), Fives (1986), Ford (1922), Padoa (1956b), Russell (1976), Zander (1986)

BLENNIIDAE — *Lipophrys pholis* (Linnaeus, 1758)



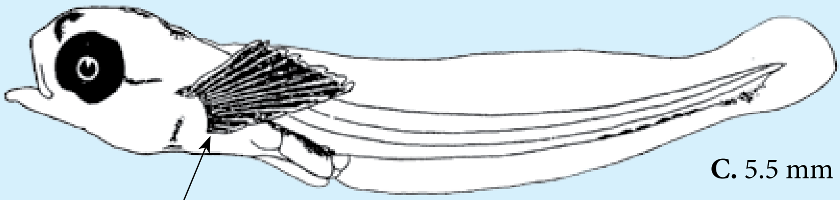
A. 4.4 mm

Postanal region unpigmented in yolk-sac larvae



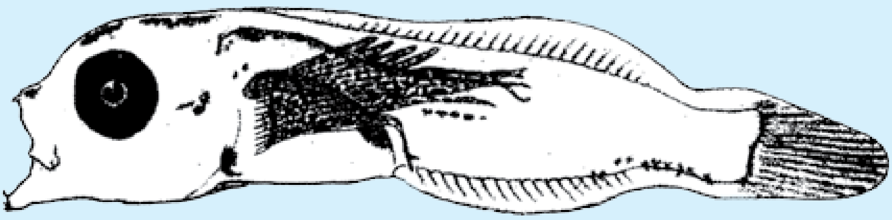
B. 5.0 mm

Row of melanophores on ventral tail-end region



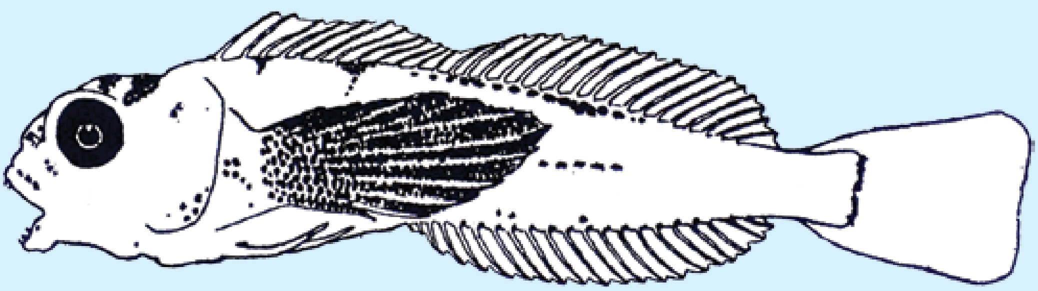
C. 5.5 mm

Pectoral fin very large with 13 rays



D. 9.0 mm

Teeth apparent in larger larvae



E. 17.5 mm TL

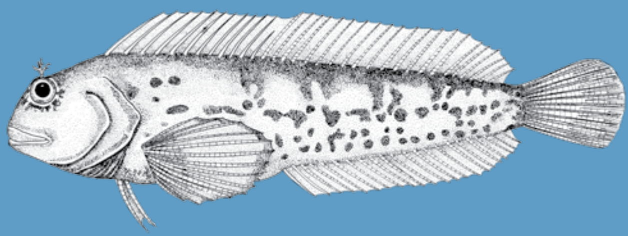
A: Russell (1976); **B–D:** Ford (1922); **E:** Fives (1986)

BLENNIIDAE *Parablennius pilicornis* (Cuvier, 1829)

En: Ringneck blenny

Habitat: Benthic, littoral

Spawning season: No information



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–F

Distinctive characters: body elongate; pectoral fins fairly large; preopercular spines appear at 4.0 mm SL

Preanus length: 36% of SL in young larvae, diminishes to 32% in older larvae

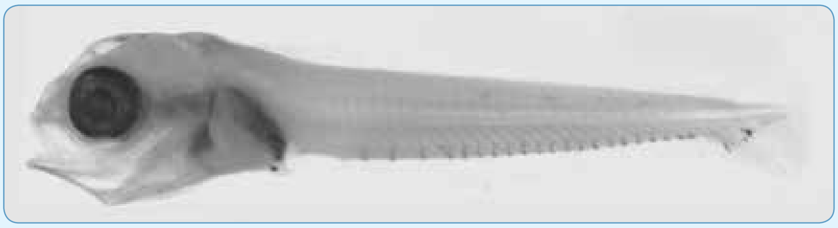
Pigmentation: young larvae with only one stellate melanophore on head (many in older larvae); dorsal surface of gut heavily pigmented, pigmentation of abdominal region increases with development; a single melanophore ventrally over hindgut; ventral row of melanophores from anus to notochord tip; older larvae show a melanophore on caudal–fin base; dorsal pigmentation in tail region appears in larvae larger than 13 mm SL

Length at flexion: between 5 and 6 mm SL

PHOTOS

by J.M. Rodriguez

2.8 mm SL

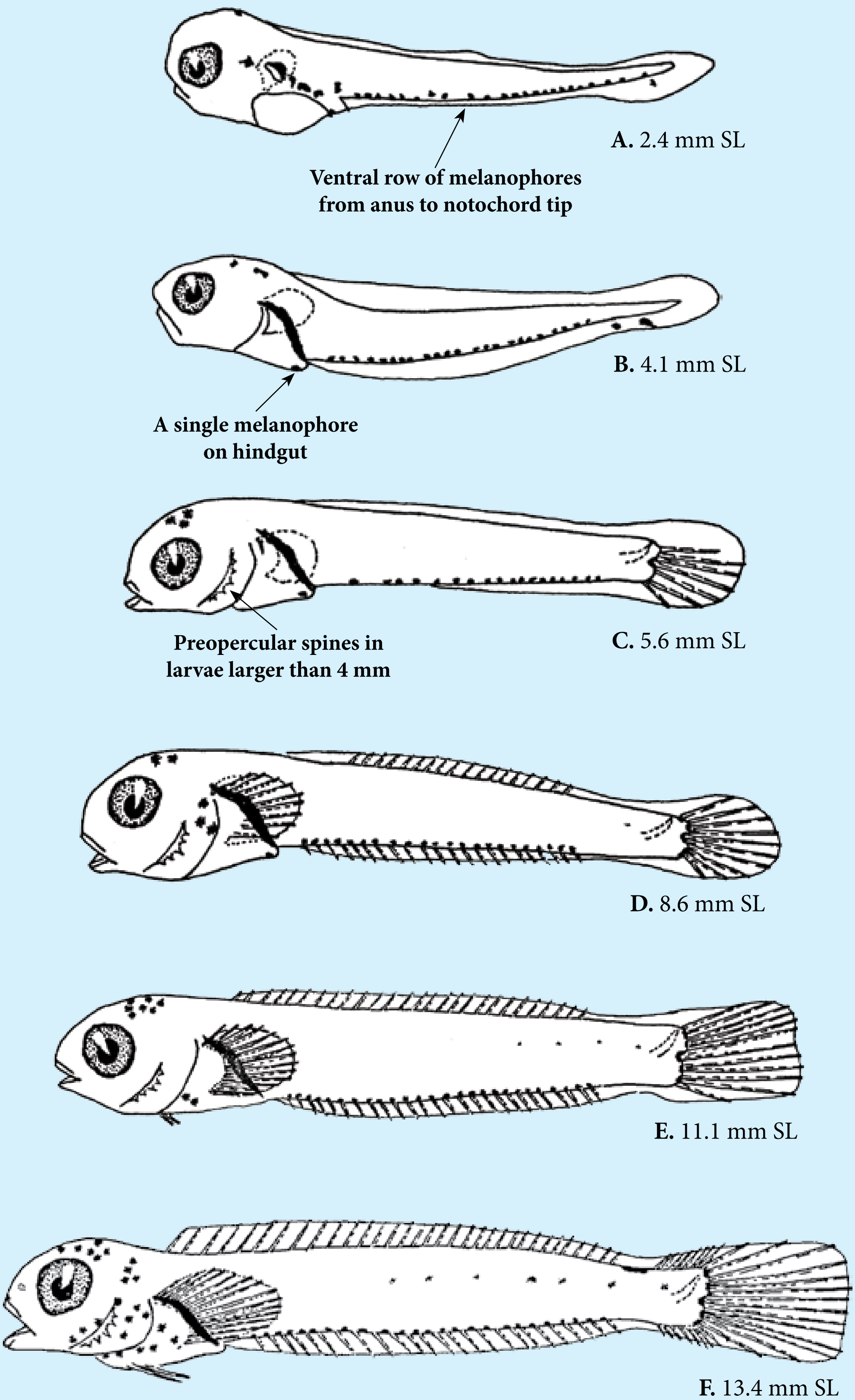


3.3 mm SL

8.4 mm SL

Literature: Olivar (1986), Olivar and Fortuño (1991), Zander (1986)

BLENNIIDAE — ***Parablennius pilicornis*** (Cuvier, 1829)



A–F: Olivar (1986)

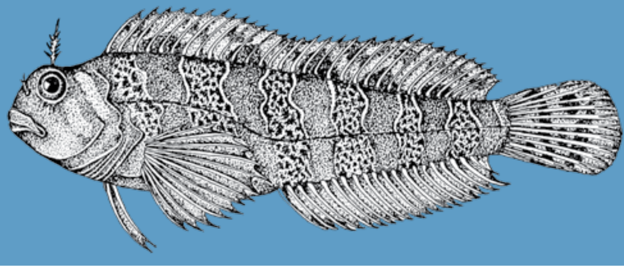
BLENNIIDAE

Parablennius gattorugine **(Linnaeus, 1758)**

En: Tompot blenny – Sp: Cabruza

Habitat: Benthic, littoral

Spawning season: No information



EGGS

Habitat: demersal
Shape: hemispherical
Diameter: 1.6 mm
Oil globules: none
Yolk: unsegmented

YOLK–SAC LARVAE

Hatch size: 4.9 mm
Pigmentation: dorsal side of gut pigmented, from behind eye to anus; a few melanophores on snout and top of head; apparently, no postanal ventral row of melanophores; pectoral fin unpigmented

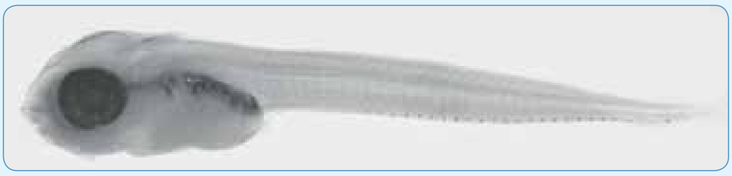
LARVAE

Figs. A–D

Distinctive characters: body elongate; pectoral fin fairly large; preanus length short
Preanus length: about one third of SL
Pigmentation: no melanophore on hindgut; black peritoneal pigment covering dorsal side of gut, to almost anus; postanal ventral row of 19–21 regularly spaced melanophores begins some distance behind anus and extends to caudal peduncle; melanophores on head and snout and some caudal melanophores; apparent paired dorsal bands of melanophores across dorsal fin in larvae larger than 18 mm; lateral row of melanophores above notochord
Length at flexion: unknown

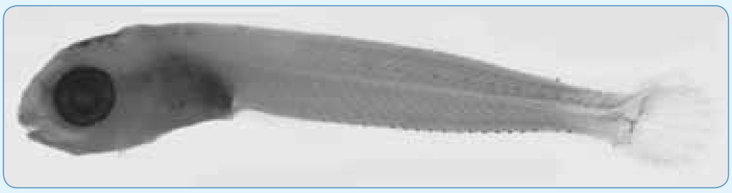
PHOTOS

by J.M. Rodriguez



3.8 mm SL

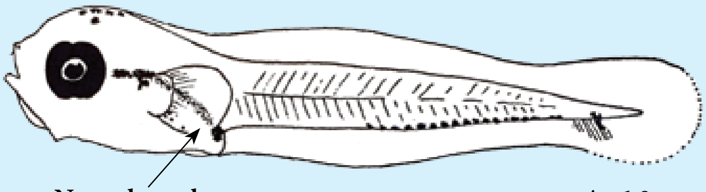
4.5 mm SL



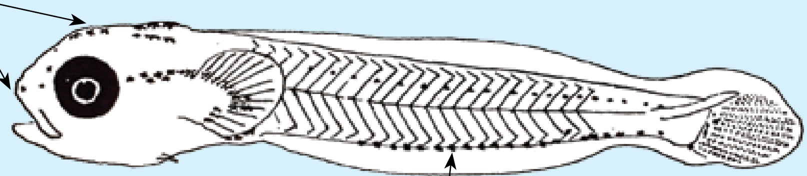
9.4 mm SL

Literature: Ford (1922), Padoa (1956b), Russell (1976), Zander (1986)

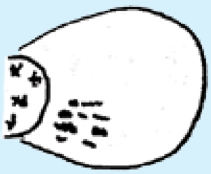
BLENNIIDAE ***Parablennius gattorugine*** (Linnaeus, 1758)



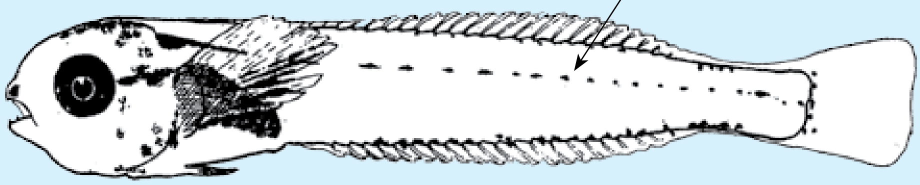
A. 6.0 mm



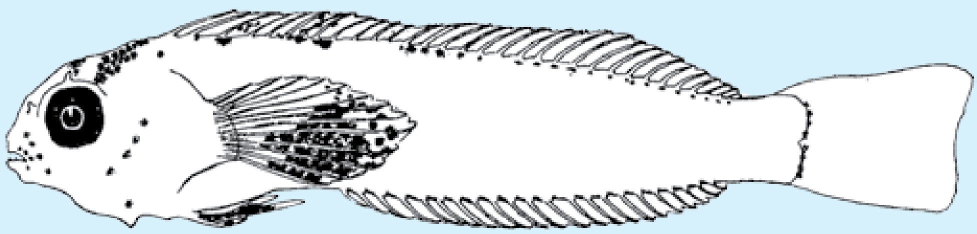
B. 10.0 mm



B. Detail of pectoral fin



C. 13.0 mm



D. 18.5 mm

A–D: Ford (1922)

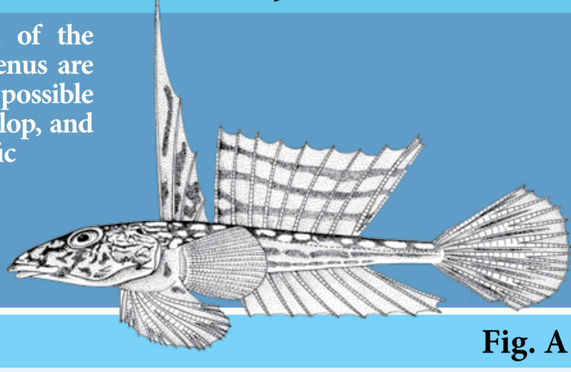
CALLIONYMIDAE

***Callionymus* Linnaeus, 1758**

In the Western Mediterranean Sea there are 6 species of the genus *Callionymus*. Younger larvae (< 3 mm SL) of this genus are indistinguishable. The identification at the species level is only possible in larvae larger than 3 mm, when preopercular spines develop, and pelvic fins and pigmentation patterns become species–specific

Habitat: Benthic, over sandy bottoms down to 650 m depth

Spawning season: Between January and August (varying by species)



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.55–0.97 mm
Chorion: in some species it shows hexagonal sculptures
Oil globules: none
Yolk: segmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 2 mm (*Callionymus lyra*); yolk appears fully absorbed at 2.3 mm SL

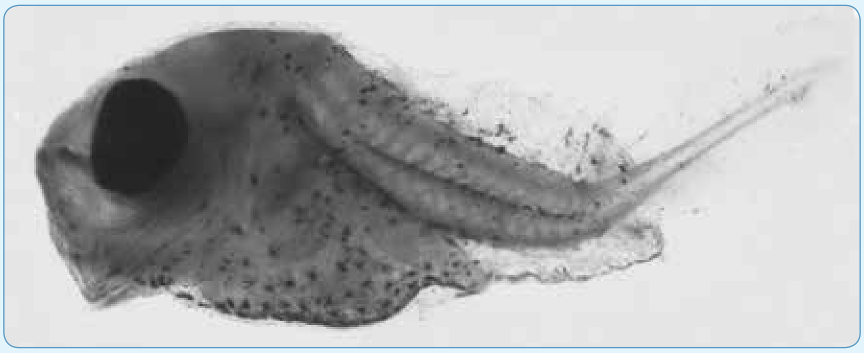
LARVAE

Figs. C–H

Distinctive characters: body short with thick head and abdomen; it shows a bifurcated preopercular spine; urostyle strongly developed and curved up at its end
Preanus length: about 50% SL
Pigmentation: strongly pigmented except for urostyle region
Length at flexion: no information

PHOTOS

by J.M. Rodriguez



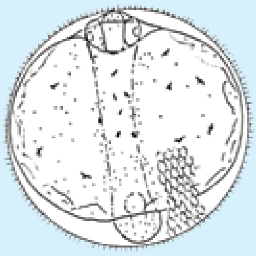
Callionymus sp.
2.5 mm SL

Callionymus sp.
5.9 mm SL

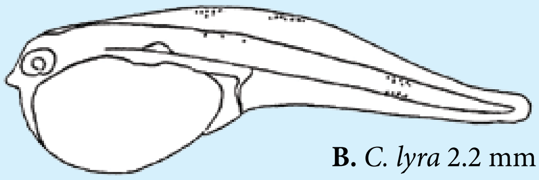
Literature: Demir (1972), Fage (1918), Fricke (1986), Padoa (1956s), Russell (1976), Sabatés (1988)

CALLIONYMIDAE

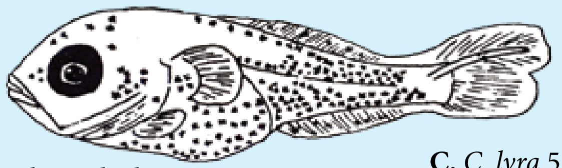
Callionymus **Linnaeus, 1758**



A.

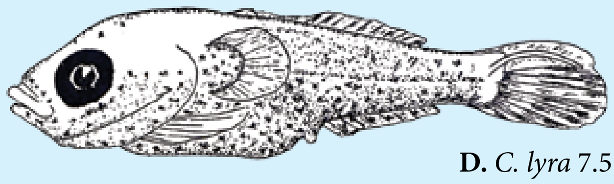


B. *C. lyra* 2.2 mm



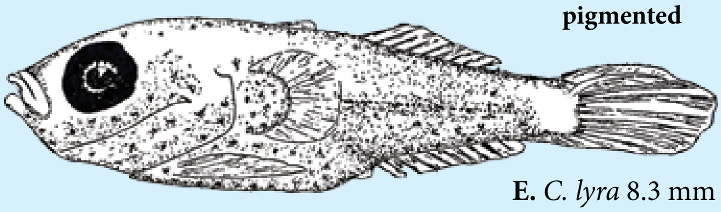
Body short; thick head and abdomen

C. *C. lyra* 5.8 mm

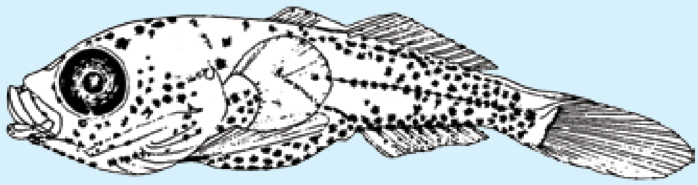


D. *C. lyra* 7.5 mm

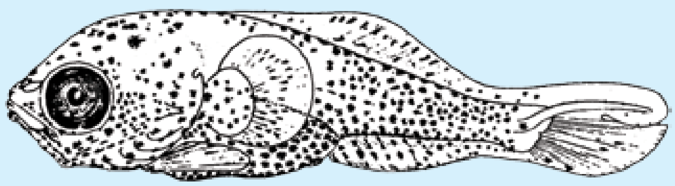
Body strongly pigmented



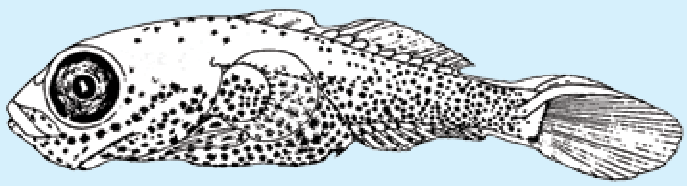
E. *C. lyra* 8.3 mm



F. *C. reticulatus* 6.6 mm TL



G. *C. lyra* 6.5 mm TL



H. *C. maculatus* 6.6 mm TL

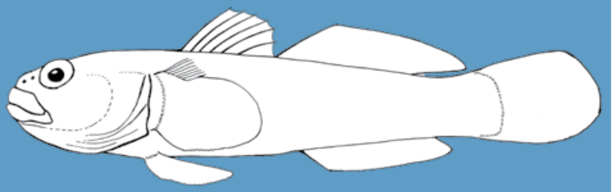
A, B: Padoa (1956s); **C–E:** Fage (1918); **F–H:** Demir (1972)

GOBIIDAE *Crystallogobius linearis* (Düben, 1845)

En: Crystal goby

Habitat: Pelagic, in coastal to offshore waters, down to over 400 m depth. Males live on the bottom during the breeding season

Spawning season: Between May and August in the NE Atlantic



Gobiidae

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body elongate and slender; first dorsal fin absent in females and showing two rays in males

Preanus length: less than 50% SL

Pigmentation: larvae up to 5 mm length, strongly pigmented with melanophores on head, in front of eye, at lower jaw tip and oocyst region; 5 large evenly spaced melanophores along dorsal contour of body; dorsal and ventral sides of gut and swimbladder pigmented; postanal ventral row of melanophores; pigmentation diminishes with development, so that larvae of ca. 11.0 mm SL have a row of postanal ventral melanophores and a series of melanophores on anterior ventral side of gut; swimbladder pigmented

Length at flexion: unknown

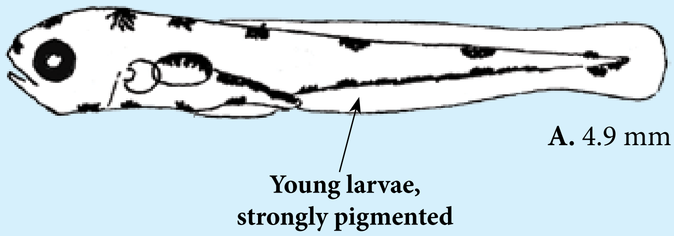
PHOTOS

by J.M. Rodriguez

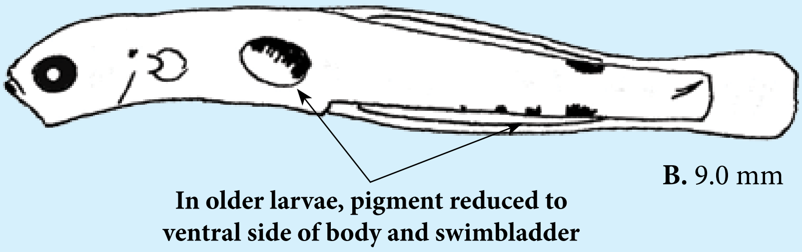
10.4 mm SL

Literature: Alemany (1997), Miller (1986), Padoa (1956h), Sabatés (1988)

GOBIIDAE — ***Crystallogobius linearis*** (Düben, 1845)

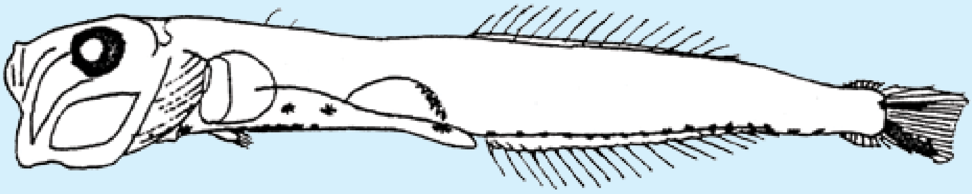


A. 4.9 mm

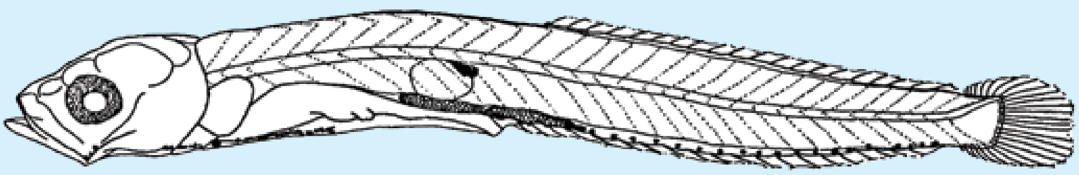


B. 9.0 mm

C. 11.2 mm



D. 14.5 mm SL



E. 15.2 mm SL

A–C: Russell (1976); **D:** Alemany (1997); **E:** Sabatés (1988)

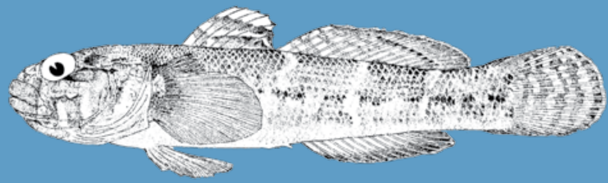
GOBIIDAE

Gobius paganellus Linnaeus, 1758

En: Rock goby – **Fr:** Gobie paganel – **Sp:** Bobí

Habitat: Benthic, in inshore and intertidal waters over rocky bottoms with weed cover

Spawning season: Between January and June



EGGS Fig. A

Habitat: demersal

Shape: fusiform, with a rounded, pointed apex

Size: 2.24 x 0.84 mm

YOLK–SAC LARVAE Fig. B

Hatch size: about 4.76 mm with mouth open and swimbladder apparent

Pigmentation: branched melanophores on ventral profile of abdomen; large, opposing dorsal and ventral melanophores at about mid–postanal region; swimbladder pigmented; a melanophore on hindgut; no melanophores on head

LARVAE Figs. C–F

Distinctive characters: body relatively elongate and slender

Preanus length: about 50% SL

Pigmentation: early larvae similar to yolk–sac larvae; larvae larger than 7.0 mm with melanophores on head and a row of postanal ventral melanophores, while postanal dorsal melanophore disappears in postflexion larvae

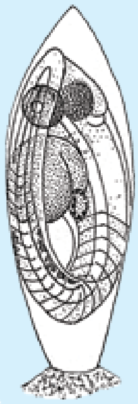
Length at flexion: unknown

PHOTOS

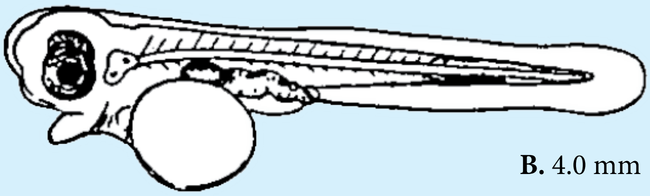
Not available

Literature: Alemany (1997), Lebour (1919), Miller (1986), Padoa (1956h)

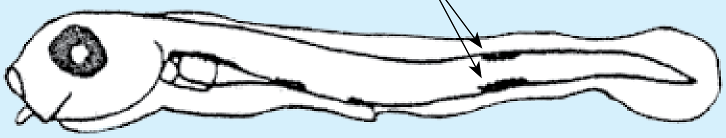
GOBIIDAE *Gobius paganellus* Linnaeus, 1758



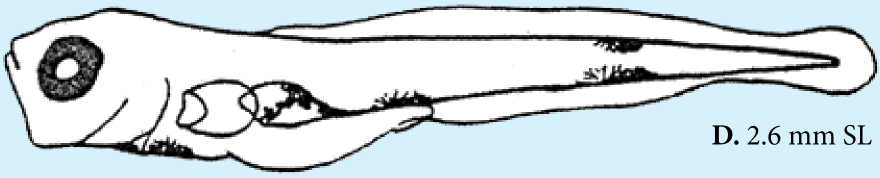
A.



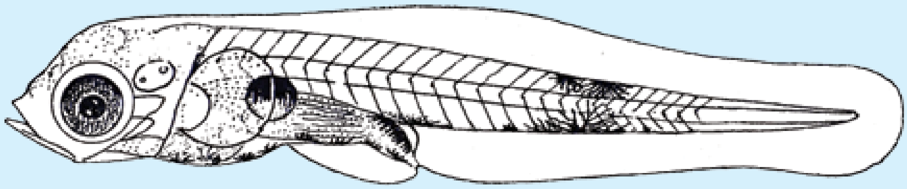
B. 4.0 mm



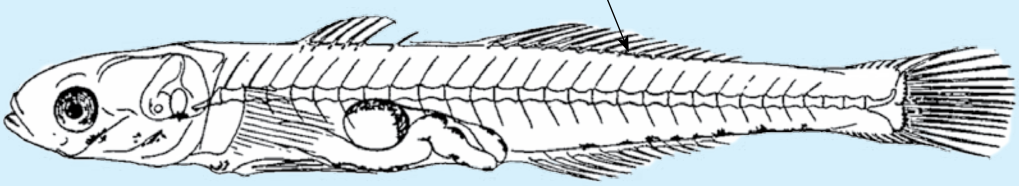
C. 2.1 mm SL



D. 2.6 mm SL



E. 4.8 mm



F. 11.5 mm

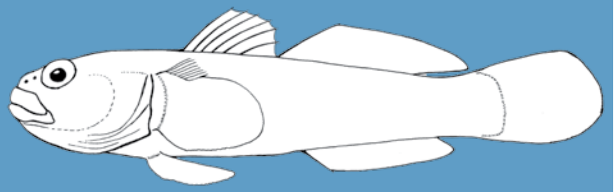
A, E: Padoa (1956h); **B, F:** Lebour (1919); **C, D:** Alemany (1997)

GOBIIDAE *Lebetus guilleti* (Le Danois, 1913)

En: Guillet's goby

Habitat: Benthic, littoral, over coarse grounds

Spawning season: Larvae in plankton from February to December in the Balearic Sea



Gobiidae

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body short and robust; small to moderate head; no cephalic spines; eyes rounded and large; prominent swimbladder; pelvic fins develop from young larvae on

Preanus length: about 67% SL

Pigmentation: body covered with melanophores except for caudal region; well–marked lateral row of melanophores and another ventral row, from anus to base of caudal fin

Length at flexion: 5.0–7.0 mm SL

PHOTOS

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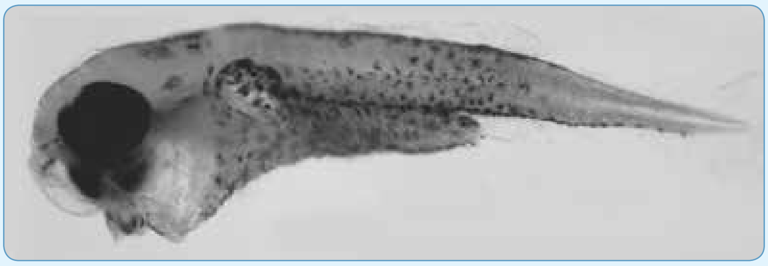
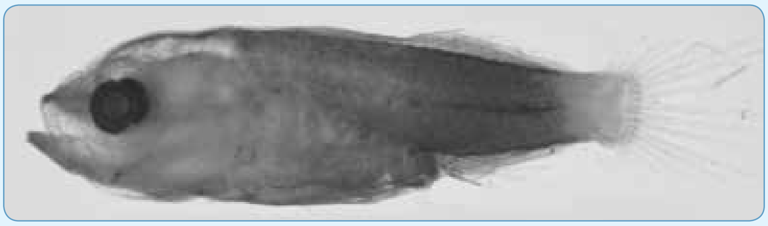


2.2 mm SL

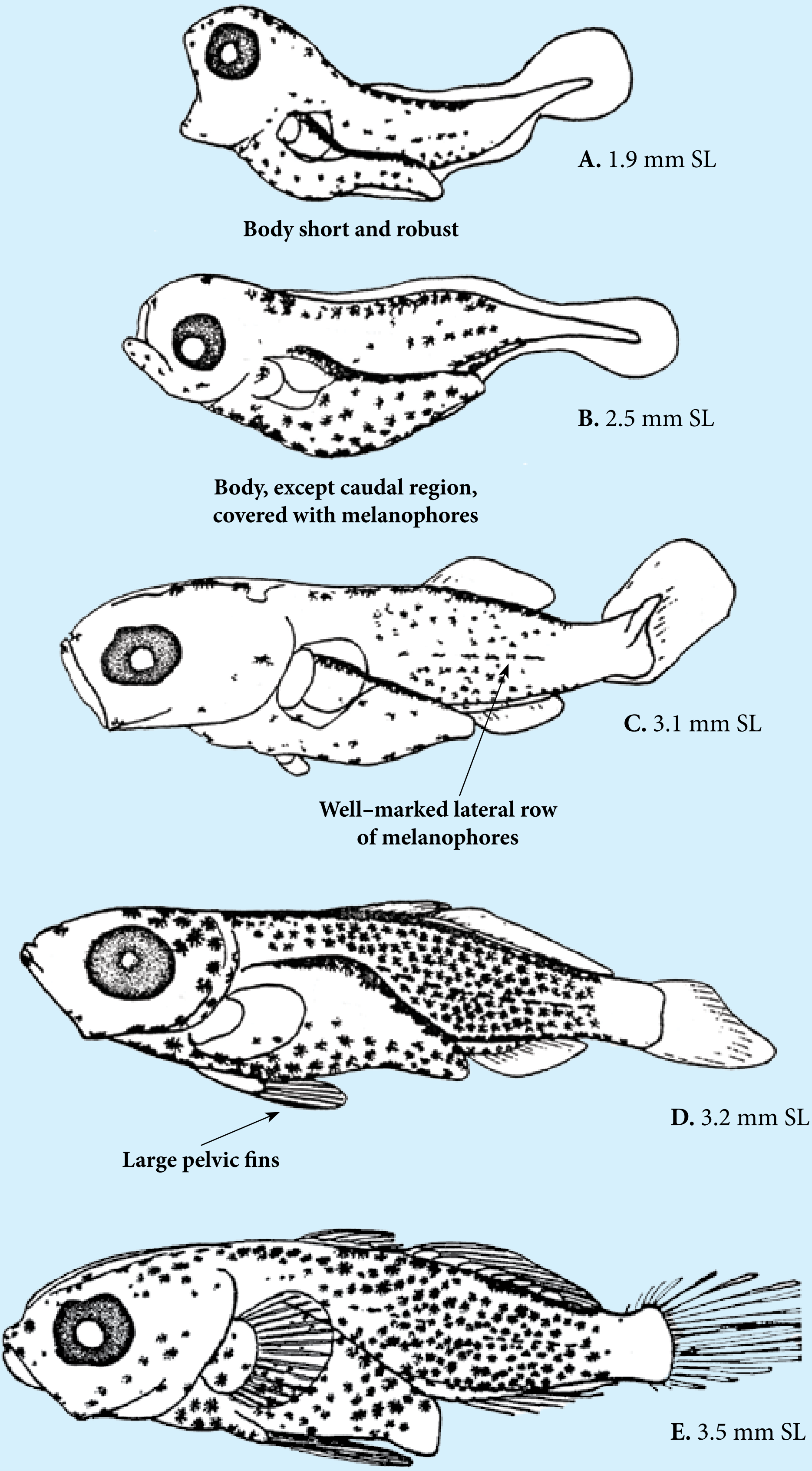
2.8 mm SL



4.5 mm SL

Literature: Alemany (1997), Miller (1986), Russell (1976)

GOBIIDAE — ***Lebetus guilleti*** (Le Danois, 1913)



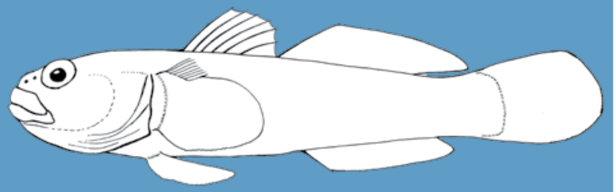
A–E: Alemany (1997)

GOBIIDAE *Pomatoschistus microps* (Krøyer, 1838)

En: Common goby – **Fr:** Gobie commun

Habitat: Benthic, coastal, frequently in estuaries and intertidal pools

Spawning season: Spring and summer



Gobiidae

EGGS Fig. A

Habitat: demersal
Shape: pear–shaped, with a rounded apex
Size: 1.0–0.7 x 0.65–08 mm
Oil globules: several, maximum size 0.08 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 3.0 mm
Pigmentation: row of melanophores along ventral side of trunk and tail; yolk sac and ventral side of gut strongly pigmented; large branched melanophore on dorsal mid–tail region

LARVAE Figs. C–F

Distinctive characters: body relatively elongate and slender
Preanus length: about 50% SL
Pigmentation: melanophores on head and lower jaw; an almost continuous row of ventral melanophores from throat, along trunk and tail region, one of which is highly ramified; highly ramified melanophore on mid dorsal tail region, opposite to ventral one
Length at flexion: unknown

PHOTOS

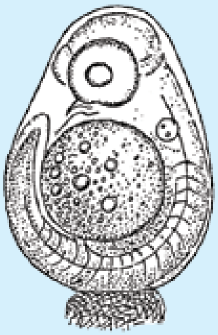
by J.M. Rodriguez

3.2 mm SL

5.9 mm SL

Literature: Alemany (1997), Miller (1986), Padoa (1956h), Russell (1976), Sabatés (1988)

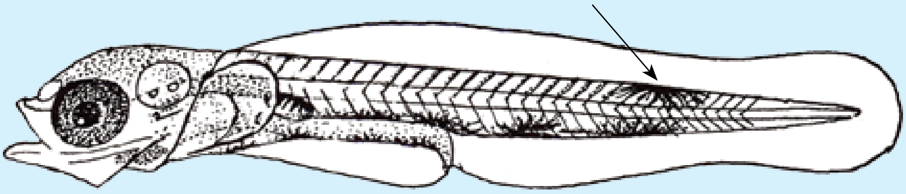
GOBIIDAE — ***Pomatoschistus microps*** (Krøyer, 1838)



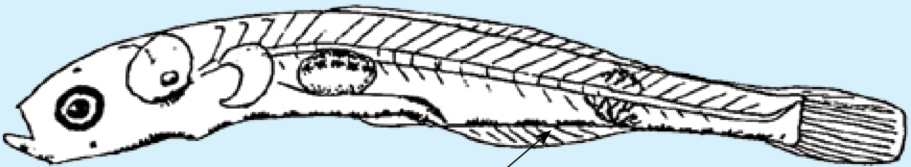
A.

B. 3.0 mm

A dorsal melanophore strongly ramifies at mid–tail region

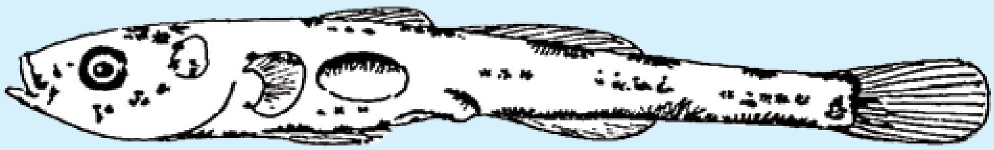


C. 3.6 mm



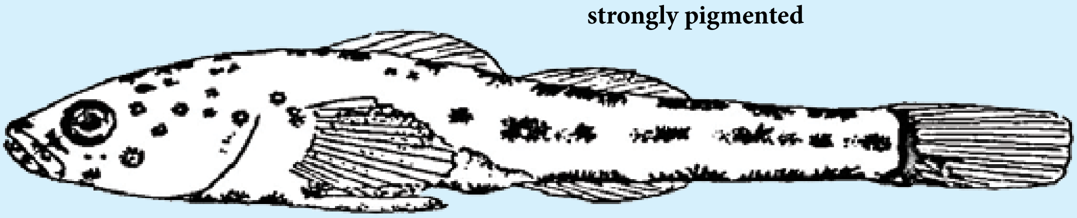
Continuous row of melanophores along ventral side of body

D. 8.0 mm



E. 11.0 mm

Large larvae strongly pigmented



F. 14.0 mm

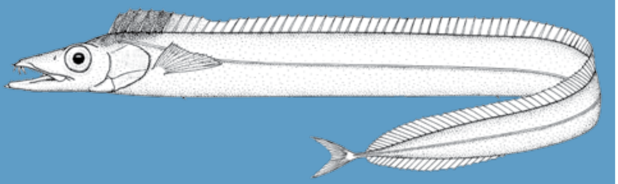
A–F: Padoa (1956h)

TRICHIURIDAE *Lepidopus caudatus* (Euphrasen, 1788)

En: Silver scabbardfish – **Fr:** Sabre argenté – **Sp:** Pez cinto

Habitat: Benthopelagic, on the continental shelf and along its edge, down to 400 m depth; usually over sandy and muddy bottoms between 100 and 250 m depth

Spawning season: Between June and November in the Adriatic Sea



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.6–1.7 mm
Chorion: smooth
Oil globules: single, 0.40 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 6.0 mm

Distinctive characters: oil globule and anus situated at posterior edge of yolk sac; high number of myomeres

Preanus length: about 25% SL

Pigmentation: two dorsal and two ventral melanophores on tail region, one at level of caudal peduncle; some melanophores on head

LARVAE Figs. C–F

Distinctive characters: body very elongate and slender; long cephalic appendix (first ray of dorsal fin) in younger larvae, shortens with development

Preanus length: about 25% SL in young larvae increases to about 50% SL in later larvae

Pigmentation: early stages, similar to yolk–sac larvae: melanophores on head, snout, and post–occipital region, tail patches move into finfold and later into dorsal fin; peritoneum and lateral sides of gut pigmented; pigment over caudal peduncle reduces to its ventral side with development; anterior dorsal pigment patch disappears and others decrease in size; melanophores on dorsal–fin base extends backwards

Length at flexion: unknown

PHOTOS

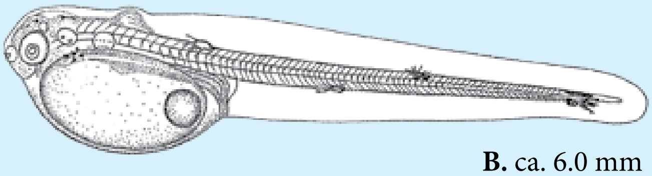
by J.M. Rodriguez

7.3 mm SL

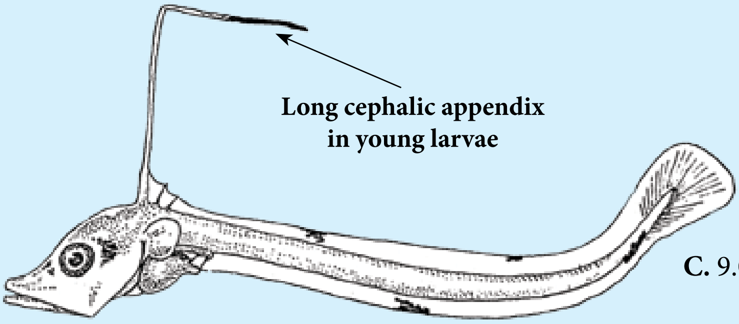
Literature: Froese and Pauly (2016), Padoa (1956o), Parin (1986), Sabatés (1988), Schmidt (1918)

TRICHIURIDAE *Lepidopus caudatus* (Euphrasen, 1788)

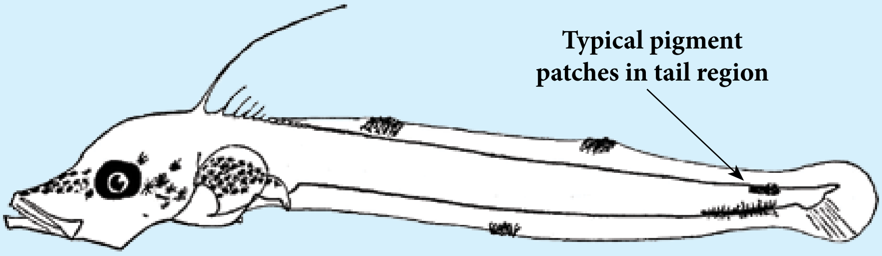
A.



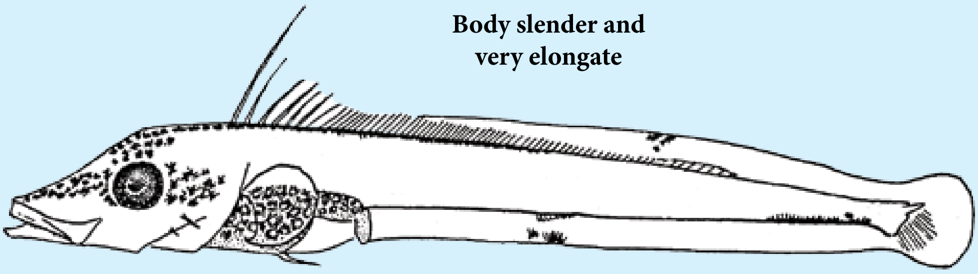
B. ca. 6.0 mm



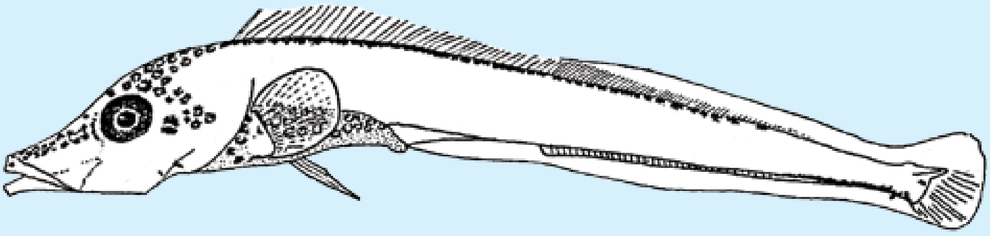
C. 9.0 mm



D. 10.2 mm



E. 12.6 mm



F. 12.9 mm

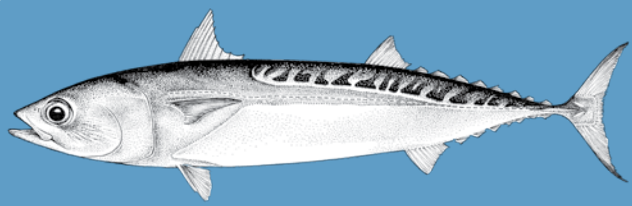
A–F: Schmidt (1918)

SCOMBRIDAE — *Auxis rochei* (Risso, 1810)

En: Bullet tuna – **Fr:** Bonitou – **Sp:** Melva(=Melvera)

Habitat: Epipelagic, in inshore waters and near islands

Spawning season: Between May and November



EGGS

Habitat: pelagic
Shape: spherical
Diameter: 0.82–1.10 mm
Chorion: smooth
Oil globules: single, 0.24–0.29 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE

Hatch size: 2.14 mm SL
Pigmentation: melanophores on head, and a row of melanophores on postanal ventral region; gut pigmented

LARVAE — Figs. A–F

Distinctive characters: body moderately elongate becoming deeper with development; gut compact and triangular; jaws relatively short, compared to other tuna–like species; preopercular spines well–developed

Preanus length: increases from about 37% to 50% SL with development

Pigmentation: early stages, similar to yolk–sac larvae; in late larvae, the origin of ventral postanal row of melanophores moves backwards and melanophores decrease in number; pigmentation of peritoneal region increases; some melanophores appear in the occipital region together with one or two dorsal melanophores, a little ahead of caudal peduncle; these latter ones extend forward with development

Length at flexion: 4.5–6.0 mm

PHOTOS

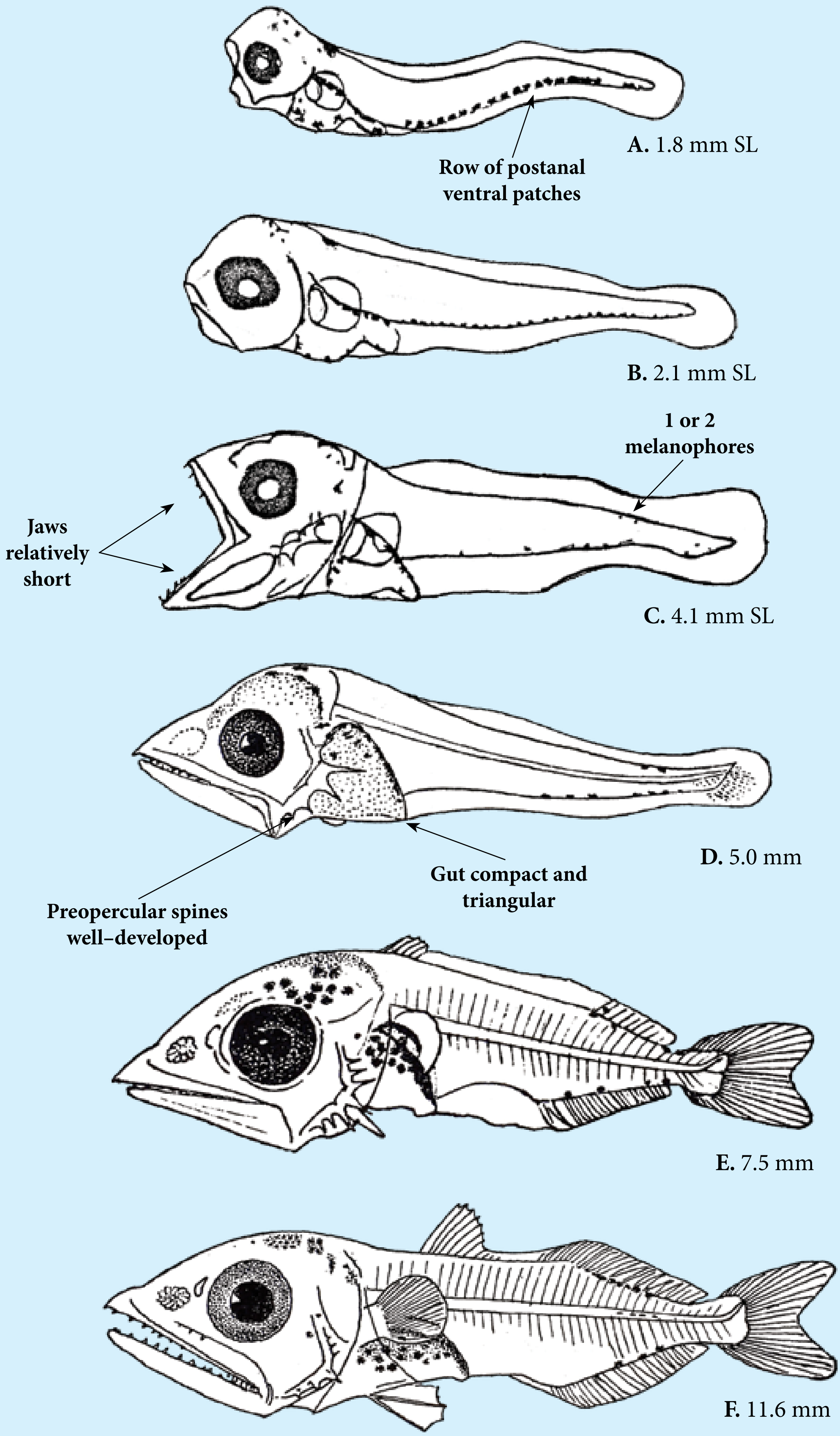
by J.M. Rodriguez

2.4 mm SL

7.0 mm SL

Literature: Alemany (1997), Collette (1986b), Fahay (2007), Padoa (1956l), Richards (2006), Sabatés (1988)

SCOMBRIDAE *Auxis rochei* (Risso, 1810)



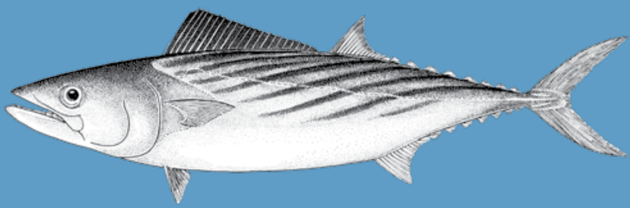
A–C: Alemany (1997); **D–F:** Padoa (1956l)

SCOMBRIDAE

Sarda sarda (Bloch, 1793)

En: Atlantic bonito – **Fr:** Bonite à dos rayé
Sp: Bonito del Atlántico

Habitat: Epipelagic, migratory
Spawning season: Between May and July



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.2–1.32 mm
Chorion: smooth
Oil globules: 1–5; 0.28–0.32 mm in diameter, when single; 0.02–0.24 mm in diameter, when multiple
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: about 4.0 mm
Distinctive characters: yolk sac voluminous; oil globules situated at posterior edge of yolk sac
Pigmentation: finfold pigmented in its anterior dorsal part; small melanophores on head and along dorsal region; some isolated melanophores on lateral and ventral sides of body

LARVAE

Figs. C–F

Distinctive characters: body moderately elongate, deepest at level of pectoral region; head large with pointed snout and jaws; prominent teeth from early larvae on; preopercular spines well developed; gut compact and triangular
Preanus length: increases from about 50% SL to 60% SL with development
Pigmentation: series of large spots along ventral tail region, move up internally between myomeres with development; top of head and peritoneal region well–pigmented; melanophores at cleithral symphysis, at lower jaw tip and caudal–fin base; patch of pigment in lateral caudal region in older larvae
Length at flexion: 6.0–7.0 mm SL

PHOTOS

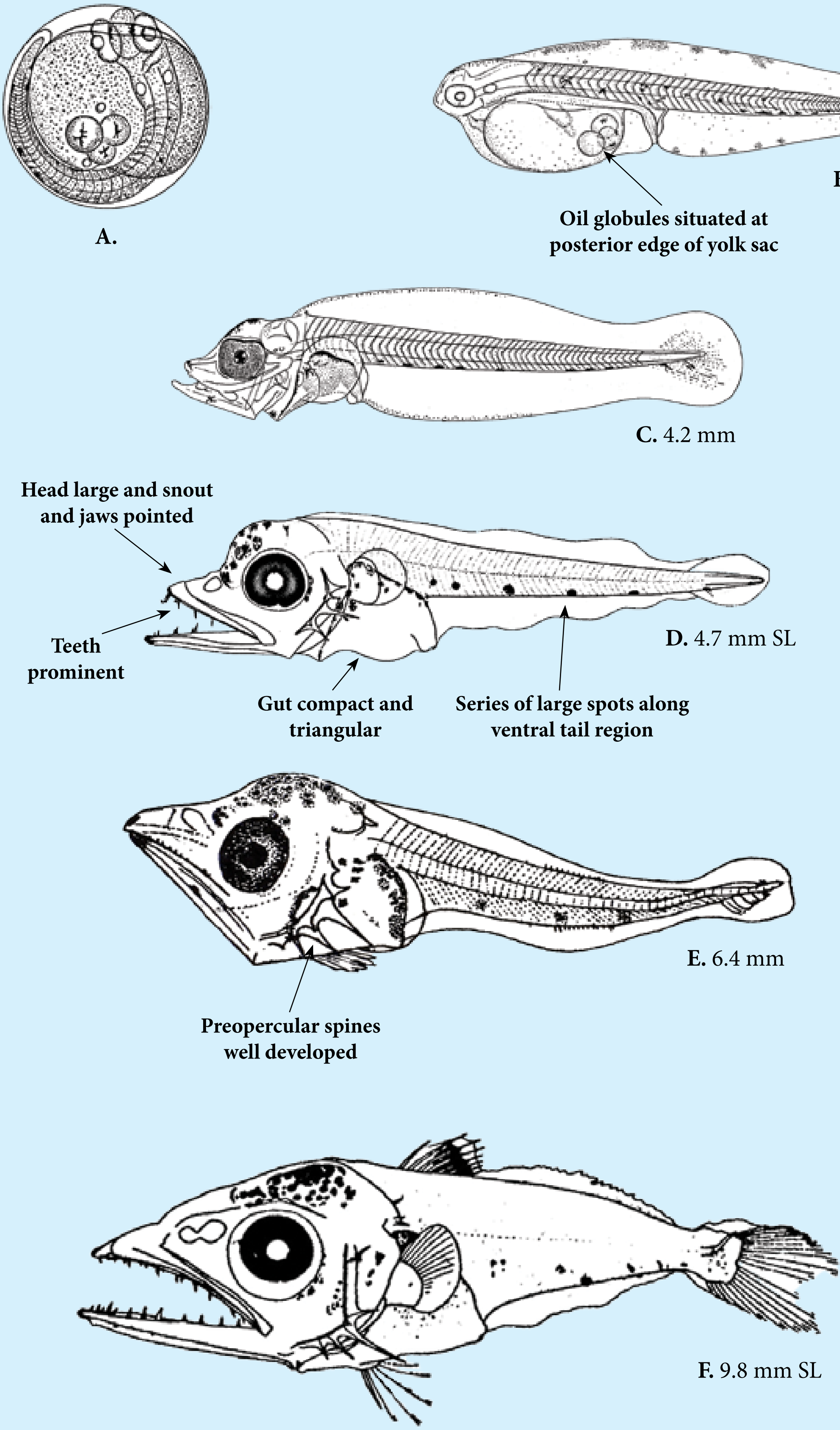
by J.M. Rodriguez

3.5 mm SL

4.0 mm SL

Literature: Collette (1986b), Fahay (2007), Padoa (1956l), Richards (2006)

SCOMBRIDAE — ***Sarda sarda*** (Bloch, 1793)



A–C, E: Padoa (1956l); **D, F:** Richards (2006)

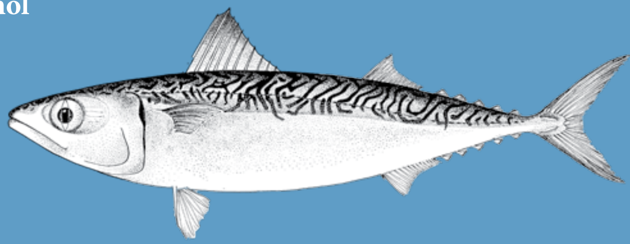
SCOMBRIDAE *Scomber colias* Gmelin, 1789

En: Atlantic chub mackerel – **Fr:** Maquereau espagnol

Sp: Estornino

Habitat: Epipelagic or meso–demersal, down to 250–300 m depth

Spawning season: Summer



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.04–1.14 mm
Chorion: smooth
Oil globules: single, 0.26–0.27 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 3.0 mm SL

Distinctive characters: body relatively elongate; oil globule located at posterior edge of the yolk sac

Pigmentation: melanophores irregularly distributed along dorsal and ventral contours of body; melanophores on snout and behind eye; yolk sac and oil globule pigmented

LARVAE Figs. C–F

Distinctive characters: body moderately elongate, becoming stubby with development, deeper than that of larvae of comparable sizes of *Scomber scombrus*; head moderate; gut compact and triangular; jaws relatively short; no head spines; teeth prominent in larvae larger than 4.0 mm SL; the number of myomeres allows for distinguishing this species (32) from *Diplodus* species (24)

Preanus length: increases from about 50% SL to more than 60% SL with development

Pigmentation: postanal ventral rows of melanophores starting some distance from anus; larvae less than 7 mm long may only show two dorsal melanophores, situated on caudal peduncle; peritoneum pigmented; melanophores at caudal–fin base; melanophores on head; no melanophores on body sides in preflexion stages; no melanophores at cleithral symphysis and on isthmus

Length at flexion: about 6 mm

PHOTOS

by J.M. Rodriguez

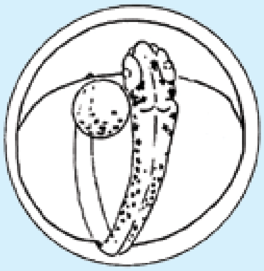
4.4 mm SL

7.0 mm SL

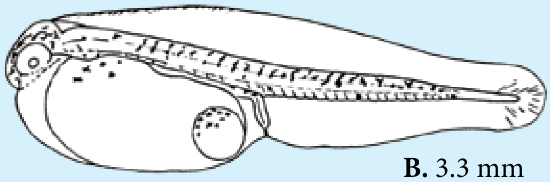
Literature: Berrien (1978), Collette (1986b), Kramer (1969), Sabatés (1988)

SCOMBRIDAE

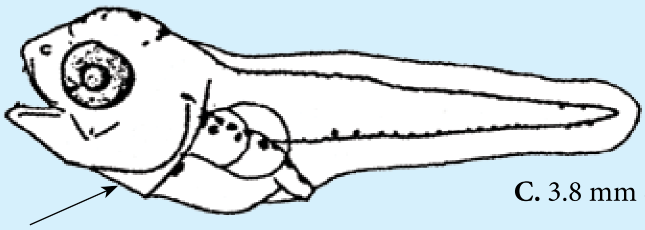
Scomber colias Gmelin, 1789



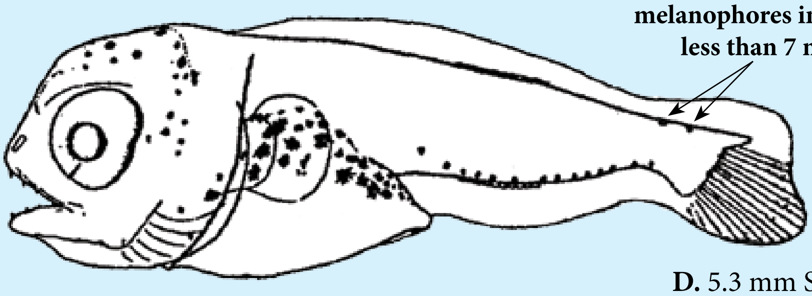
A.



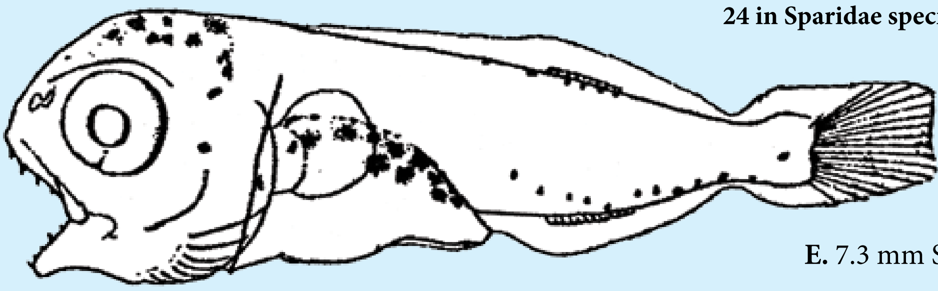
B. 3.3 mm



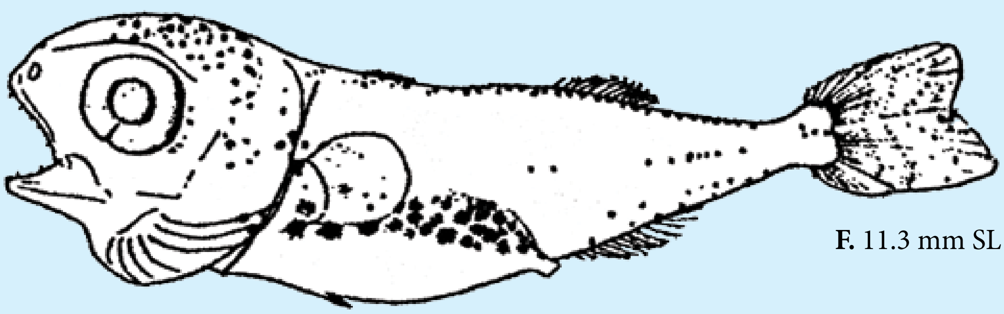
C. 3.8 mm SL



D. 5.3 mm SL



E. 7.3 mm SL



F. 11.3 mm SL

A, B: Kramer (1969); **C–F:** Berrien (1978)

SCOMBRIDAE

Scomber scombrus Linnaeus, 1758

En: Atlantic mackerel – **Fr:** Maquereau commun

Sp: Caballa del Atlántico

Habitat: Epipelagic or meso–demersal, down to 200–250 m depth

Spawning season: March and April

EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.38 mm
Chorion: smooth
Oil globules: single, 0.28–0.35 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: 3.3 mm SL

Distinctive characters: body relatively elongate; oil globule located at posterior edge of yolk sac

Pigmentation: melanophores on head; double rows of irregularly distributed melanophores along dorsal and ventral contours of body; peritoneum pigmented; melanophores on snout and behind eye; oil globule pigmented

LARVAE

Figs. C–G

Distinctive characters: body moderately elongate, becoming stubbier with development; head moderate; gut compact and triangular; jaws relatively short; no head spines; teeth prominent in larvae larger than 4.0 mm SL

Preanus length: increases from about 40% SL to more than 60% SL with development

Pigmentation: postanal rows of dorsal and ventral melanophores; in earliest larval stages, there may be fewer melanophores in the dorsal row, equaling their number (14–15) with development; peritoneum pigmented; some melanophores on urostyle and along caudal–fin base; melanophores on head and sometimes on snout and lower jaw; no melanophores on body sides in preflexion larvae; melanophores at cleithral symphysis and on itsmus

Length at flexion: 5.0–7.0 mm

PHOTOS

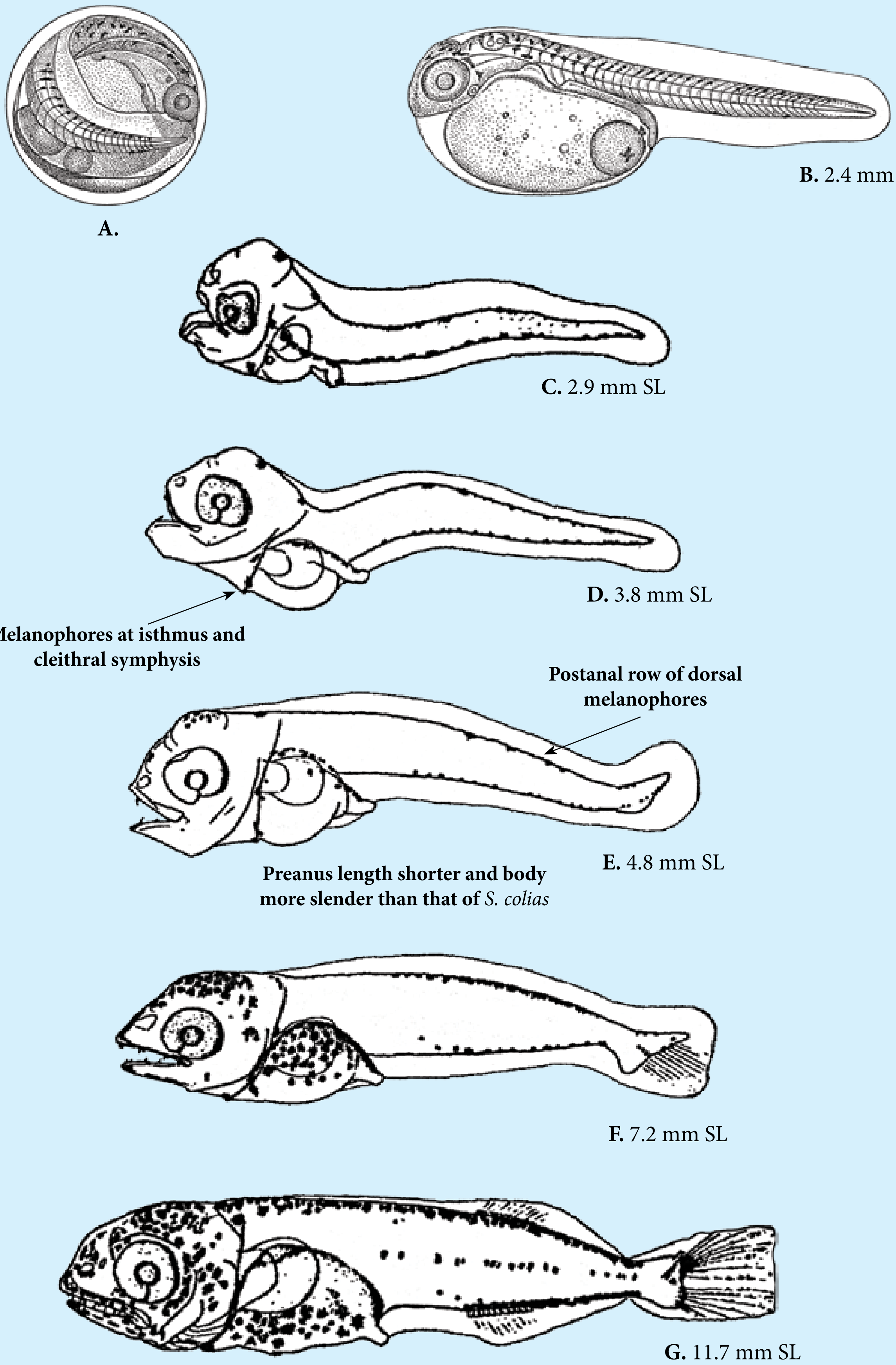
by J.M. Rodriguez

3.7 mm SL

7.0 mm SL

Literature: Berrien (1978), Collette (1986b), Froese and Pauly (2016), Padoa (1956l), Sabatés (1988)

SCOMBRIDAE — ***Scomber scombrus*** Linnaeus, 1758



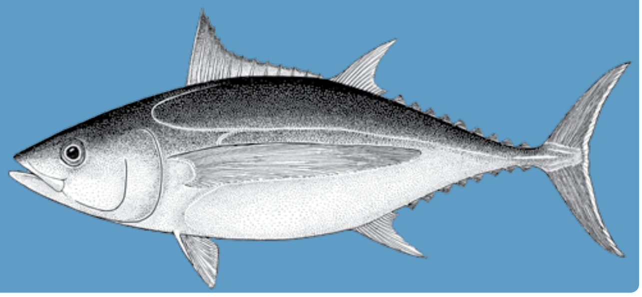
A, B: Padoa (1956l); **C–G:** Berrien (1978)

SCOMBRIDAE *Thunnus alalunga* (Bonnaterre, 1788)

En: Albacore – **Fr:** Germon – **Sp:** Atún blanco

Habitat: Epi–mesopelagic, down to 100 m depth

Spawning season: Between June and August



EGGS

Habitat: pelagic
Shape: spherical
Diameter: 0.84–0.94 mm
Chorion: smooth
Oil globules: single, 0.24 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE Fig. A

Hatch size: about 2.6 mm SL
Pigmentation: melanophores on yolk and on gut; dotted melanophores dorsal and ventral to urostyle

LARVAE Figs. B–F

Distinctive characters: body moderately stocky, deepest at level of pectoral region, tapering to a narrow caudal peduncle; large head with pointed snout and jaws; preopercular spines present; gut compact and triangular
Preanus length: increases from about 40% SL to about 55% SL with development
Pigmentation: few dotted dorsal melanophores over urostyle disappear with development; peritoneal region strongly pigmented; occipital region pigmented; melanophore at snout tip in older larvae
Length at flexion: 5.0–7.0 mm SL

PHOTOS

by J.M. Rodriguez

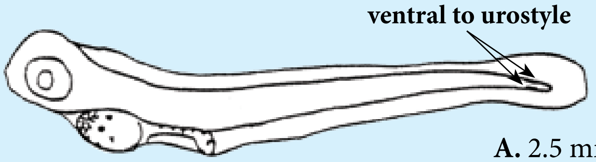
3.4 mm SL

7.0 mm SL

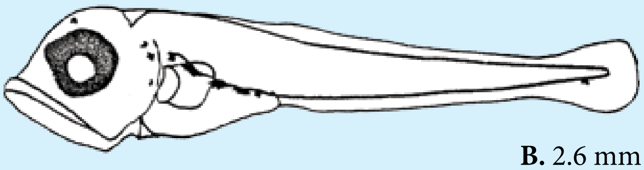
Literature: Alemany (1997), Fahay (2007), Froese and Pauly (2016), Richards (2006)

SCOMBRIDAE

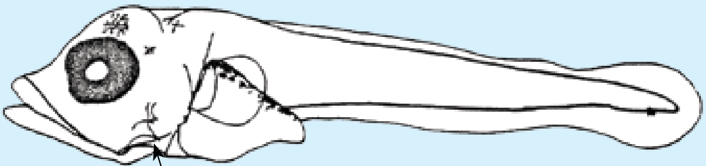
Thunnus alalunga (Bonnaterre, 1788)



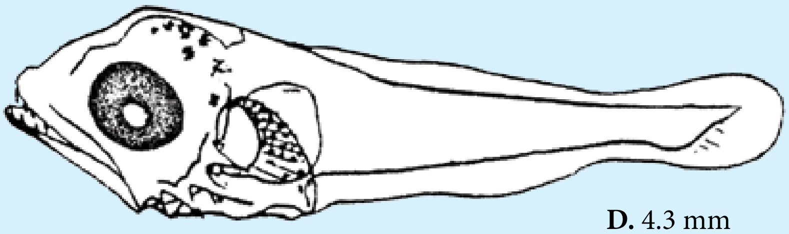
A. 2.5 mm SL



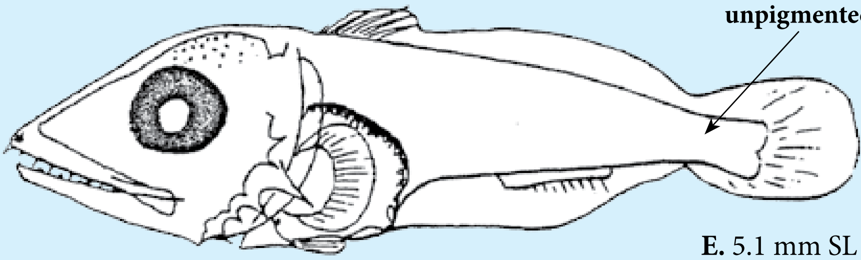
B. 2.6 mm SL



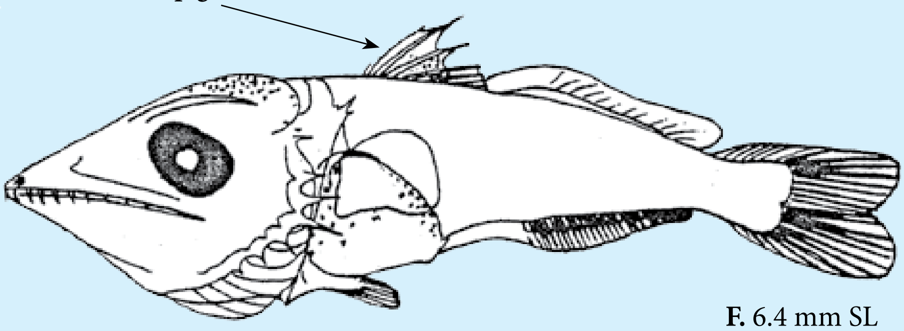
C. 3.1 mm SL



D. 4.3 mm



E. 5.1 mm SL



F. 6.4 mm SL

A–F: Alemany (1997)

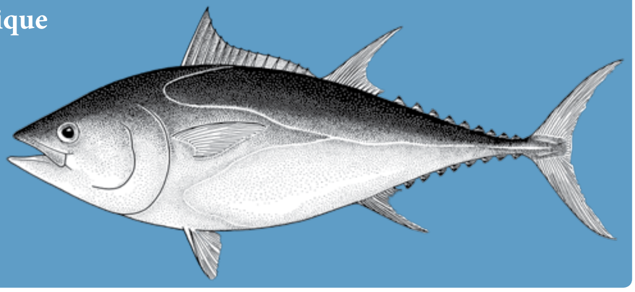
SCOMBRIDAE *Thunnus thynnus* (Linnaeus, 1758)

En: Atlantic bluefin tuna – **Fr:** Thon rouge de l'Atlantique

Sp: Atún rojo del Atlántico

Habitat: Epi–mesopelagic, carrying out trans–oceanic migrations

Spawning season: Between May and July



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.12 mm
Chorion: smooth
Oil globules: single, 0.25–0.28 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Hatch size: 3.0 mm TL
Pigmentation: large mid–trunk dorsal melanophore extending to finfold

LARVAE Figs. B–F

Distinctive characters: body stout, deepest at level of pectoral region, tapering to a narrow caudal peduncle; large head with pointed snout and jaws; gut compact and triangular; preopercular spines present

Preanus length: increases from about 40% SL to about 55% SL with development

Pigmentation: about 4 dotted postanal–ventral melanophores; a single melanophore on dorsal side of mid–tail, migrating towards dorsal fin with development; peritoneal region strongly pigmented

Length at flexion: 5.0–7.0 mm SL

PHOTOS

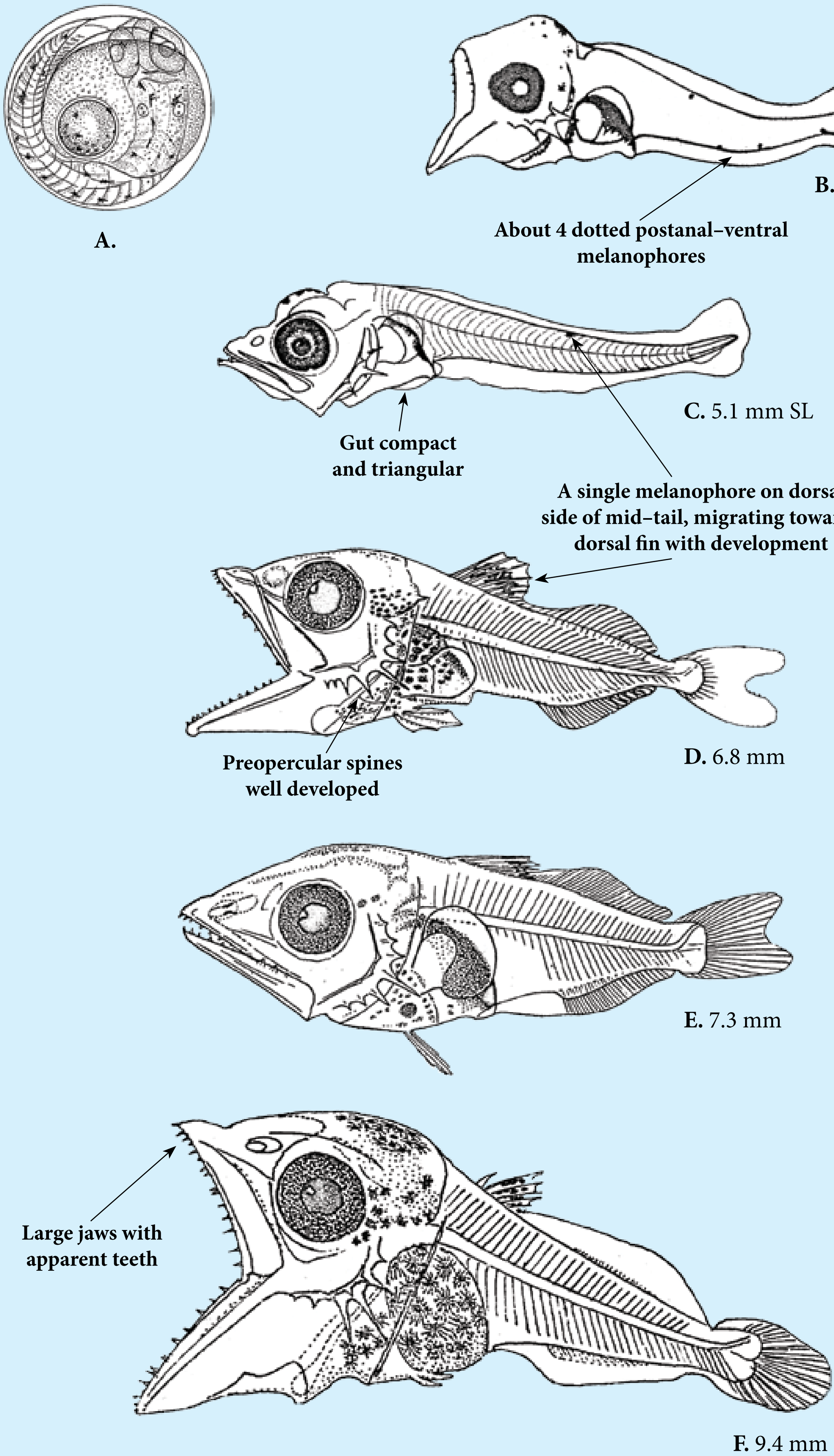
by J.M. Rodriguez

3.8 mm SL

6.7 mm SL

Literature: Alemany (1997), Collette (1986b), Fahay (2007), Richards (2006)

SCOMBRIDAE *Thunnus thynnus* (Linnaeus, 1758)



A, D–F: Padoa (1956l); **B:** Alemany (1997); **C:** Richards (2006)

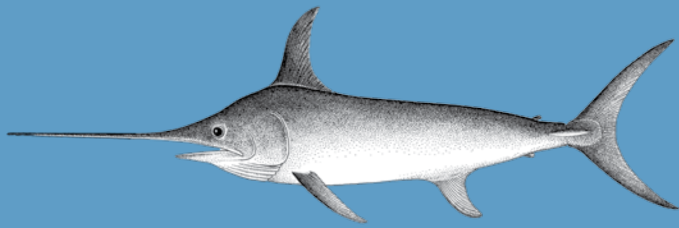
XIPHIIDAE

Xiphias gladius Linnaeus, 1758

En: Swordfish – **Fr:** Espadon – **Sp:** Pez espada

Habitat: Pelagic, oceanic down to 800 m depth, strongly migratory

Spawning season: June to September



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.6–1.8 mm
Chorion: smooth
Oil globules: single, 0.40 mm in diameter
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE — Fig. B

Hatch size: about 4.2 mm
Distinctive characters: yolk sac large; oil globule situated at posterior edge of yolk sac
Pigmentation: body and finfold covered with small melanophores, grouped at myosepta

LARVAE — Figs. C–F

Distinctive characters: body relatively stubby, with bulky gut, becoming elongate with development; head shallow, with elongate jaws; mouth very large, extending posteriorly beyond eye; teeth well formed by 6.0 mm SL; spinous scales in larger larvae
Preanus length: between 70 and 80% SL, increasing with development
Pigmentation: body, except caudal peduncle, covered with small branched melanophores
Length at flexion: 8.0–12.0 mm SL

PHOTOS

by J.M. Rodriguez

3.7 mm SL

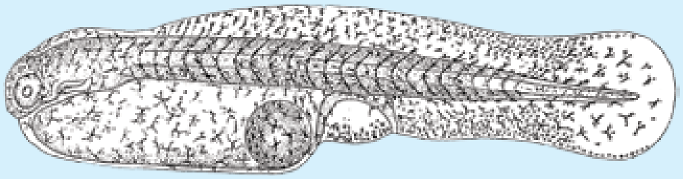
Not sized

Literature: Alemany (1997), Arata Jr. (1954), Nakamura (1986), Padoa (1956r), Richards (2006)

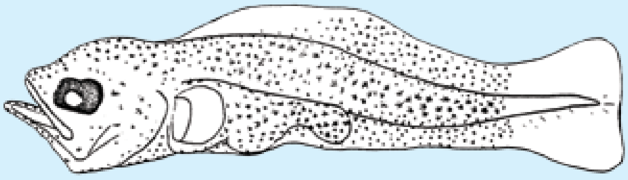
XIPHIIDAE

Xiphias gladius Linnaeus, 1758

A.

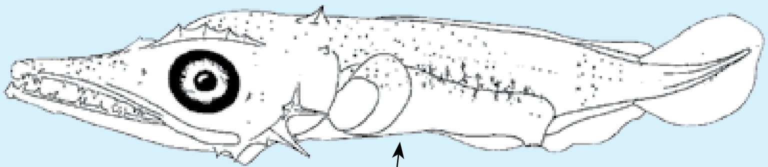


B. 4.2 mm SL



Body, except caudal peduncle, covered with small branched melanophores

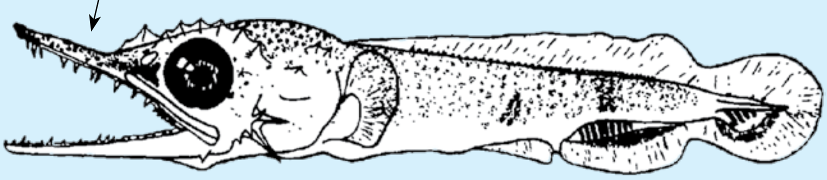
C. 4.1 mm SL



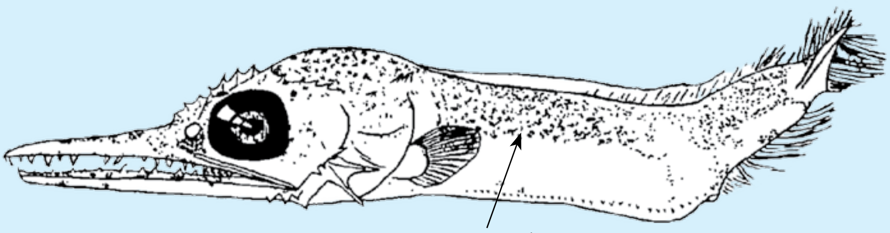
Gut bulky

D. 6.1 mm SL

Mouth large with elongate jaws and prominent teeth



E. 7.8 mm SL



Spinous scales in larger larvae

F. 9.0 mm SL

A, B: Padoa (1956r); **C:** Alemany (1997); **D:** Collette *et al.* (1984); **E, F:** Arata Jr. (1954)

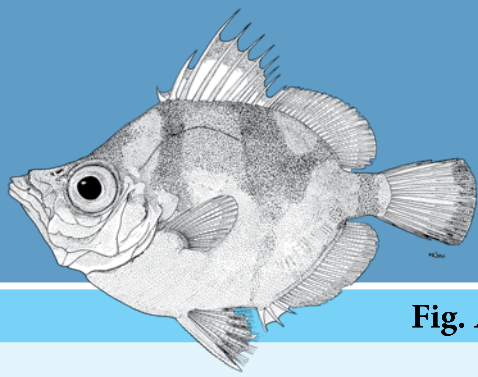
CAPROIDAE

Capros aper (Linnaeus, 1758)

En: **Boarfish** – **Fr:** **Sanglier** – **Sp:** **Ochavo**

Habitat: Benthic, between 25 and 600 m depth

Spawning season: Between March and August



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.90–1.01 mm
Chorion: smooth
Oil globules: single, 0.15–0.17 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: 2.02–2.46 mm
Pigmentation: body, except caudal region, covered with large stellate melanophores

LARVAE

Figs. C–F

Distinctive characters: body thin during first stages of development, acquires a rhomboid shape at about 3 mm SL; opercular spines and a spiny crest over head appear with development; first dorsal fin spinous; body covered with small spines in later larvae

Preanus length: about 50% SL

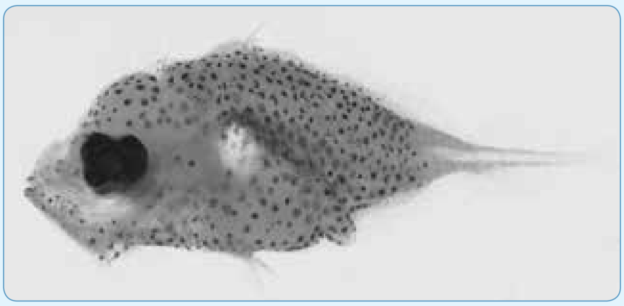
Pigmentation: early larvae with a row of ventral melanophores above gut to about midway, along postanal region; dorsal row of six large melanophores extending from mid–gut to level of ventral row; row of melanophores along ventral abdominal surface; some melanophores on head and on mid–lateral side of body; upper and lower jaw tips pigmented; only caudal peduncle remains free of pigment in later larvae

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez

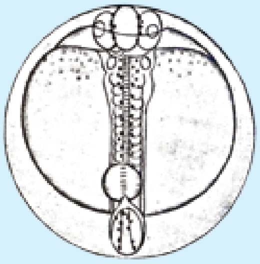
2.0 mm SL



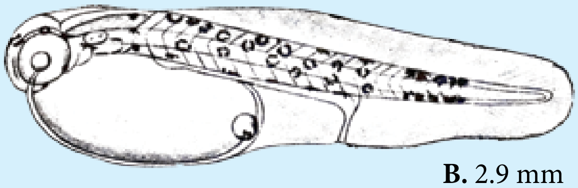
3.0 mm SL

Literature: Alemany (1997), Froese and Pauly (2016), Quero (1986a), Russell (1976)

CAPROIDAE *Capros aper* (Linnaeus, 1758)



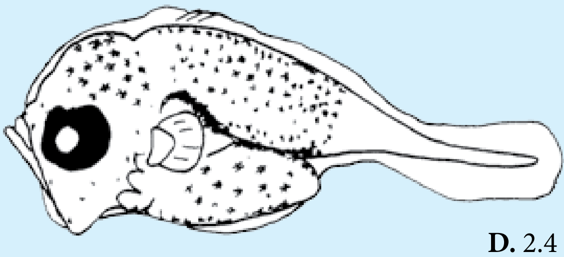
A.



B. 2.9 mm

C. 2.9 mm

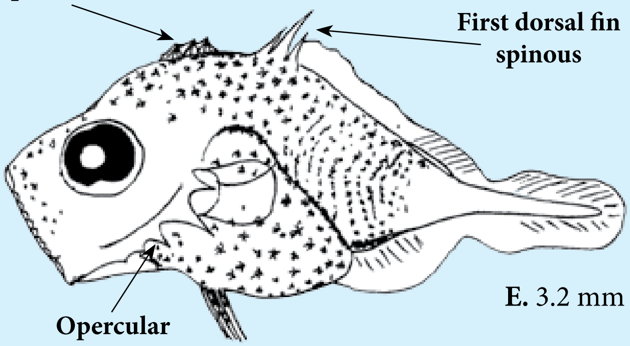
Body rhomboid-shaped in late larvae



D. 2.4 mm SL

Spinous crest

First dorsal fin spinous

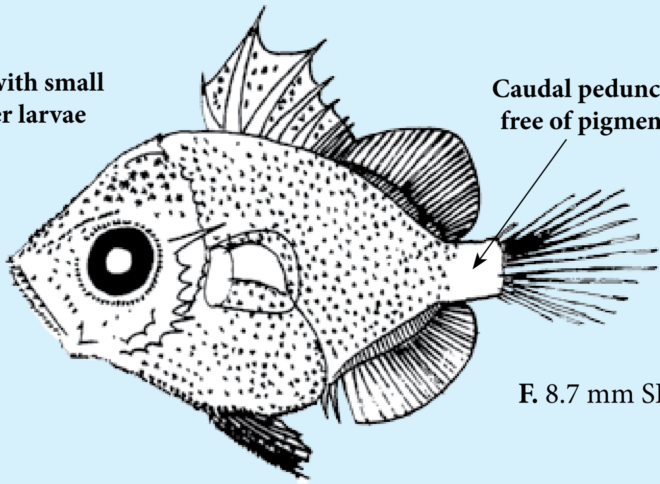


Opercular spines

E. 3.2 mm SL

Body covered with small spines in older larvae

Caudal peduncle free of pigment



F. 8.7 mm SL

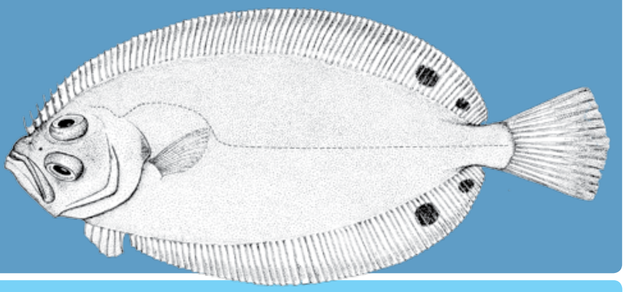
A, B: Sanzo (1956b); **C:** Russell (1976); **D, E:** Alemany (1997); **F:** Fage (1918)

SCOPHTHALMIDAE *Lepidorhombus boscii* (Risso, 1810)

En: Four–spot megrim – **Fr:** Cardine à quatre taches
Sp: Gallo de cuatro manchas

Habitat: Benthic, down to 800 m depth

Spawning season: Between May and October



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE Figs. A–E

Distinctive characters: body relatively slender at early stages; trunk and abdominal regions increase considerably in depth with development; larvae more than 5.0 mm long show preopercular spines and a spine on each side of upper posterior side of head

Preanus length: less than 50% SL

Pigmentation: 4 melanophores evenly arranged along dorsal side of body and 3 postanal ventral melanophores; gut, head and frontal region pigmented

Length at flexion: unknown

Remarks: asymmetry starts when the larva is about 9.7 mm long

PHOTOS

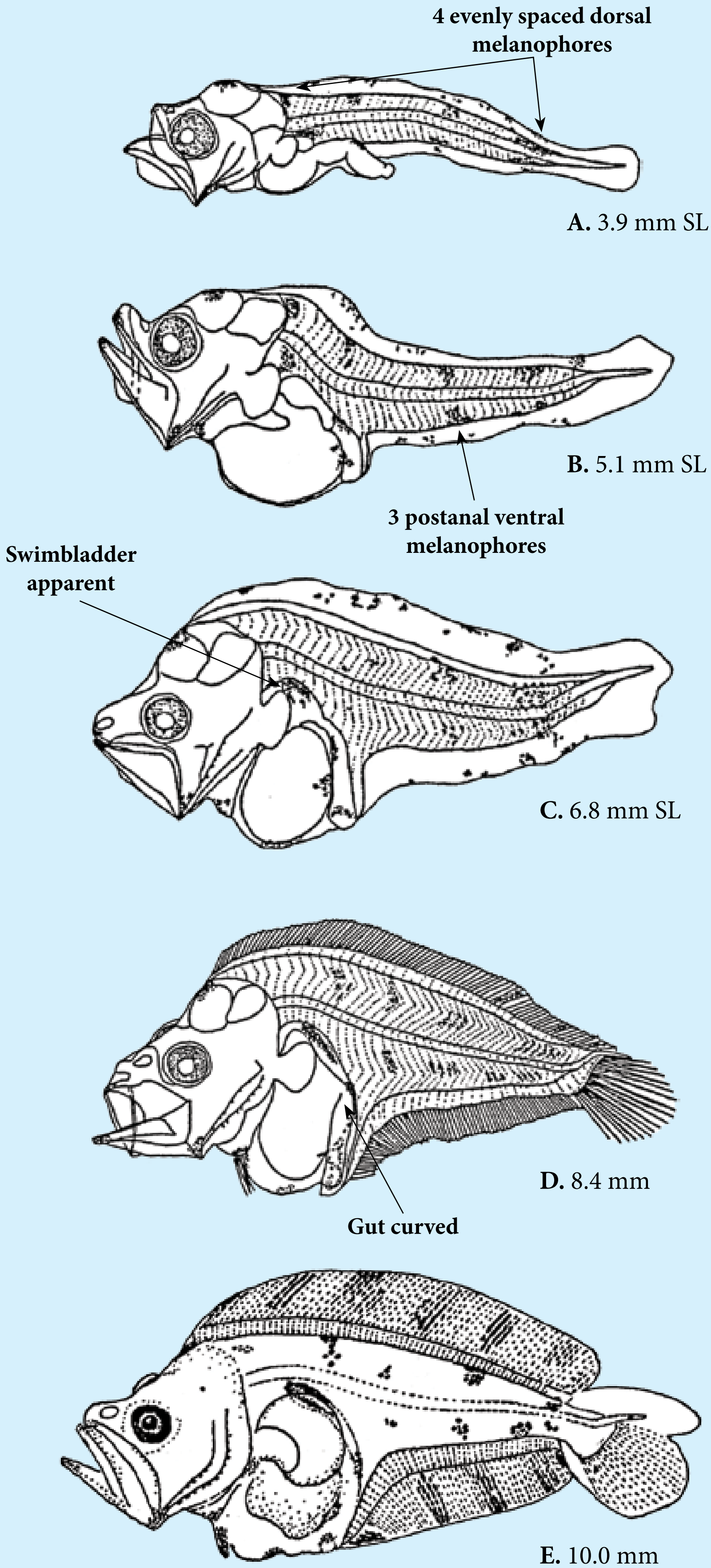
by J.M. Rodriguez

3.2 mm SL

6.9 mm SL

Literature: Alemany (1997), Nielsen (1986d), Padoa (1956c), Russell (1976), Sabatés (1991)

SCOPHTHALMIDAE *Lepidorhombus boscii* (Risso, 1810)



A–D: Sabatés (1991); **E:** Padoa (1956c)

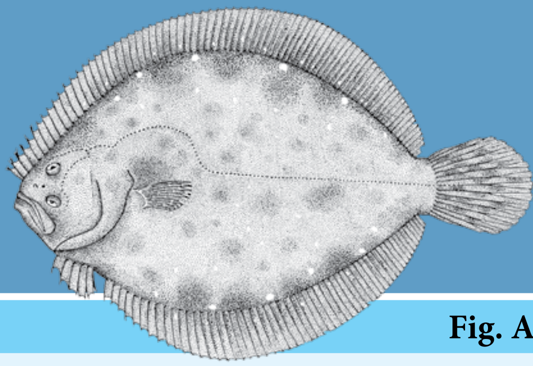
SCOPHTHALMIDAE

Scophthalmus rhombus (Linnaeus, 1758)

En: Brill – **Fr:** Barbue – **Sp:** Rémol

Habitat: Benthic, between 5 and 70 m depth

Spawning season: Between February and April (probably)



EGGS

Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.24–1.50 mm
Chorion: smooth
Oil globules: 0.16–0.25 mm in diameter
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE

Fig. B

Hatch size: 3.8–4.0 mm

Pigmentation: body (except caudal region) and yolk sac pigmented; melanophores extend onto finfold to form a wide postanal bar and a dorsal patch above gut

LARVAE

Figs. C–F

Distinctive characters: body relatively elongate and slender becomes laterally compressed and ovoid with development; a spiny ridge above eye and opercular spines

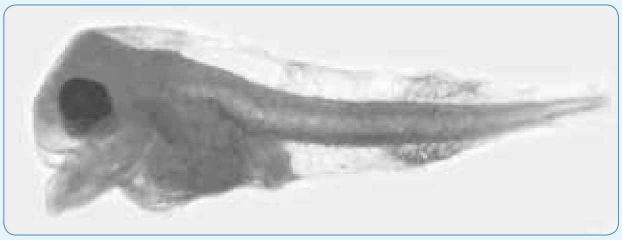
Preanus length: about 50% SL

Pigmentation: body covered with melanophores (caudal region free of pigment in early larvae); body pigment extends onto dorsal and anal fins forming almost regular bands in older larvae

Length at flexion: unknown

PHOTOS

by J.M. Rodriguez



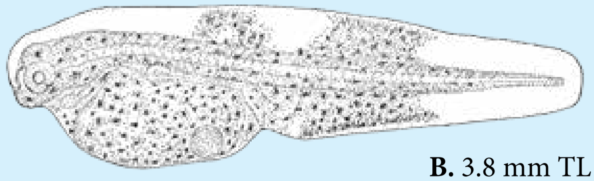
2.8 mm SL

3.2 mm SL

Literature: Jones (1972), Padoa (1956c), Russell (1976), Sabatés (1988)

SCOPHTHALMIDAE *Scophthalmus rhombus* (Linnaeus, 1758)

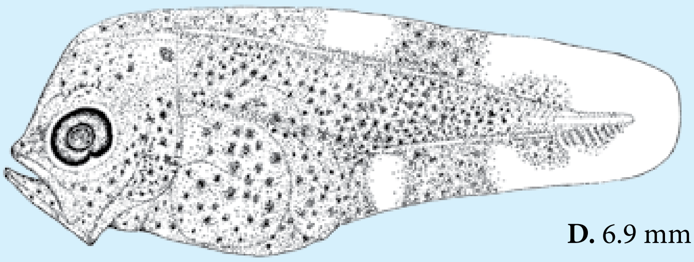
A.



B. 3.8 mm TL

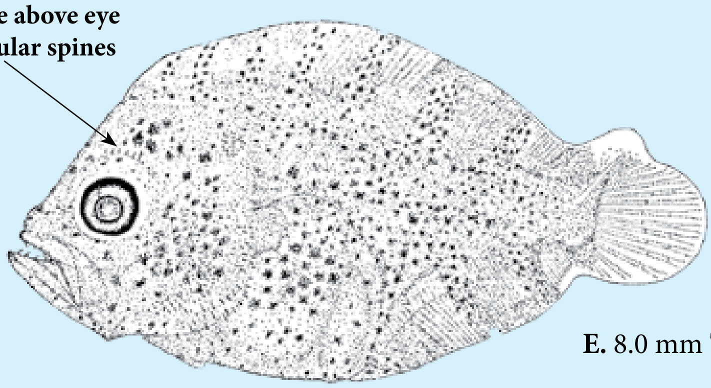
C. 5.8 mm TL

Body covered with melanophores (caudal region free of pigment in early larvae)



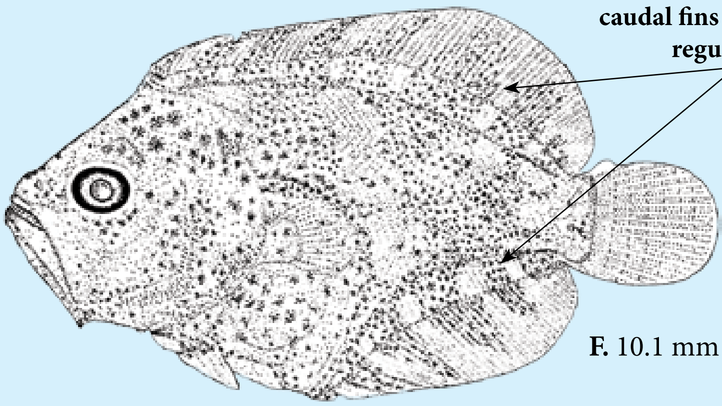
D. 6.9 mm TL

Spiny ridge above eye and opercular spines



E. 8.0 mm TL

In old larvae, body pigment extends onto dorsal and caudal fins forming almost regular bands



F. 10.1 mm TL

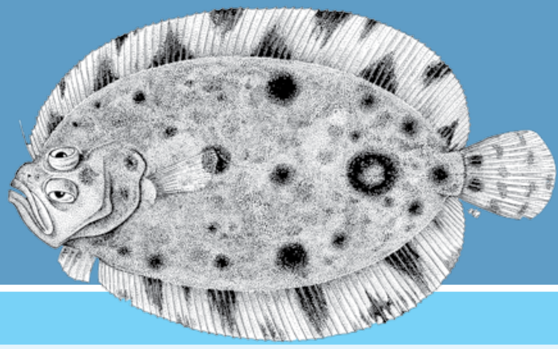
A: Padoa (1956c); **B–F:** Jones (1972)

SCOPHTHALMIDAE *Zeugopterus regius* (Bonnaterre, 1788)

En: Eckström's topknot – **Sp:** Pelaya miseres

Habitat: Benthic, from a few to 300 m depth

Spawning season: Between May and August in the British Isles



EGGS

Habitat: pelagic
Shape: spherical
Diameter: 0.90–0.99 mm
Chorion:. smooth
Oil globules: 0.16–0.18 mm in diameter
Yolk: unsegmented

YOLK–SAC LARVAE Fig. A

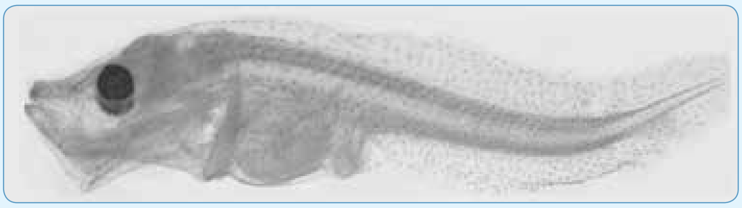
Hatch size: about 2.4 mm
Pigmentation: body, yolk sac and finfold covered with small melanophores

LARVAE Figs. B–E

Distinctive characters: body relatively short and relatively deep at level of pectoral region; two large otocystic spines on each side of head
Preanus length: about 50% SL
Pigmentation: body and fins covered with small melanophores
Length at flexion: completed at about 6.7 mm

PHOTOS

by J.M. Rodriguez

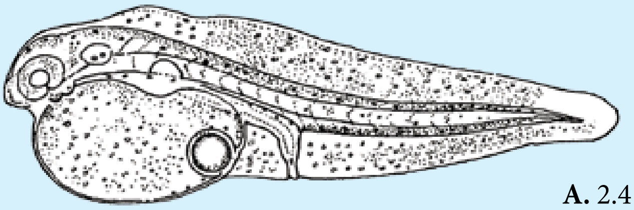


4.8 mm SL

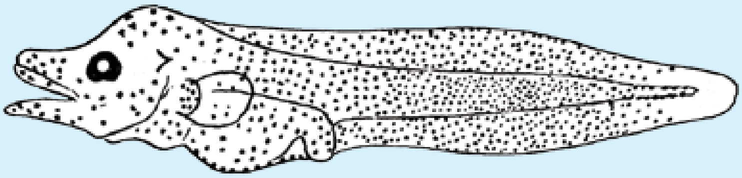
9.0 mm SL

Literature: Padoa (1956c), Russell (1976), Sabatés (1988), Tortonese (1970)

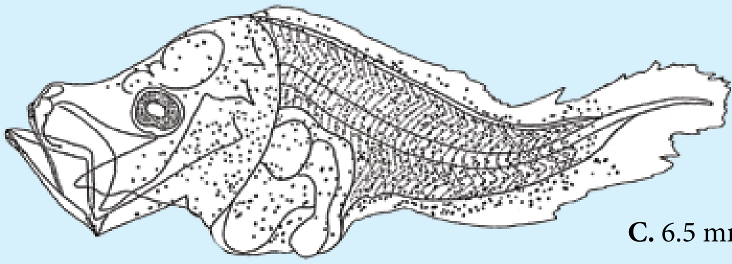
SCOPHTHALMIDAE ***Zeugopterus regius*** (Bonnaterre, 1788)



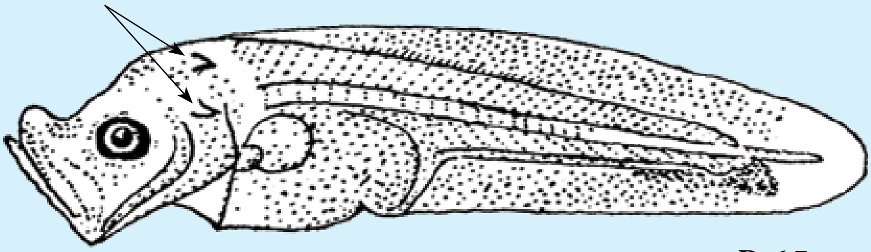
A. 2.4 mm



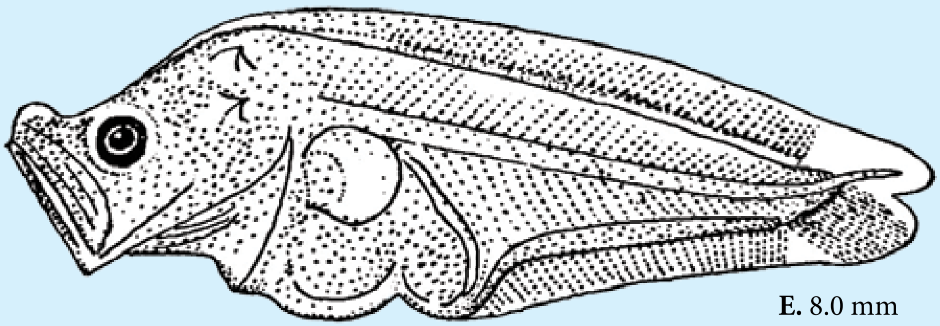
B. 4.7 mm



C. 6.5 mm SL



D. 6.7 mm



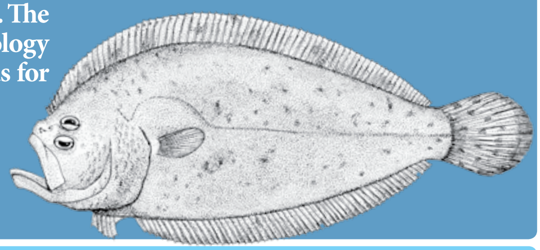
E. 8.0 mm

A, D, E: Padoa (1956c); **B:** Russell (1976); **C:** Sabatés (1988)

BOTHIDAE *Arnoglossus laterna* (Walbaum, 1792)

En: Mediterranean scaldfish – Fr: Arnoglosse de Méditerranée – Sp: Serrandell

Five *Arnoglossus* species are known to occur in the Mediterranean Sea. The identification of their larvae is difficult due to their similar morphology and pigmentation pattern. *A. laterna* is the only species of this genus for which all early life stages have been described and is here presented.



Habitat: Benthic, over muddy and sandy bottoms down to 200 m depth, occasionally to 400 m

Spawning season: Between April and August

EGGS — Fig. A

Habitat: pelagic

Shape: spherical

Diameter: 0.60–0.76 mm

Chorion: smooth

Oil globules: single, 0.11–0.15 mm in diameter

Perivitelline space: small

Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: about 2.5 mm

Pigmentation: free of black pigment

LARVAE — Figs. C–F

Distinctive characters: body relatively elongate, increases in height and becomes laterally compressed with development; gut becomes curved; elongate tentacle over head, disappears in older larvae; swimbladder prominent; minute spines on different regions of body in larger larvae

Preanus length: about 40% SL

Pigmentation: two rows of evenly spaced ventral melanophores, extending from anus to caudal end; dorsal bar of melanophores close to caudal region; melanophores along abdominal ventral contour, on lower jaw and over hindgut; swimbladder pigmented

Length at flexion: unknown

PHOTOS

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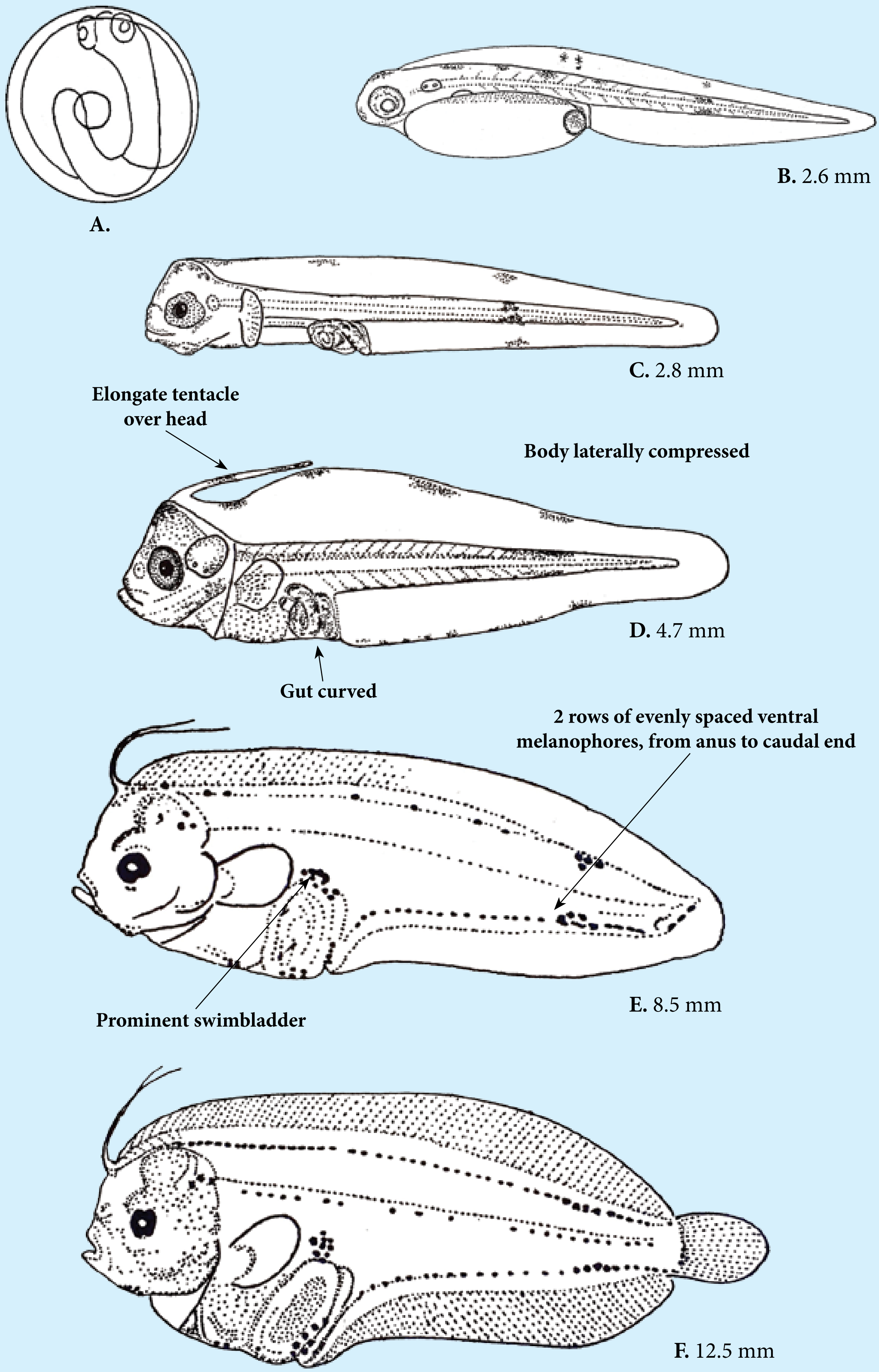
3.9 mm SL

6.2 mm SL

Literature: Alemany (1997), Nielsen (1986a), Padoa (1956c), Russell (1976), Sabatés (1988)

BOTHIDAE *Arnoglossus laterna* (Walbaum, 1792)



A–F: Padoa (1956c)

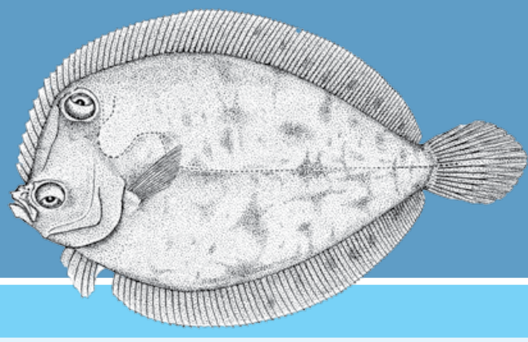
BOTHIDAE

Bothus podas (Delaroche, 1809)

En: Wide–eyed flounder

Habitat: Benthic, over sand and mud of the continental shelf and slope, from a few to 400 m depth

Spawning season: Between May and August



EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE

Figs. A–D

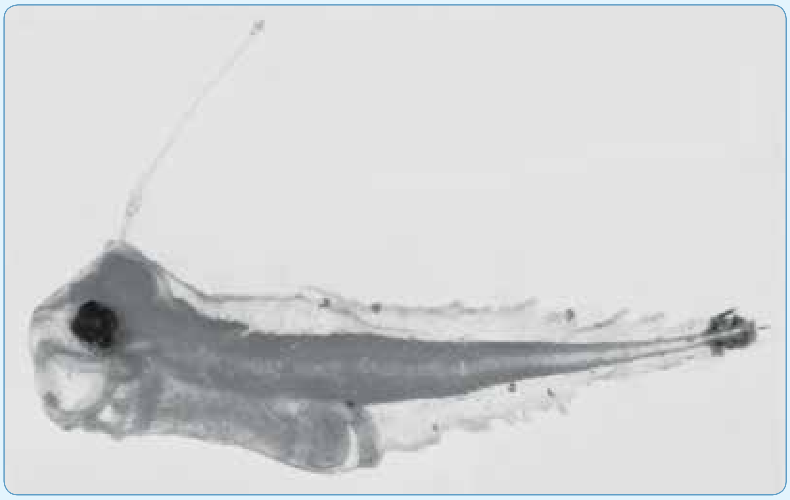
Distinctive characters: body very similar to that of *Arnoglossus* larvae; relatively elongate, increases in height and becomes laterally compressed with development; gut curved; elongate tentacle over head; swimbladder prominent

Pigmentation: large melanophores on dorsal and ventral side of urostyle; rest of body, unpigmented

Length at flexion: flexion begins at about 7.0 mm

PHOTOS

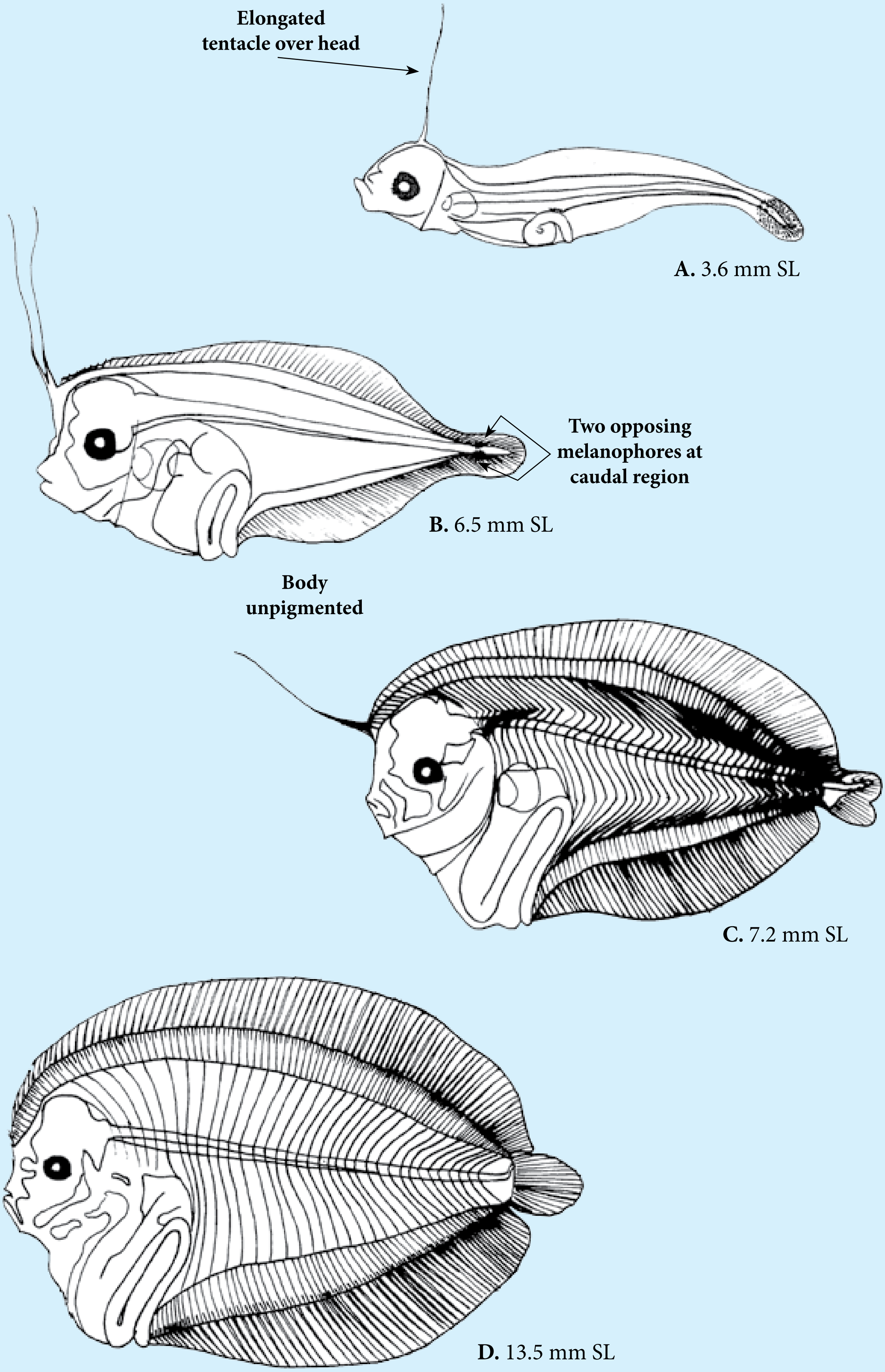
by J.M. Rodriguez



3.9 mm SL

Literature: Alemany (1997), Padoa (1956c), Sabatés (1988), Tortonese (1975)

BOTHIDAE — ***Bothus podas*** (Delaroche, 1809)



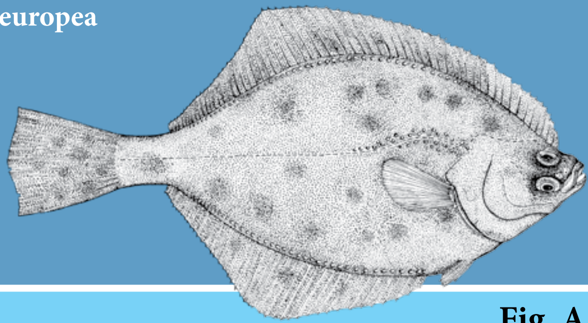
A–D: Alemany (1997)

PLEURONECTIDAE *Platichthys flesus* (Linnaeus, 1758)

En: European flounder – **Fr:** Flet d'Europe – **Sp:** Platija europea

Habitat: Benthic, at shallow depths on soft bottoms

Spawning season: Between December and March (Black Sea)



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.8–1.13 mm
Chorion: smooth
Oil globules: none
Perivitelline space: small
Yolk: unsegmented

YOLK–SAC LARVAE — Fig. B

Hatch size: about 2.3 mm

Pigmentation: no pigmentation on primordial fin in earlier larvae; as development proceeds, a group of melanophores develops about mid–way along postanal region, spreading out dorsally and ventrally onto the primordial fin; other melanophores scattered on body; postanal end region unpigmented

LARVAE — Figs. C–F

Distinctive characters: body elongate and slender, becoming more robust and laterally compressed with development

Preanus length: less than 50% SL

Pigmentation: many scattered melanophores along ventral sides of body, spreading out over anal and caudal fin where melanophores tend to be aligned with fin rays

Length at flexion: unknown

Remarks: asimmetry starts at about 7 mm and is completed at about 10 mm length

PHOTOS

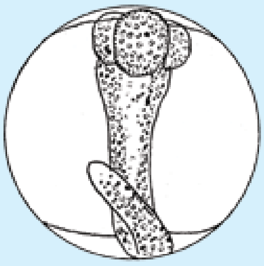
by J.M. Rodriguez

2.7 mm SL

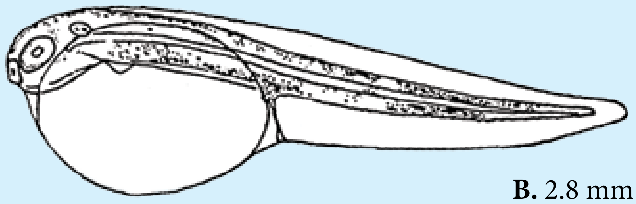
7.0 mm SL

Literature: Froese and Pauly (2016), Nielsen (1986c), Russell (1976)

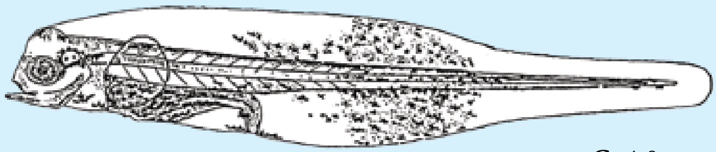
PLEURONECTIDAE *Platichthys flesus* (Linnaeus, 1758)



A.

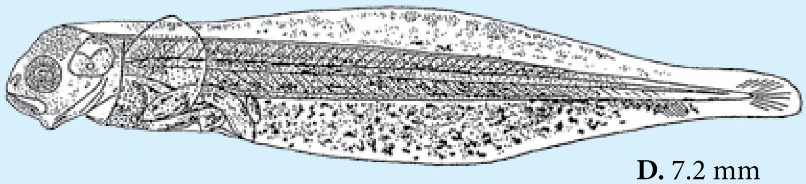


B. 2.8 mm

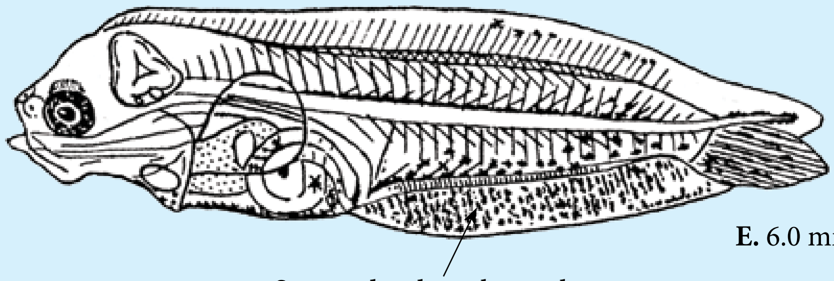


C. 4.0 mm

Body elongate and slender in young larvae

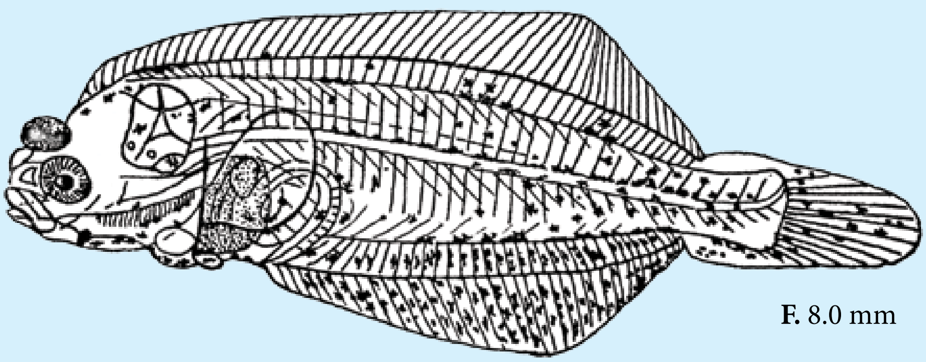


D. 7.2 mm



E. 6.0 mm

Scattered melanophores along ventral sides of body spreading out over anal and caudal fins



F. 8.0 mm

A–F: Padoa (1956t)

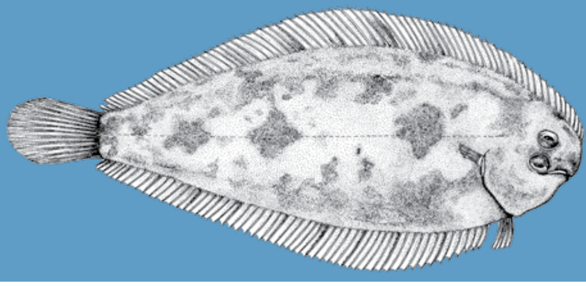
SOLEIDAE

Buglossidium luteum (Risso, 1810)

En: Solenette

Habitat: Benthic, over sandy bottoms, between 5 and 450 m depth

Spawning season: February



EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 0.64–0.94 mm
Chorion: smooth
Oil globules: 12–15 small oil globules
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE — Figs. B, C

Hatch size: about 2.0 mm

Pigmentation: melanophores on head; 4 spots on dorsal and 1 or 2 on ventral margins of primordial fin; some melanophores on body margins

LARVAE — Figs. D–F

Distinctive characters: body short with large head and deep abdominal region; body becomes laterally compressed with development; swimbladder prominent

Preanus length: less than 50% SL

Pigmentation: evenly spaced melanophores along dorsal (9–13) and ventral (8–11) body contours; swimbladder and pectoral fin pigmented

Length at flexion: unknown

Remarks: asimmetry begins at about 6.0 mm SL, almost completed at 8.0 mm SL

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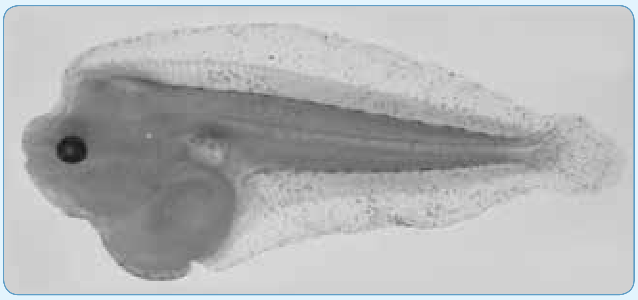
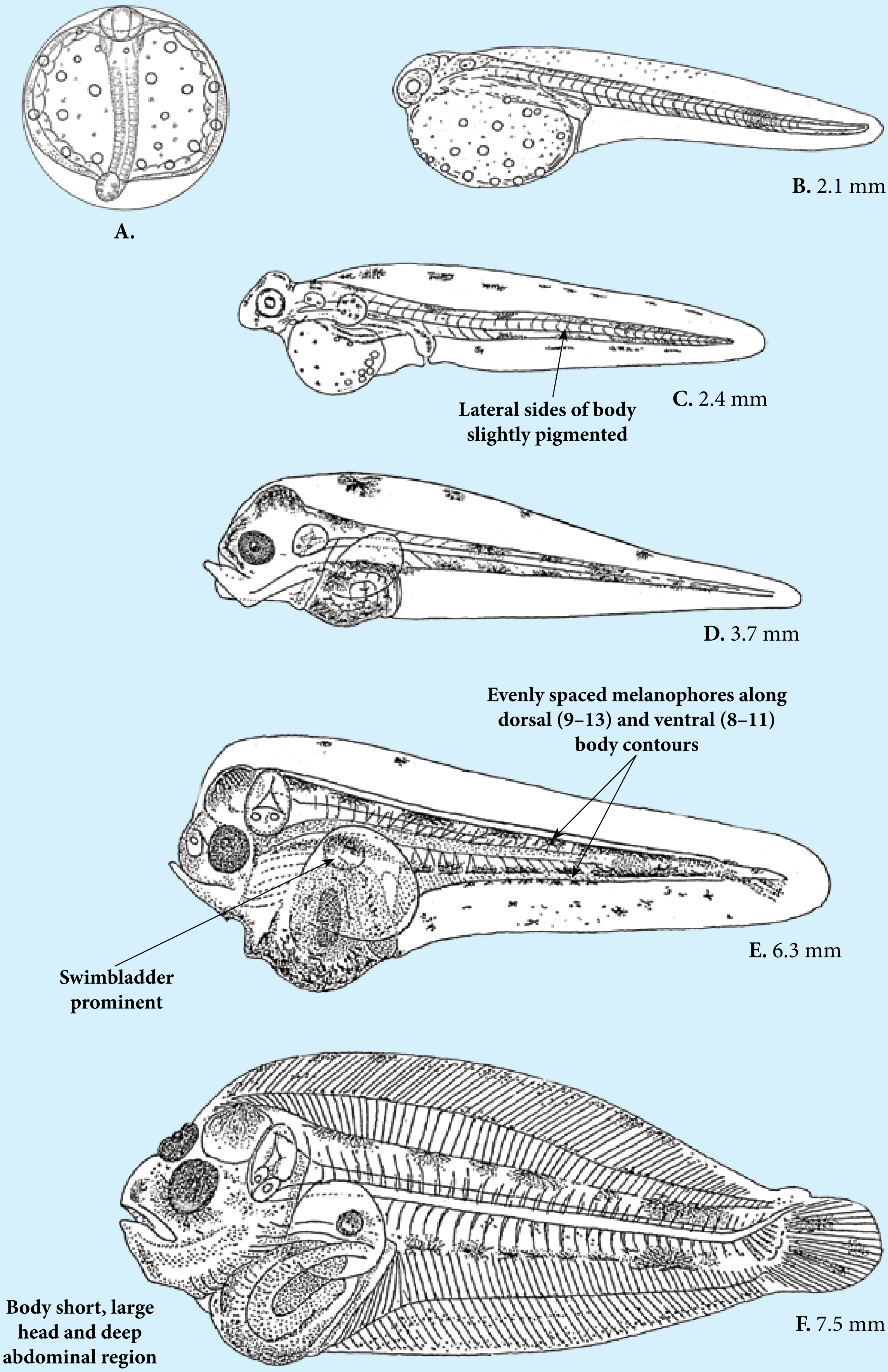
3.5 mm SL



6.5 mm SL

Literature: Munk and Nielsen (2005), Padoa (1956m), Quero *et al.* (1986b), Russell (1976)

SOLEIDAE — ***Buglossidium luteum*** (Risso, 1810)



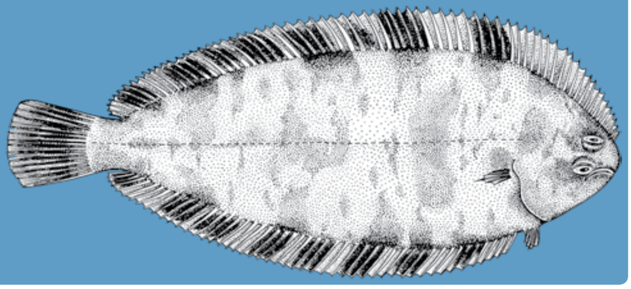
A–F: Padoa (1956m)

SOLEIDAE *Microchirus variegatus* (Donovan, 1808)

En: Thickback sole – **Sp:** Golleta

Habitat: Benthic, over sand and mud on the continental shelf and slope, at depths between 80 and 400 m

Spawning season: Spring



EGGS Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.28–1.42 mm
Chorion: smooth
Oil globules: 50 or more scattered oil globules
Perivitelline space: small
Yolk: segmented

YOLK–SAC LARVAE Fig. B

Hatch size: about 2.5 mm

Pigmentation: body and primordial fins covered with small stellate melanophores; apparent rows of stellate melanophores along the body contours

LARVAE Figs. C–F

Distinctive characters: body short with a prominent head and deep abdominal region; no swimbladder

Preanus length: about 50% SL

Pigmentation: body and fins covered with small stellate melanophores; dorsal and ventral rows of melanophores (dorsal of about 70 and ventral of about 50) along body contours, these melanophores are larger and tend to merge and form continuous rows

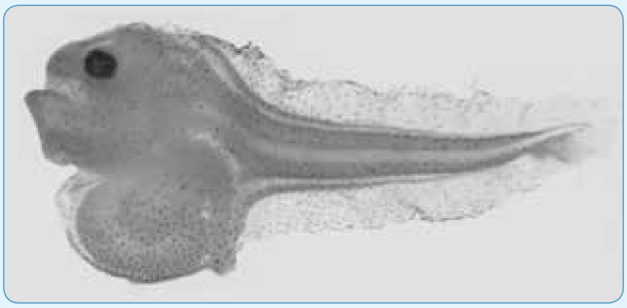
Length at flexion: unknown

Remarks: asimmetry completed at 12.0 mm SL

PHOTOS

by J.M. Rodriguez

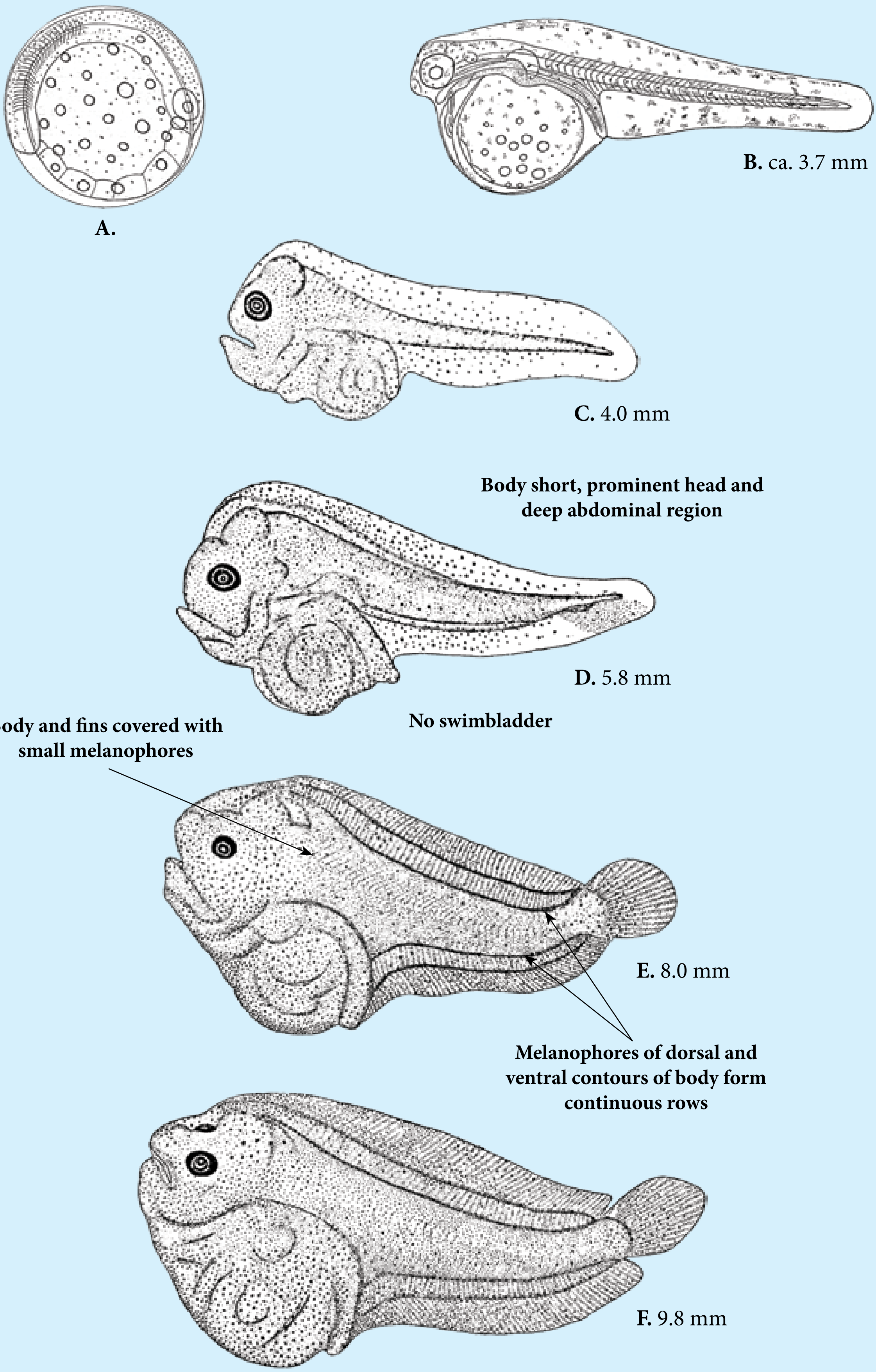
3.0 mm SL



5.1 mm SL

Literature: Alemany (1997), Padoa (1956m), Quero *et al.* (1986b), Russell (1976)

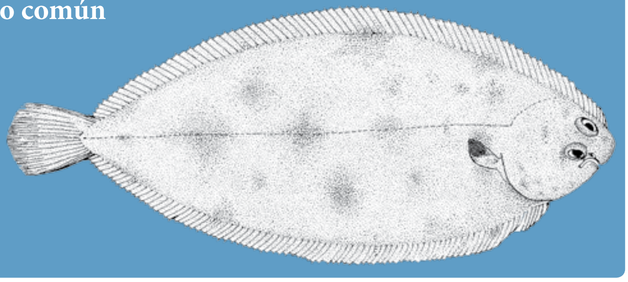
SOLEIDAE *Microchirus variegatus* (Donovan, 1808)



A, B: Padoa (1956m); **C–F:** Nichols (1976)

SOLEIDAE *Solea solea* (Linnaeus, 1758)

En: Common sole – **Fr:** Sole commune – **Sp:** Lenguado común



Habitat: Benthic, over sand and mud of continental shelf from a few to 150–200 m depth

Spawning season: Between January and May

EGGS — Fig. A

Habitat: pelagic
Shape: spherical
Diameter: 1.0–1.6 mm
Chorion: smooth
Oil globules: many small oil globules aggregated in clusters
Perivitelline space: small
Yolk: peripherally segmented

YOLK–SAC LARVAE — Fig. B

Hatch size: 3.8 mm

Pigmentation: body (except caudal end), primordial fin and yolk sac covered with small stellate melanophores; rows of melanophores along dorsal (9–14 melanophores) ventral (4–12) contours of body, number of melanophores in these rows increases with age

LARVAE — Figs. C–F

Distinctive characters: body short with a prominent head and deep abdominal region; swimbladder small, apparent at 6–7 mm long

Preanus length: about 50% SL

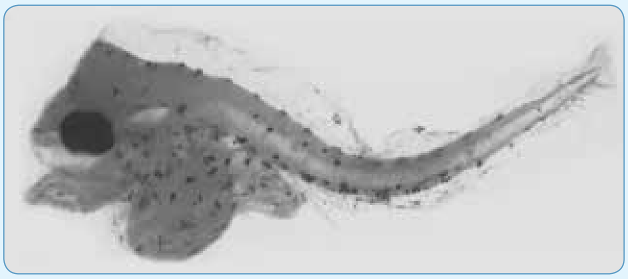
Pigmentation: similar to that of yolk–sac larvae in earlier stages; larger larvae, body covered with large stellate melanophores; dorsal and ventral rows of melanophores almost forming an unbroken line of pigment

Length at flexion: unknown

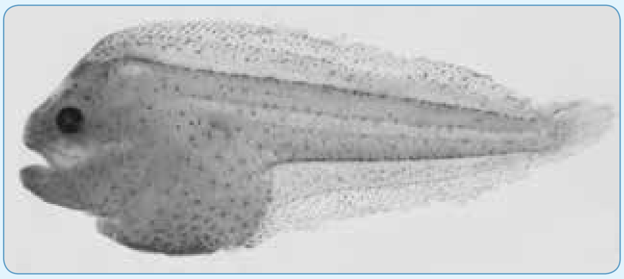
Remarks: asimmetry begins at 7–8 mm, almost completed at 9.5 mm

PHOTOS

by J.M. Rodriguez



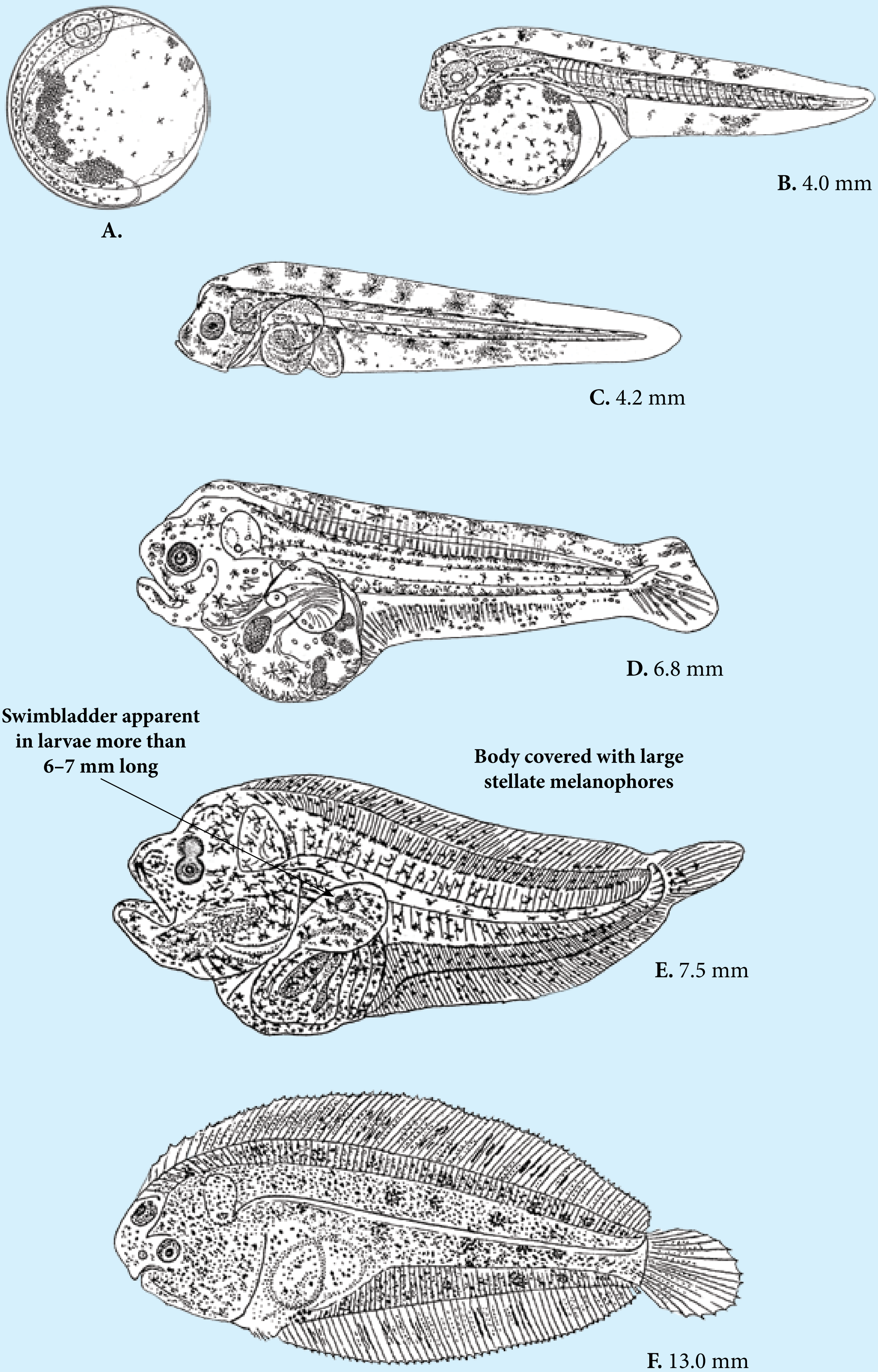
3.6 mm SL



7.3 mm SL

Literature: Aboussouan (1964), Padoa (1956m), Quero *et al.* (1986b), Russell (1976), Sabatés (1988)

SOLEIDAE — ***Solea solea*** (Linnaeus, 1758)



A–F: Padoa (1956m)

CYNOGLOSSIDAE — ***Symphurus nigrescens*** Rafinesque, 1810

En: Tonguesole – **Fr:** Plagusie sombre

Habitat: Benthic, over sand and mud of the continental shelf and slope, from 20 to 1 140 m depth

Spawning season: Between May and October

EGGS

Undescribed

YOLK–SAC LARVAE

Undescribed

LARVAE — Figs. A–C

Distinctive characters: body relatively short with a large head and abdominal region, laterally compressed since early stages of development; finger–shaped prolongation of gut at posterior ventral side of gut loop; 4 first anterior rays of dorsal fin considerably enlarged (these rays enlarge in a sequential order, from anterior to posterior)

Preanus length: less than 50% SL

Pigmentation: melanophores on ventral side of gut and on gut prolongation; melanophore on hindgut; group of ventral melanophores on anterior region of tail; group of dorsal and another ventral melanophore at about mid–tail in later larvae

Length at flexion: unknown

PHOTOS

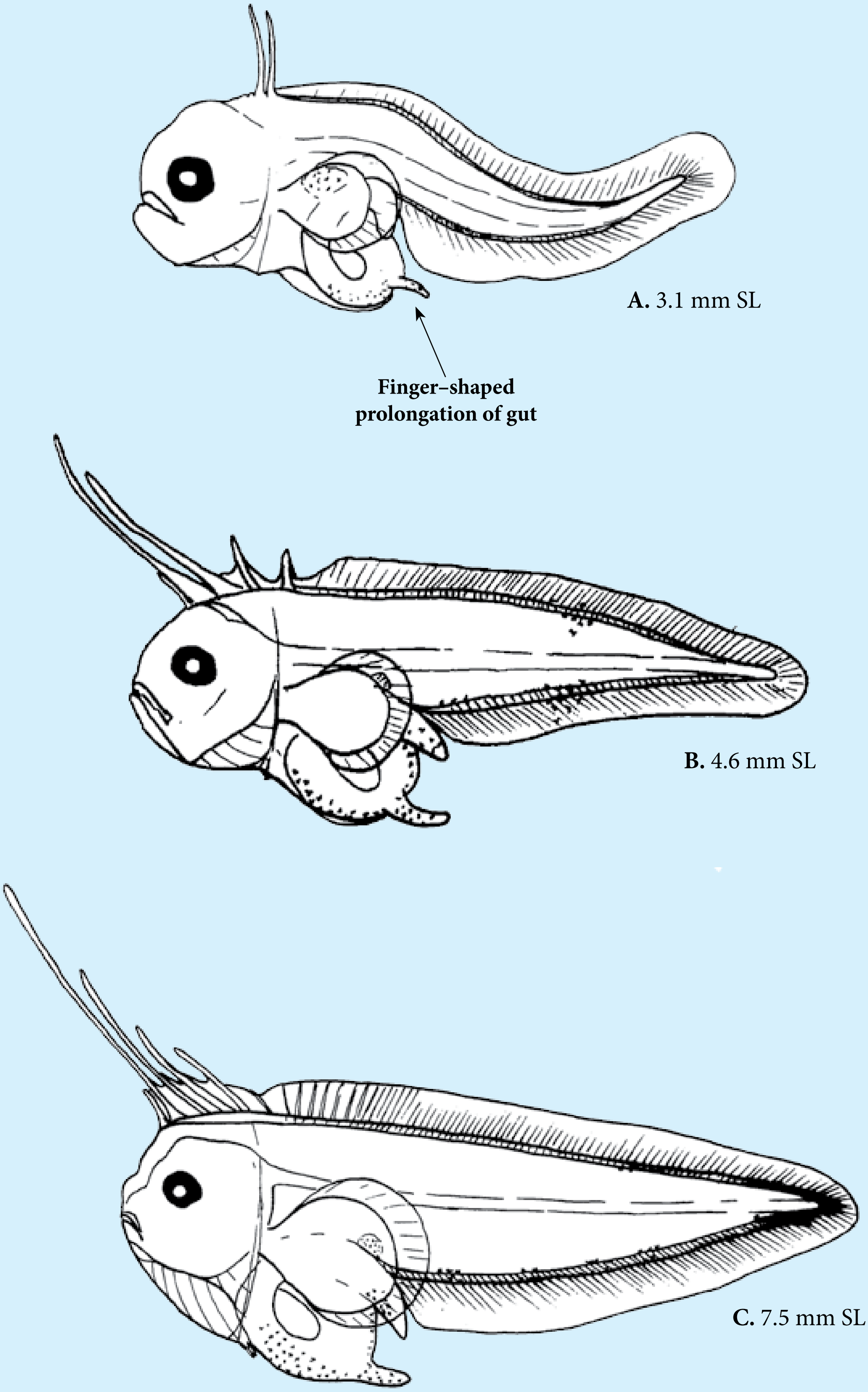
by J.M. Rodriguez

6.0 mm SL

Literature: Alemany (1997), Padoa (1956g), Quero *et al.* (1986a), Sabatés (1988)

CYNOGLOSSIDAE

Symphurus nigrescens **Rafinesque, 1810**



A–C: Alemany (1997)

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This guide presents the egg and larval descriptions of 100 species of fishes belonging to 55 families, which are most likely to be present in plankton samples collected in the continental shelf and oceanic waters of the Western Mediterranean Sea. The guide is structured in two parts. The first introductory part describes the different applications of ichthyoplankton studies in fisheries research, the main sampling strategies, methods and gears, the early life history of fishes and how to identify them. A brief historical account of ichthyoplankton identification studies in the Mediterranean Sea is also provided. The second part of the guide contains the identification sheets of the species. Each species sheet includes the following information: illustration of the adult fish and information on its habitat and spawning season; description of the main features useful towards identifying the egg, yolk sac and larval stage of each fish species; illustrations and (when available) photos of the different life stages.

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