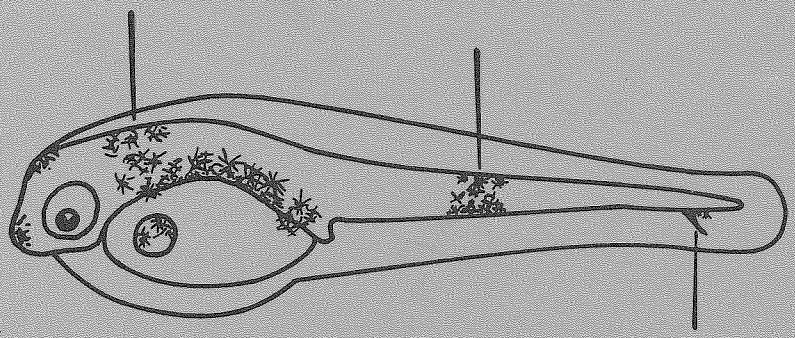

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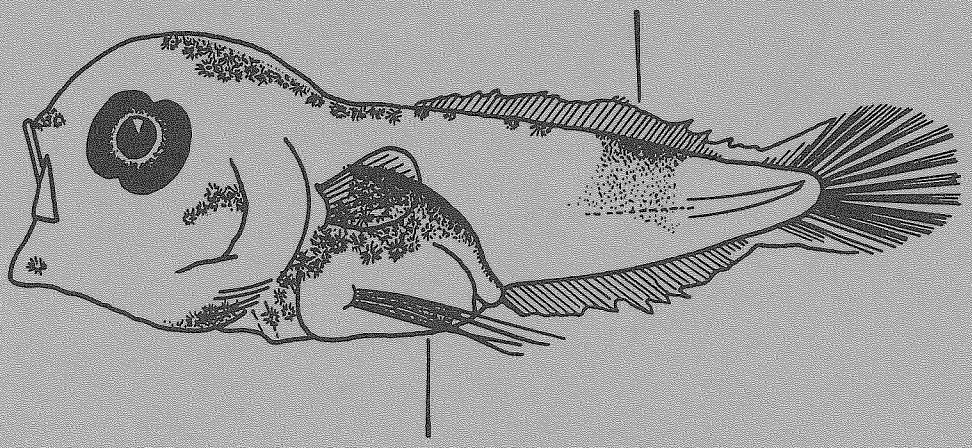
GUIDE FOR IDENTIFYING THE COMMON PLANKTONIC FISH EGGS AND LARVAE OF CONTINENTAL SHELF WATERS, CAPE SABLE TO BLOCK ISLAND ° ° °

BY

JOHN B. COLTON JR. and ROBERT R. MARAK

LABORATORY REFERENCE No. 69-9, SEPTEMBER 15, 1969



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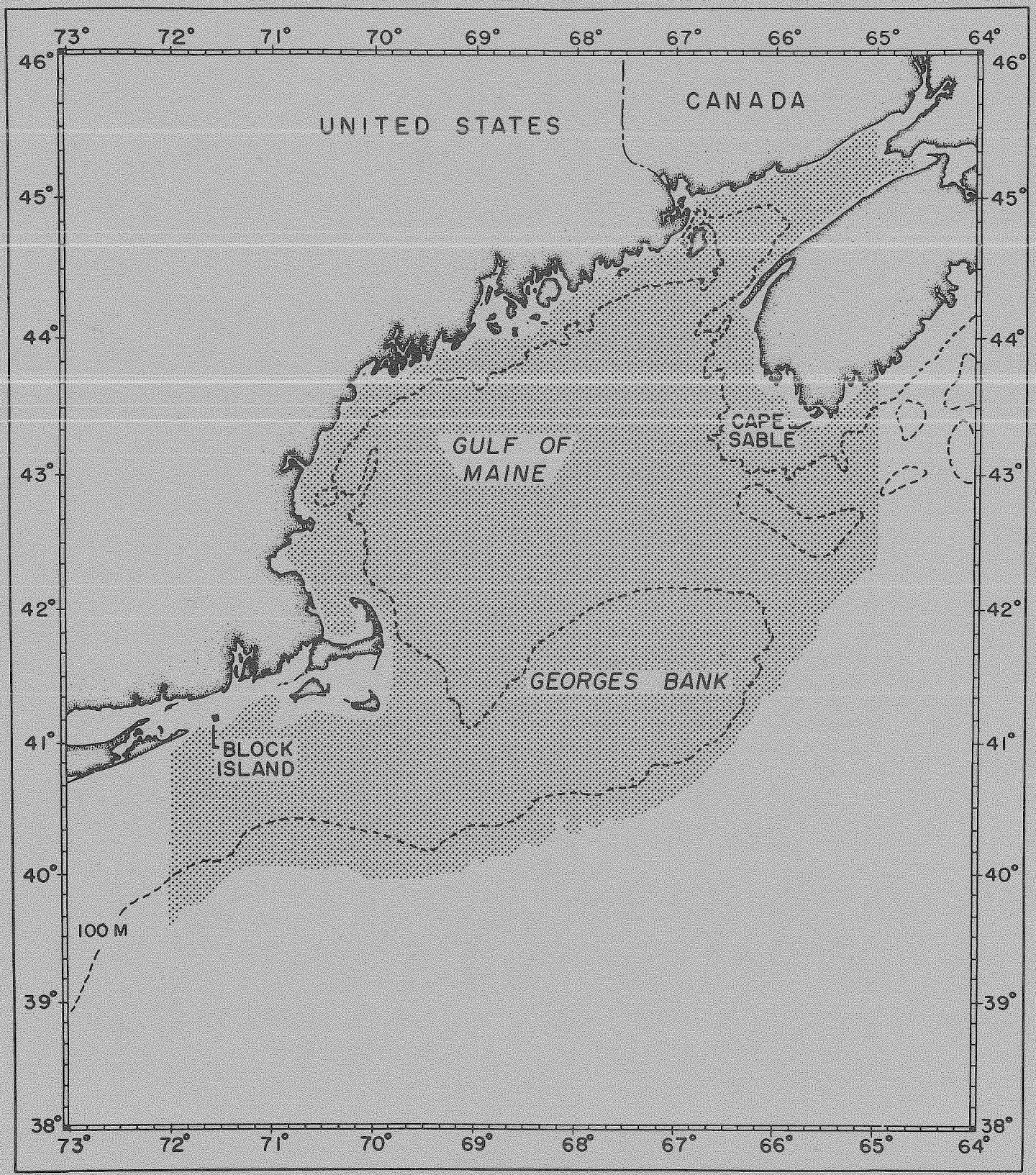

Figure 1. Fish egg and larvae sampling area.

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Bureau of Commercial Fisheries
Biological Laboratory
Woods Hole, Massachusetts
Laboratory Reference No. 69-9
September 15, 1969

CONTENTS

	Page
Abstract	3
Introduction	4
Methods and use of illustrations and text	6
CLUPEIDAE (Herrings)	
Brevoortia tyrannus (Latrobe) - Atlantic menhaden	11
Clupea harengus harengus Linnaeus - Atlantic herring	12
GADIDAE (Codfishes and Hakes)	
Brosme brosme (Müller) - Cusk	13
Enchelyopus cimbrius (Linnaeus) - Fourbeard rockling	14
Gadus morhua Linnaeus - Atlantic cod	15
Melanogrammus aeglefinus (Linnaeus) - Haddock	16
Merluccius albidus (Mitchill) - Offshore hake	17
Merluccius bilinearis (Mitchill) - Silver hake	18
Pollachius virens (Linnaeus) - Pollock	19
Urophycis chuss (Walbaum) - Squirrel hake	20
SPARIDAE (Porgies)	
Stenotomus chrysops (Linnaeus) - Scup	21
LABRIDAE (Wrasses)	
Tautoga onitis (Linnaeus) - Tautog	22
Tautogolabrus adspersus (Walbaum) - Cunner	23
SCOMBRIDAE (Mackerels and Tunas)	
Scomber scombrus Linnaeus - Atlantic mackerel	24
SCORPAENIDAE (Scorpionfishes and Rockfishes)	
Sebastes marinus (Linnaeus) - Redfish or ocean perch	25
COTTIDAE (Sculpins)	
Myoxocephalus octodecemspinosus (Mitchill) - Longhorn sculpin	26

Page

AMMODYTIDAE (Sand Lances)

Ammodytes dubius Reinhardt - Northern sand lance ---------- 27

PHOLIDAE (Gunnels)

Pholis gunnellus (Linnaeus) - Rock gunnel---------- 28

STICHAEIDAE (Pricklebacks)

Lumpenus lumpretaeformis (Walbaum) - Snake blenny -------- 29

STROMATEIDAE (Butterfishes)

Poronotus triacanthus (Peck) - Butterfish ---------- 30

BOTHIDAE (Lefteye Flounders)

Paralichthys dentatus (Linnaeus) - Summer flounder---------- 31

Paralichthys oblongus (Mitchill) - Fourspot flounder--------- 32

Scophthalmus aquosus (Mitchill) - Windowpane---------- 33

PLEURONECTIDAE (Righteye Flounders)

Glyptocephalus cynoglossus (Linnaeus) - Witch flounder----- 34

Hippoglossoides platessoides (Fabricius) - American plaice -- 35

Limanda ferruginea (Storer) - Yellowtail flounder---------- 36

Pseudopleuronectes americanus (Walbaum) - Winter flounder-- 37

Acknowledgements---------- 38

Literature Cited---------- 39

ABSTRACT

The more common planktonic fish eggs and larvae occurring in the Gulf of Maine and contiguous waters are described. The average diameter and range in diameter of the egg and oil globule are given along with the average hatching length and range in hatching length of the larvae. The identifying characteristics of the prolarvae and postlarvae are described and illustrated. Pigmentation pattern is the main criterion used in the identification of larvae, but morphological data are included where relevant.

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INTRODUCTION

During the spring of 1953, 1955, 1956, and 1957 the Bureau of Commercial Fisheries conducted surveys to determine the distribution of haddock eggs and larvae in the Gulf of Maine and contiguous waters. From September through February, 1956-57 and 1957-58, the Bureau of Commercial Fisheries in cooperation with the Fisheries Research Board of Canada conducted surveys to determine the distribution of larval herring in the same area. The eastern and western boundaries of the area covered during these surveys were 65° and 72° West Longitude, respectively. The offshore boundary was at approximately the 250-meter isobath and the inshore boundary at approximately the 20-meter isobath (fig. 1). Meter-net samples of fish eggs and larvae were obtained during all months, except July and August.

Although there are a number of references describing the eggs and larvae of fish species common to New England and Canadian coastal and offshore waters, no single work exists that would serve as a compendium for the many different fish eggs and larvae collected during these surveys. It is the purpose of this paper to describe and illustrate simply and concisely, the fish eggs and larvae most likely to be encountered in the offshore waters of the Gulf of Maine and southern

New England. Existing descriptions and illustrations have been used where possible, but in most cases we have supplemented or substituted these data with our own observations.

The material forming the basis of this paper was originally compiled for our own use. However, the interest shown in these descriptions and illustrations made it evident that such a compilation would be helpful to other investigators, especially those not experienced in the taxonomy of fishes. The descriptions are as simple as is compatible with scientific accuracy and are limited for the most part to such external features as may serve for ready identification. The identification of fish eggs and larvae is often the most difficult and laborious of zooplankton analyses. We hope that these descriptions will simplify the task of the increasing number of investigators concerned with the identification of zooplankton in boreal Continental Shelf waters.

METHODS AND USE OF ILLUSTRATIONS AND TEXT

To aid us in our identifications, a sample of eggs was periodically hatched aboard ship and reared to an identifiable larval stage. Notwithstanding this procedure, the identification of eggs and larvae of many species proved difficult because of the considerable overlap in the location and time of spawning, the size and morphology of the eggs, and the length, morphometry, and pigmentation of the larvae. Our main source of reference for identification was the "Fishes of the Gulf of Maine," (Bigelow and Schroeder, 1953). However, for many species it was necessary to refer to other publications or to verify identifications by stripping, fertilizing, and rearing eggs from mature fish.

Information given on spawning times, egg and oil globule diameters, hatching lengths, number and location of pigment granules, etc., represent average conditions. The spawning times listed cover the range to be expected in an average year in the Gulf of Maine and south to Block Island. Spawning times followed by a question mark are approximations.

Egg diameter and hatching length tend to decrease as the spawning season progresses. These measurements also vary with geographical location, so that we have included only measurements made on specimens collected in the Northwest Atlantic. For the most part the measurements given cover the whole of the spawning season. Measurements given to the nearest 0.01 mm. are based on measurements of 200 or more specimens. Measurements given to the nearest 0.1 mm. are based on fewer measurements or cited from the

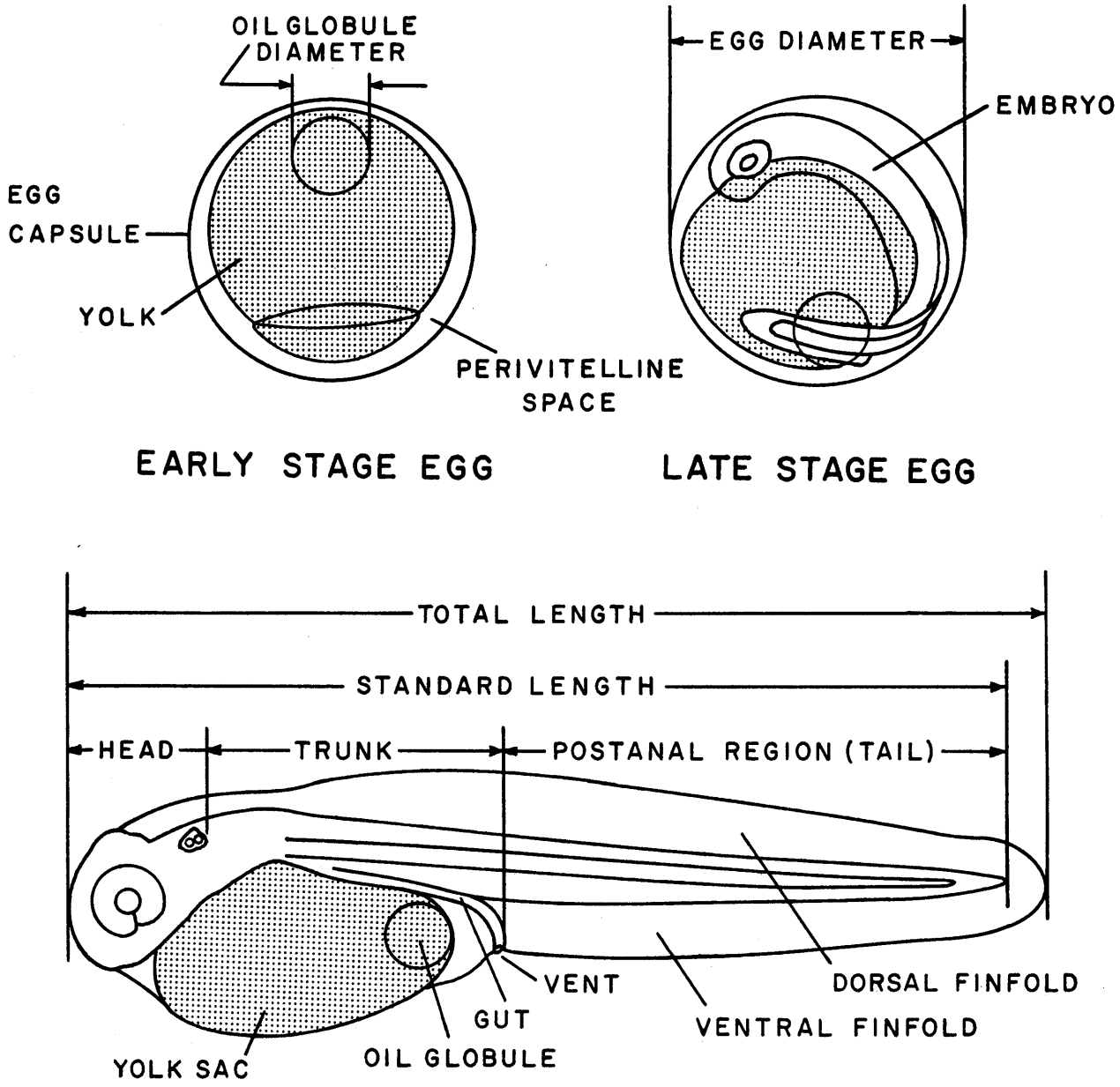


Figure 2. Diagram of the egg and prolarva of a typical teleost with the terms and measurements used in their description.

literature. Measurements other than our own are indicated by superscript numbers corresponding to the numbered reference list at the end of each species account. All our measurements were made on preserved specimens (5 per cent formalin). All length measurements are total lengths (tip of snout to posterior margin of finfold or caudal fin). Currently, standard length (tip of snout to tip of notochord, urostyle, or hypural plate) is the measurement most widely used by taxonomists. However, total length is the measurement used or presumed to be used in all the literature cited. We have used this length measurement to assure uniformity.

The terminology commonly used in describing teleostean eggs and larvae and illustrations of the anatomy and development of the egg and larval stages are given by Mansueti and Hardy (1967). A detailed description of the embryology of a typical teleost is given by Ryder (1884). The measurements and terms we have used in describing eggs and larvae are shown in Figure 2. Descriptions of the adult forms and summaries of the distribution, relative abundance, and life history of all the species described in this guide are given by Bigelow and Schroeder (1953).

The illustrations are camera lucida pen and ink drawings of preserved specimens. The drawings are semi-diagrammatic and are designed principally to illustrate the pigmentation pattern. The fin rays are portrayed to show the extent of development rather than their exact number. The pectoral fins have been omitted where they tend to obscure pigmentation. Shading and stippling have also been avoided. The only concession to convention has been in

rendering the pupils of the eyes black, although they are not so in actual specimens. Only melanophores are included in the drawings, for althouth xanthophores and erythrophores are present in many species they disappear rapidly on preservation. The configuration of the chromatophores was copied as closely as possible, although there was some variation from specimen to specimen. The pointer lines indicate the most outstanding species characteristics described in the text. The larvae illustrated represent our judgement of the individual most typical of that species. It is only reasonable to expect, however, that some specimens may differ from the illustrations and descriptions given.

Illustrations based on published material are indicated by superscript numbers following the length measurements. The superscript numbers correspond to the numbered reference list at the end of each species account. These references include only papers containing original descriptions and illustrations that may be helpful as additional aids to identification.

The common and scientific nomenclature used follows that recommended by the American Fisheries Society (1960). The families are arranged in phyletic sequence. The genera are arranged in alphabetical order. The following allocation proposed by Hubbs (1943) has been used in the separation of the early stages of fish:

Prolarva - Larva still bearing yolk.

Postlarva - From absorption of yolk to time when adult characteristics are assumed.

Juvenile - Young essentially similar to adults.

The method for using this guide is to leaf through the illustrations until several possible species are found, and to proceed from that point by deciding which description best fits the specimen in question. As an aid in the initial separation of likely species, the species are grouped in Table 1 into the following four categories: those having pelagic eggs with no oil globule; those having pelagic eggs with an oil globule; those having demersal eggs; and ovoviviparous species. The species in the first two groupings are listed in order of increasing egg diameter. In addition, the spawning season for the species, the average diameter and range in diameter of the egg and oil globule, and the average hatching length and range in hatching length of the prolarvae are given. Eggs of many species are separable by size, morphology, time of occurrence, etc., while those of others are so similar in these features that positive identification is impossible. The best method for overcoming this difficulty is to preserve and measure a portion of the eggs collected and to allow the remainder to hatch into more easily identifiable larvae.

General body shape, although sometimes distinctive, is not of great value in identification of larval fish for specimens are so often curled or damaged. Appendages are also not always helpful for they are often missing or broken. The type and arrangement of pigmentation is the best single key character, but as helpful as pigmentation is, it is subject to variation and tends to fade with time.

In the late postlarval stages, when the fish are undergoing a metamorphosis from larval to juvenile form, the increasing complexity of pigmentation patterns make identification extremely difficult. In these cases we have found that

counts of abdominal vertebrae (vertebrae without haemal spines) serve as an excellent means of separating a number of closely related species of post-larvae. We have included vertebral counts in the description of species where such counts are a distinguishing characteristic. The technique for clearing and staining fish for vertebral counts is described by Hollister (1934) and Clothier (1950).

TABLE 1.--Spawning season, average diameter and range in diameter of the egg and oil globule, and average hatching length and range in hatching length of the species described.

Species	Spawning Season	Egg Diameter (mm.) Av.	Egg Diameter (mm.) Range	Oil Globule Diameter (mm.) Av.	Oil Globule Diameter (mm.) Range	Hatching Length (mm.) Av.	Hatching Length (mm.) Range
Cunner	May - Aug.	0.85	0.78 - 0.97	None		2.90	2.33 - 3.43
Yellowtail flounder	Mar. - Aug.	0.88	0.79 - 1.01	None		2.75	2.00 - 3.52
Tautog	May - June	1.03	0.89 - 1.15	None		3.0	
Pollock	Nov. - Feb.	1.15	1.0 - 1.2	None		4.0	3.4 - 4.2
Witch flounder	Mar. - Aug.	1.25	1.14 - 1.36	None		4.82	3.52 - 5.59
Haddock	Feb. - May	1.46	1.10 - 1.67	None		4.08	3.08 - 4.99
Atlantic cod	Dec. - Apr.	1.52	1.32 - 1.72	None		4.38	3.30 - 5.71
American plaice	Mar. - May	2.28	1.50 - 2.77	None		5.24	4.14 - 6.34
Squirrel hake	May - Aug.	0.76	0.63 - 0.97	0.19	0.15 - 0.22	2.04	1.76 - 2.29
Butterfish	June - Aug.	0.77	0.75 - 0.79	0.20	0.17 - 0.21	1.72	1.68 - 1.75
Fourbeard rockling	Apr. - Aug.	0.82	0.74 - 0.89	0.16	0.13 - 0.20	2.03	1.63 - 2.42
Silver hake	May - Oct.	0.91	0.84 - 1.02	0.26	0.19 - 0.31	3.02	2.64 - 3.52
Scup	May - July	0.94	0.89 - 0.99	0.18	0.16 - 0.20	2.0	
Fourspot flounder	May - July	1.04	0.91 - 1.12	0.17		2.9	2.7 - 3.2
Summer flounder	Oct. - Apr.	1.04	0.93 - 1.13	0.22	0.20 - 0.26	3.1	2.5 - 3.6
Windowpane	May - Aug.	1.1	0.9 - 1.3		0.2 - 0.3	2.0	
Offshore hake	Apr. - July	1.10	0.99 - 1.18	0.32	0.29 - 0.36	3.54	3.05 - 3.75
Atlantic mackerel	May - June	1.15	0.98 - 1.37	0.29	0.26 - 0.31	3.31	2.46 - 3.83
Cusk	Apr. - July	1.31	1.15 - 1.41	0.27	0.21 - 0.31	4.01	2.99 - 4.62
Atlantic menhaden	June - Oct.	1.61	1.04 - 1.95	0.14	0.11 - 0.17	4.5	
Winter flounder	Jan. - May	Demersal				3.2	2.8 - 3.5
Longhorn sculpin	Nov. - Feb.	Demersal				6.84	6.27 - 7.29
Herring	Aug. - Oct.	Demersal				6.95	5.90 - 8.30
Northern sand lance	Nov. - Feb.	Demersal					
Snake blenny	Oct. - Apr.	Demersal					
Rock gunnel	Nov. - Mar.	Demersal				9.0	
Redfish	May - Aug.	Ovoviviparous				7.0	6.5 - 7.3

CLUPEIDAE

Brevoortia tyrannus - Atlantic menhaden

Spawning:

June - October.

Eggs:

Average diameter: 1.61 mm.[6]; range: 1.04 - 1.95 mm.[5,6]

Average oil globule diameter: 0.14 mm.; range: 0.11 - 0.17 mm.[1,6]

Identifying characteristics: Menhaden eggs are characterized by having a broad perivitelline space, and a high egg diameter to oil globule diameter ratio (approximately 11/1).

Prolarvae:

Average hatching length: 4.5 mm.[3]

Identifying characteristics: Hatching length (7.0 mm. in Atlantic Herring). The vent is located about four-fifths the length of the body from the anterior end. There is a row of fine melanophores dorsally near base of finfold and ventrally on body posterior to vent.

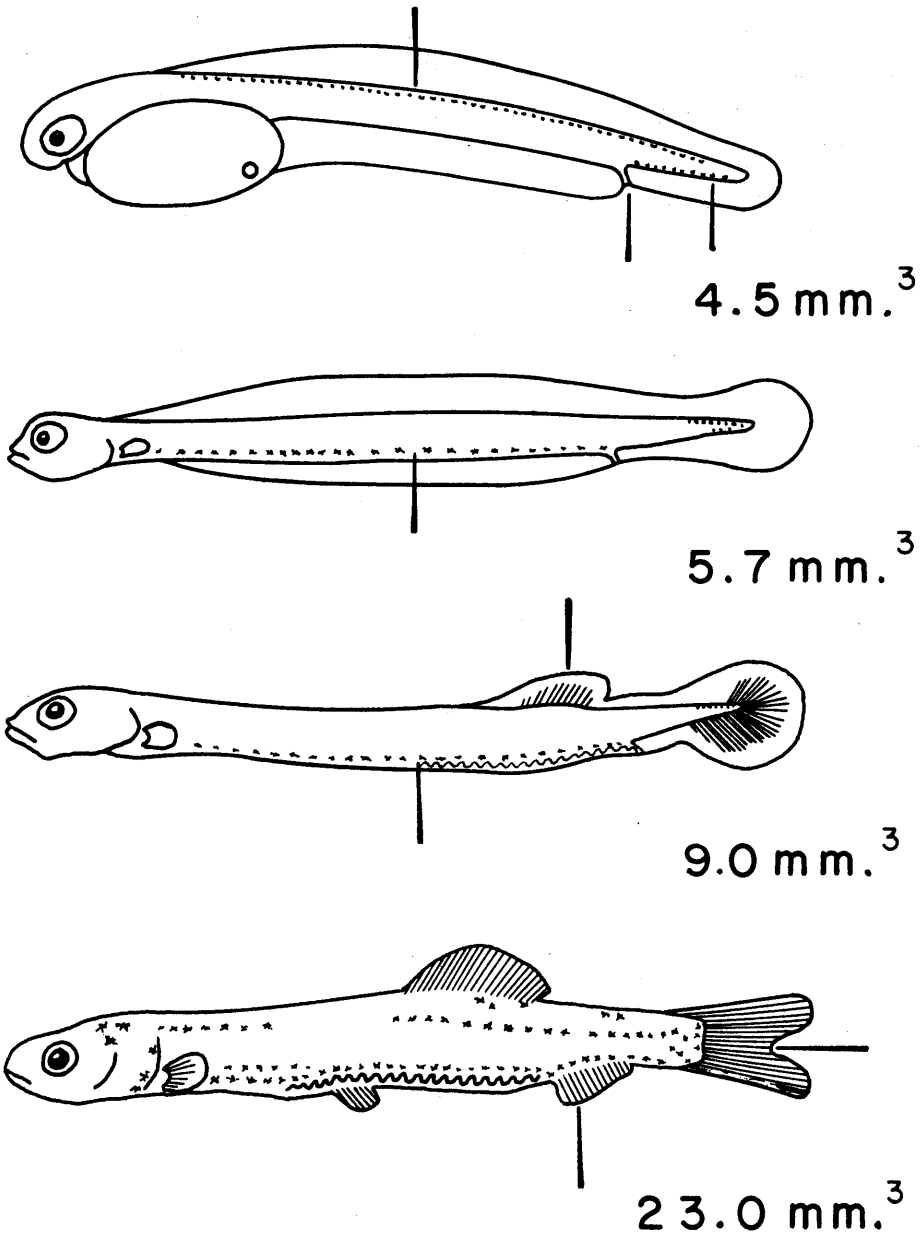
Postlarvae:

Identifying characteristics: There is a series of melanophores ventrally at a level slightly above the gut from pectoral fins to vent. Incipient dorsal fin rays are visible at approximately 9 mm. (15 mm. in herring). The anal fin rays are evident at 13-20 mm. (approximately 30 mm. in herring). The fins are formed, tail forked, and body deeper at a much earlier stage than in herring. Metamorphosis is complete at about 20 mm. (40 mm. in herring).
Total vertebrae: 45-50[7] (52 - 58 in herring).

References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.
2. Herman, S.S., 1963.
3. Kuntz, A. and L. Radcliffe, 1917.
4. Mansueti, A.J. and J.D. Hardy, 1967.
5. Richards, S.W., 1959.
6. Wheatland, S.B., 1956.
7. Sutherland, D.F., 1963.

ATLANTIC MENHADEN



CLUPEIDAE

Clupea harengus harengus - Atlantic herring

Spawning:

Mid-August - October (limited and sporadic spawning occurs during the spring along the southwest coast of Nova Scotia and eastern coast of Maine, but larvae from these spawnings are very rarely encountered in offshore waters).

Eggs:

Demersal.

Prolarvae:

Average hatching length: 6.95 mm.; range: 5.90 - 8.30 mm.

Identifying characteristics: Hatching length (4.5 mm. in menhaden). The vent is located about four-fifths the length of body from anterior end. The pigmentation is very sparse and confined to a linear series of small stellate melanophores dorsal to the gut, and ventrally on body posterior to the vent. (This fine pigmentation often disappears after prolonged preservation).

Postlarvae:

Identifying characteristics: There is a series of melanophores ventrally at a level slightly above the gut. Incipient dorsal fin rays are visible at approximately 15 mm. (9 mm. in menhaden). The anal fin rays are evident at approximately 30 mm. (13 - 20 mm. in menhaden). Metamorphosis is complete at approximately 40 mm. (20 mm. in menhaden).
Total vertebrae: 52-58 (45 - 50 in menhaden).

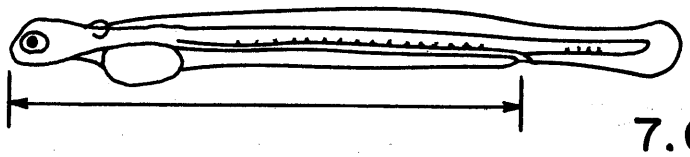
References:

1. Ehrenbaum, E., 1905.

2. Mansueti, A.J. and J.D. Hardy, 1967.

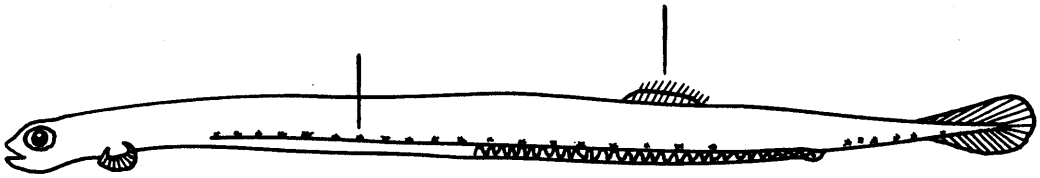
3. Prince, E.E., 1907.

ATLANTIC HERRING

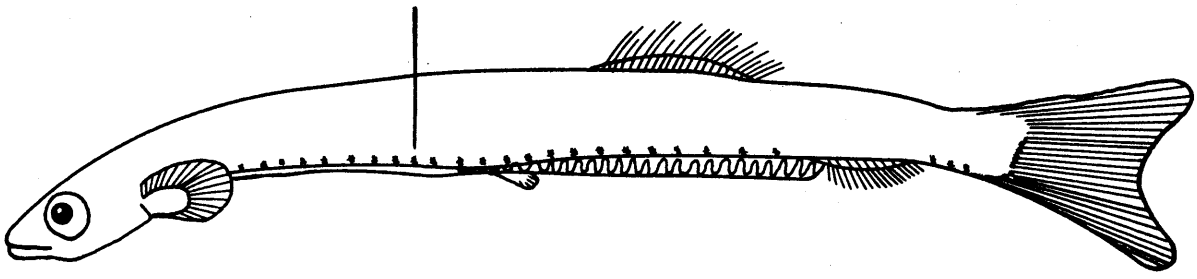


7.0mm.

8.0mm.



15.0mm.



30.0mm.

GADIDAE

Brosme brosme - Cusk

Spawning:

April - July.

Eggs:

Average diameter: 1.31 mm.; range: 1.15 - 1.41 mm.

Average oil globule diameter: 0.27 mm.; range: 0.21 - 0.31 mm.

Identifying characteristics: The egg and oil globule diameters are similar to those of the mackerel, but cusk eggs have a pinkish unpigmented oil globule while in mackerel eggs it is pigmented and pale yellow. In late stage eggs the characteristic prolarval pigmentation is readily discernible on the embryo. M'Intosh (1892) describes the surface of the cusk egg as being finely pitted. This has not been apparent in any of the eggs we have examined.

Prolarvae:

Average hatching length: 4.01 mm.; range: 2.99 - 4.62 mm.

Identifying characteristics: The vent opens laterally at the base of the finfold as in other gadoids, but the cusk is distinguishable by the presence of the pinkish oil globule at the posterior end of the gut. The pigmentation in the prolarvae is finely granular giving the appearance of dense even color. There is a light scattering of pigment on the anterior portion of the head and a patch centrally located over the gut. The postanal pigmentation consists of two vertical bands which divide the tail into three nearly equal sections (the posterior of these bands is sometimes constricted at its center) and a third concentration at the tip of the tail, confined mostly to the finfold and giving the appearance of feathers on an arrow.

Postlarvae:

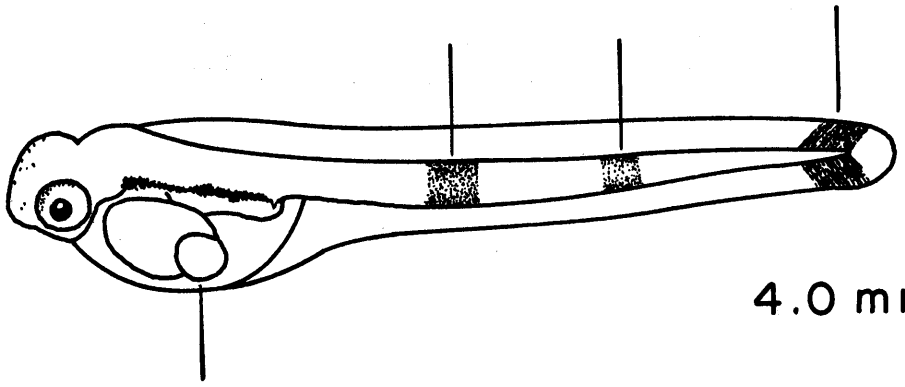
Identifying characteristics: The prolarval pigmentation pattern persists in specimens up to approximately 20 mm. At about 6 mm. the ventral fins, which are heavily pigmented at their distal end, are readily discernible. The ventral fins of the cusk are separate one from the other, while those of the squirrel hake and the fourbeard rockling are connected by a membrane.

References:

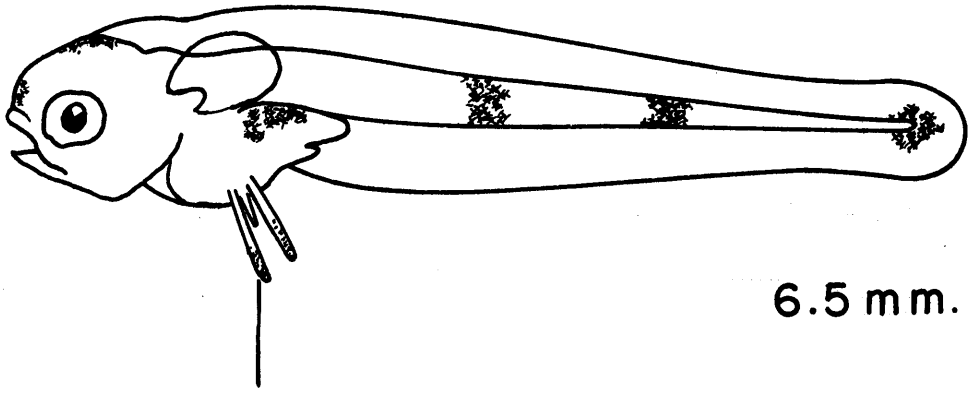
1. M'Intosh, W.C., 1892.

2. Schmidt, J., 1905 b.

CUSK



4.0 mm.



6.5 mm.

GADIDAE

Enchelyopus cimbrius - Fourbeard rockling

Spawning:

April - August.

Eggs:

Average diameter: 0.82 mm.; range: 0.74 - 0.89 mm.

Average oil globule diameter: 0.16 mm.; range: 0.13 - 0.20 mm.

Identifying characteristics: None in early stages (the egg and oil globule diameters are similar to those of the squirrel hake and butterfish), but the characteristic prolarval pigmentation is readily discernible on the late stage embryo.

Prolarvae:

Average hatching length: 2.03mm.; range: 1.63 - 2.42 mm.

Identifying characteristics: The vent opens laterally at the base of the ventral finfold. There is a small amount of pigmentation on tip of snout and on top of head dorsal to the eye. A vertical band of dendritic melanophores posterior to the otocyst extends horizontally the full length of the intestine. There is a dark vertical bar of pigmentation across the tail midway between the vent and the tip of the tail and a large stellate melanophore just ventral to the muscle somites at the base of the tail extending onto the finfold.

Postlarvae:

Identifying characteristics: The tail spot disappears shortly after yolk sac adsorption, but the postanal pigmentation band is discernible in larvae up to about 8 mm. In late stage larvae the ventral fins are large and heavily pigmented with the individual rays connected by a fin membrane.

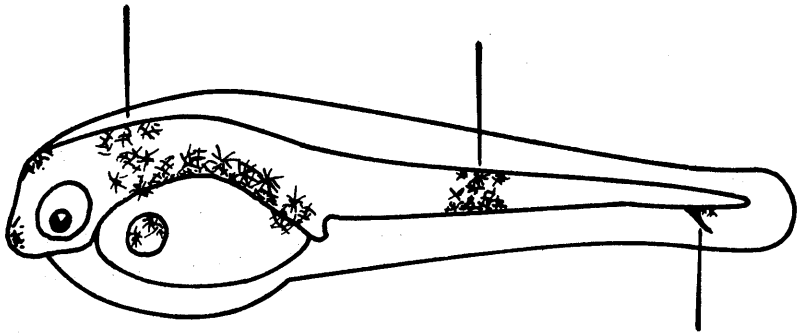
References:

1. Battle, H.I., 1929.

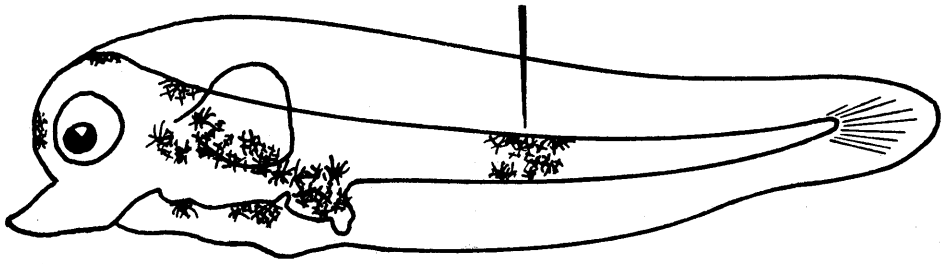
2. Dannevig, A., 1918.

3. Ehrenbaum, E., 1905.

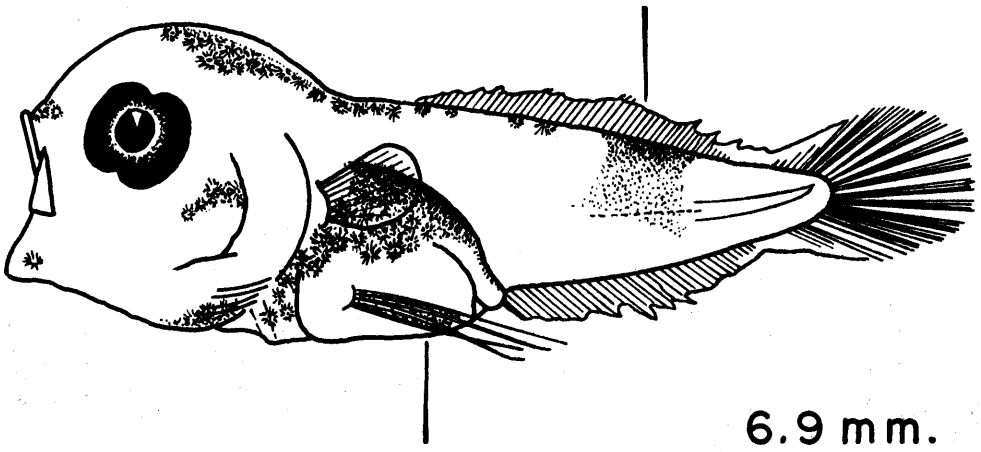
FOURBEARD ROCKLING



2.2 mm.



3.0 mm.



6.9 mm.

GADIDAE

Gadus morhua - Atlantic cod

Spawning:

December - April. (Season greatly attenuated with beginning and end variable. In Gulf of Maine peak of spawning occurs in February).

Eggs:

Average diameter: 1.52 mm.; range: 1.32 - 1.72 mm.

Identifying characteristics: None in early stages, but the characteristic prolarval pigmentation is readily discernible on late stage embryo.

Prolarvae:

Average hatching length: 4.38 mm.; range: 3.30 - 5.71 mm.

Identifying characteristics: The vent opens laterally at the base of the finfold as in other larval gadoids. Postanal pigmentation consists of a dorsal row of melanophores in two segments each shorter than the segments of the ventral row (opposite to pollock). The ventral row usually consists of three segments, the last being near the tip of the chorda. Occasionally, the last ventral segment of pigmentation is reduced to several spots.

Postlarvae:

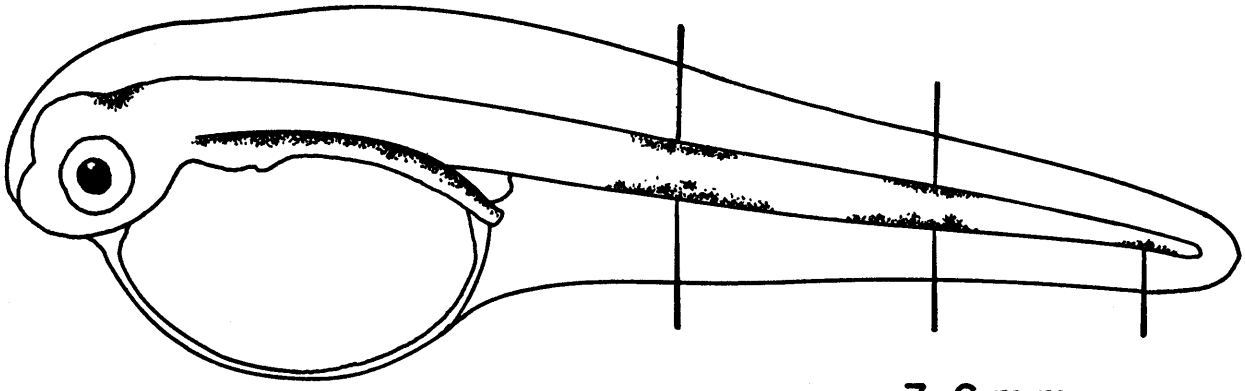
Identifying characteristics: The characteristic prolarval pigmentation persists until the larvae reach 7 to 10 mm., at which time the pigment bars fuse and the postanal pigmentation becomes indistinguishable from that of the pollock and haddock. After this stage the number of abdominal vertebrae (17-20) usually serves to distinguish this species (see description of pollock).

References:

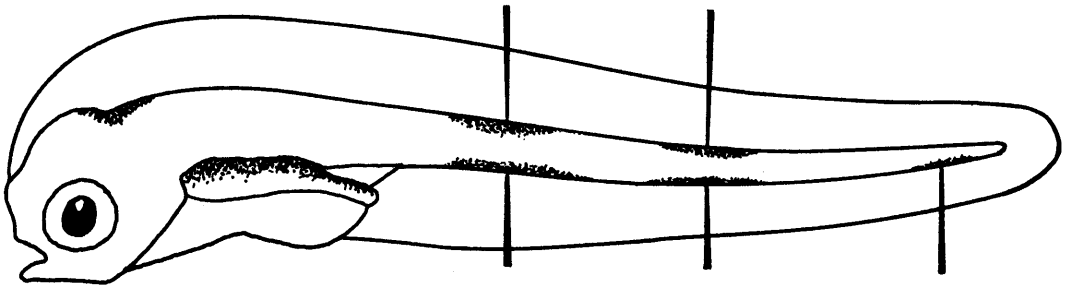
1. Ryder, J.A., 1884.

2. Schmidt, J., 1905 a.

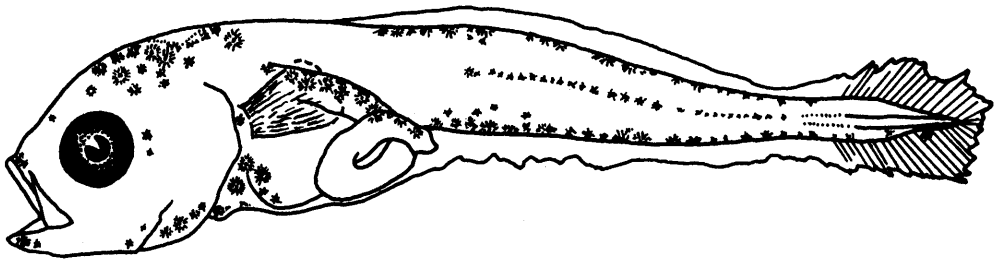
ATLANTIC COD



3.6 mm.



5.5 mm.



7.8 mm.

GADIDAE

Melanogrammus aeglefinus - Haddock

Spawning:

February - May.

Eggs:

Average diameter: 1.46 mm.; range: 1.10 - 1.67 mm.

Identifying characteristics: None in early stages, but the characteristic prolarval pigmentation is readily discernible on late stage embryo.

Prolarvae:

Average hatching length: 4.08 mm.; range: 3.08 - 4.99 mm.

Identifying characteristics: The vent opens laterally at the base of the finfold. There are scattered chromatophores on the back of the head and heavy pigmentation over the gut. Postanal pigmentation consists of a ventral row of rather fine melanophores extending from the vent to the tip of the tail.

Postlarvae:

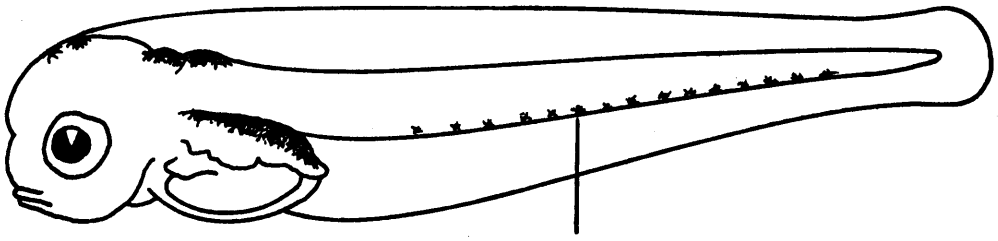
Identifying characteristics: The characteristic prolarval pigmentation persists until the larvae reach 8 to 10 mm., at which time the pigmentation becomes more diffuse and although somewhat lighter resembles that of the pollock and cod. After this stage the number of abdominal vertebrae (19-22) usually serves to distinguish this species (see description of pollock).

References:

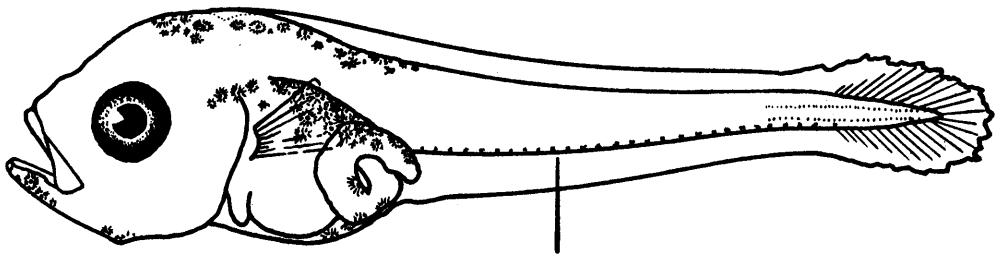
1. Ehrenbaum, E., 1905.

2. Schmidt, J., 1905 a.

HADDOCK



4.8 mm.



7.8 mm.

GADIDAE

Merluccius albidus - Offshore hake

Spawning:

April - July?

Eggs:

Average diameter: 1.10 mm.; range: 0.99 - 1.18 mm.

Average oil globule diameter: 0.32 mm.; range: 0.29 - 0.36 mm.

Identifying characteristics: Low egg diameter to oil globule diameter ratio, average egg and oil globule diameters greater than those of the silver hake, in late stage eggs the embryo has characteristic prolarval pigmentation and there are melanophores on the yolk mass (none in silver hake) as well as on oil globule.

Prolarvae:

Average hatching length: 3.54 mm.; range: 3.05 - 3.75 mm.

Identifying characteristics: The vent opens laterally near the base of the ventral finfold. There are rather dense patches of melanophores on the jaw, on the posterior part of the head, on the yolk mass, and on the oil globule. The body has four distinct concentrations of melanophores; two dorsal to the yolk sac, one of which is over the vent, another one-third the distance from the vent to the tip of the tail, and the last, two-thirds the distance from the vent to the tip of the tail. The last band of melanophores extends dorsally and ventrally onto the finfold.

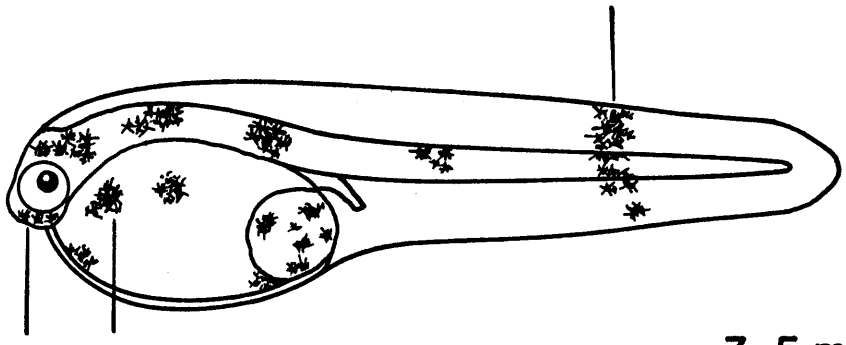
Postlarvae:

No information available. It is likely, however, that the prolarval pigmentation changes in later stages as it does in M. bilinearis and M. productus. Thus it may not be diagnostic for later stage larvae.

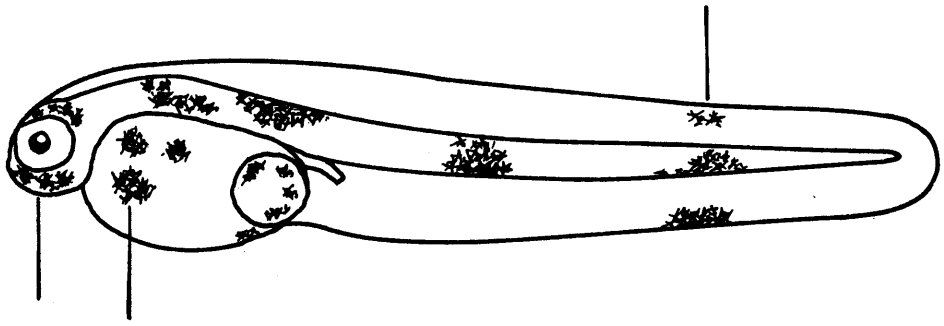
References:

1. Marak, R.R., 1967.

OFFSHORE HAKE



3.5mm.



3.9mm.

GADIDAE

Merluccius bilinearis - Silver hake

Spawning:

May - mid-October.

Eggs:

Average diameter: 0.91 mm.; range: 0.84 - 1.02 mm.

Average oil globule diameter: 0.26 mm.; range: 0.19 - 0.31 mm.

Identifying characteristics: Low egg diameter to oil globule diameter ratio, average egg and oil globule diameters less than those of the offshore hake, oil globule pigmented soon after blastopore closure, characteristic prolarval pigmentation on late stage embryo.

Prolarvae:

Average hatching length: 3.02 mm.; range: 2.64 - 3.52 mm.

Identifying characteristics: The vent opens laterally near base of finfold. There is a sparse scattering of melanophores on the head, over the gut, and on the oil globule. Two evenly spaced vertical bands of scattered melanophores are on the tail, one located a short distance posterior to the vent and the other somewhat more than half the distance from the vent to the posterior end of the body.

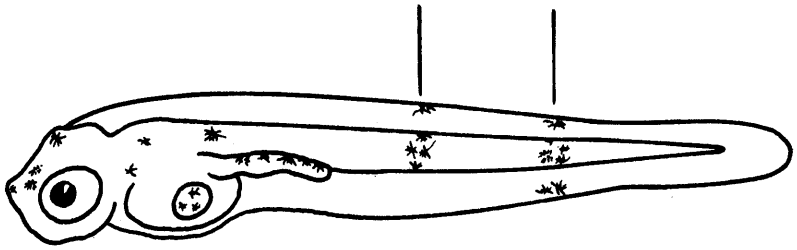
Postlarvae:

Identifying characteristics: There are large melanophores on dorsal aspect of head and over the gut. The postanal pigment is made up of three vertical bands, one just posterior to the vent, one approximately half-way from vent to posterior end of body, and a third at the posterior end of the body. (These three bands of pigment are distinguishable in larvae up to about 11 mm. at which time the general form of the fins is similar to that in the adult). A single row of conical teeth is readily discernible in larvae of about 7.5 mm.

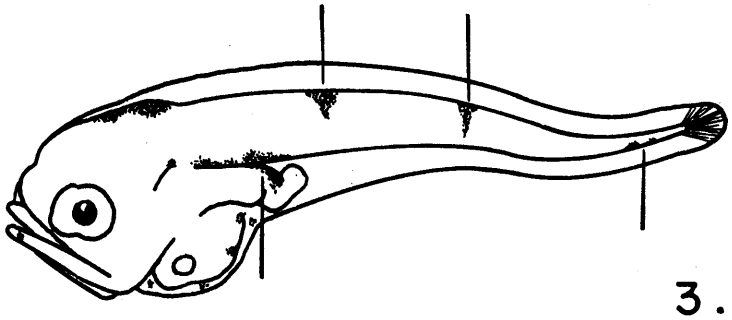
References:

1. Kuntz, A., and L. Radcliffe, 1917.

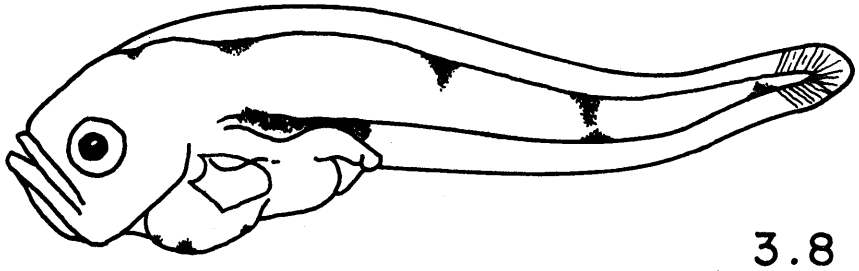
SILVER HAKE



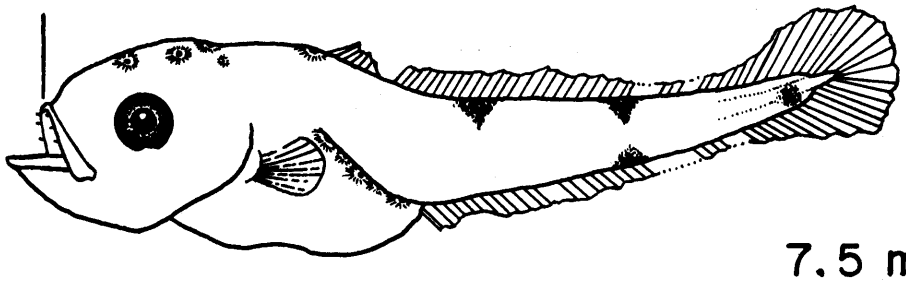
2.9 mm.



3.3 mm.



3.8 mm.



7.5 mm.

GADIDAE

Pollachius virens - Pollock

Spawning:

November - mid-February.

Eggs:

~~Average diameter: 1.15~~ mm.[1]; range: 1.0 - 1.2 mm.

Identifying characteristics: The egg is considerably smaller than those of the cod and haddock. These are the only two species that have overlapping spawning periods with whose eggs those of the pollock could possibly be confused.

Prolarvae:

Average hatching length: 4.0 mm.; range: 3.4 - 4.2 mm.

Identifying characteristics: The vent opens laterally at the base of the ventral finfold. At hatching the pigmentation is sparse and scattered over the anterior aspect of the body. In late prolarvae the melanophores tend to group themselves in specific areas, but unlike the cod the characteristic bars of pigmentation do not form until the time of yolk sac absorption.

Postlarvae:

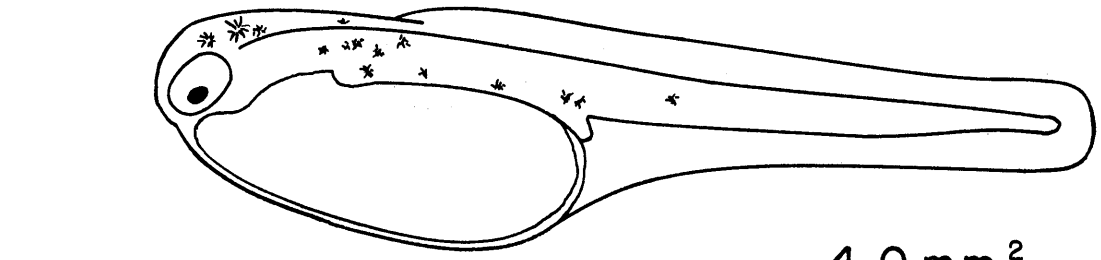
Identifying characteristics: At the time of yolk sac absorption the characteristic postanal pigmentation consists of two dorsal and two ventral bars of melanophores. The dorsal bars are longer than the ventral bars (opposite to cod). The space between the bars is greater ventrally. This characteristic pigmentation pattern persists until the larvae have reached a length of 8 to 9 mm. In later stages, the pigmentation no longer shows any trace of the arrangement in bars and the scattered postanal pigmentation is undistinguishable from that of the cod and haddock. The most reliable method of separating the late postlarvae of these three species is by the number of abdominal vertebrae. These are as follows:

	Average	Range
Pollock	23.6	23-25
Haddock	20.3	19-22
Cod	18.4	17-20

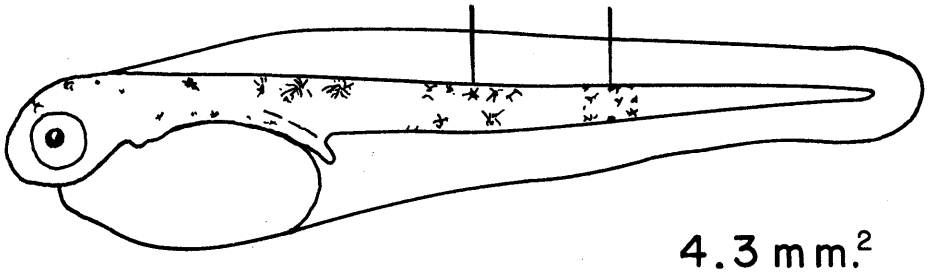
References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.
2. M'Intosh, W.C., 1894.
3. Schmidt, J., 1905a.

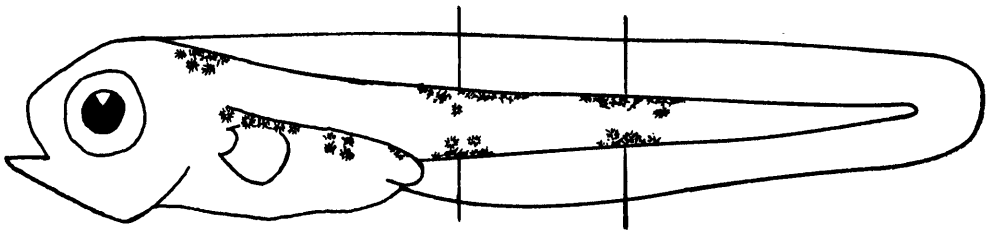
POLLOCK



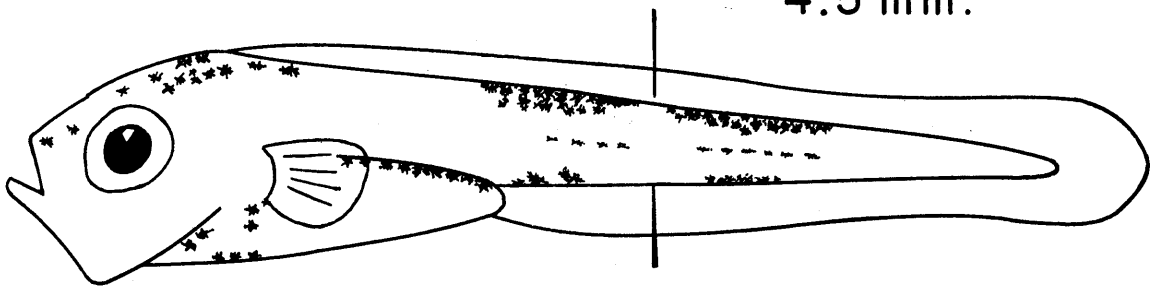
4.0 mm.^{2}



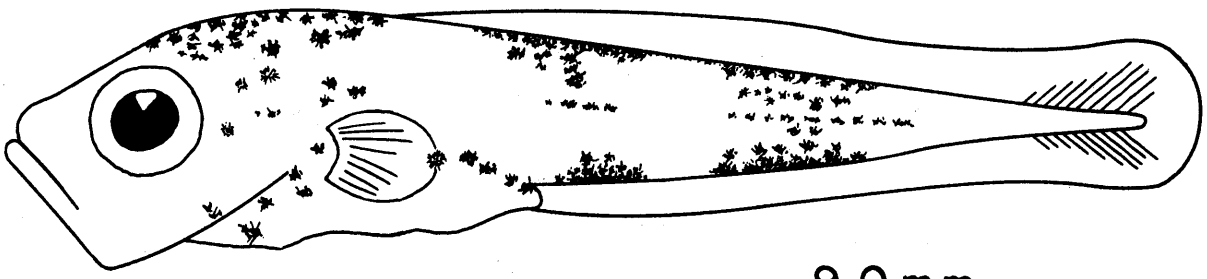
4.3 mm.^{2}



4.5 mm.



6.8 mm.



9.0 mm.

GADIDAE

Urophycis chuss - Squirrel hake

Spawning:

May - August.

Eggs:

Average diameter: 0.76 mm.; range: 0.63 - 0.97 mm.

Average oil globule diameter: 0.19 mm.; range: 0.15 - 0.22 mm.

Identifying characteristics: The egg and oil globule diameters are similar to those of the butterfish and the fourbeard rockling, but late-stage hake eggs have pigmentation on the yolk sphere (none in butterfish) and more conspicuous pigmentation on the oil globule and embryo. The characteristic prolarvae pigmentation is readily discernible on the late stage embryo.

Prolarvae:

Average hatching length: 2.04 mm.; range: 1.76 - 2.29 mm.

Identifying characteristics: The vent opens laterally at the base of the ventral finfold. At the time of hatching there are three large stellate melanophores on the forehead, and about six scattered on the trunk. In the postanal region there are two melanophores on the dorsal edge (the anterior of which is directly above the vent) and one on the ventral edge approximately midway between the vent and the tail tip. The oil globule, which is located posterior to the yolk mass, is conspicuously pigmented. In late-stage prolarvae there is an additional small concentration of pigment on the dorsal surface of the gut and an increase in the number of melanophores in the postanal region. The location of the postanal melanophores in late-stage prolarvae is variable.

Postlarvae:

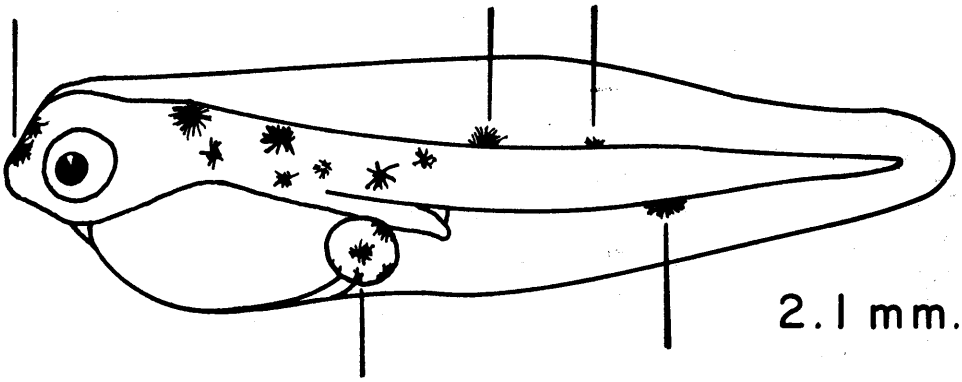
Identifying characteristics: At the completion of yolk sac absorption there is a marked change in pigmentation pattern. A single large melanophore is located on the nape, a dorso-ventral pair of melanophores occur approximately midway between the vent and the tail tip, and the gut is heavily pigmented on its dorsal surface. This pattern persists until the larvae are about 6 mm. From this stage on the pigmentation becomes more scattered and the number of abdominal vertebrae (average: 14.9; range: 14 - 16) serves best to distinguish this species from the white hake (U. tenuis)[1/] (average: 16.0; range: 15 - 17).

References:

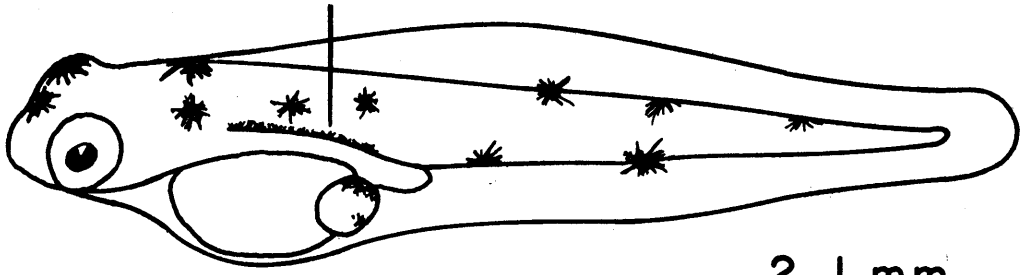
1. Agassiz, A. and C.O. Whitman, 1885 (misidentified as "Species allied to Motella").
2. Hildebrand, S.F. and L.E. Cable, 1938.
3. Kuntz, A. and L. Radcliffe, 1917 (misidentified as butterfish).
4. Miller, D. and R.R. Marak, 1959.

1/ The eggs and larvae of the white hake have not been described. Eggs and prolarvae identifiable as this species were not collected during any survey, nor have we been able to collect ripe and running adults. However, late postlarval and juvenile white hake (13 - 68 mm.) distinguishable by the number of their abdominal vertebrae, were abundant at the surface throughout the Gulf of Maine during the spring months.

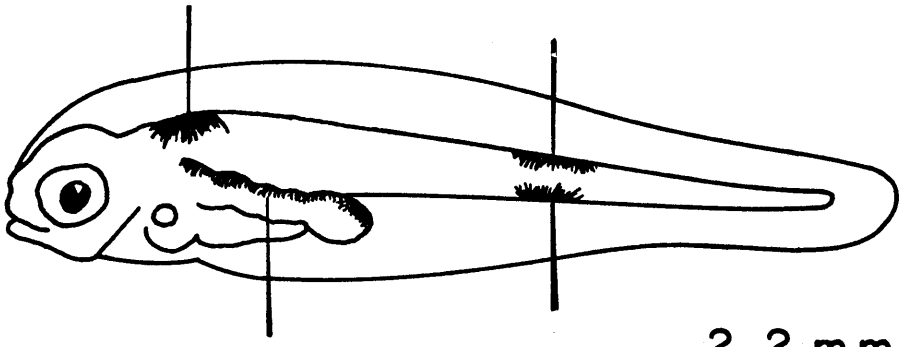
SQUIRREL HAKE



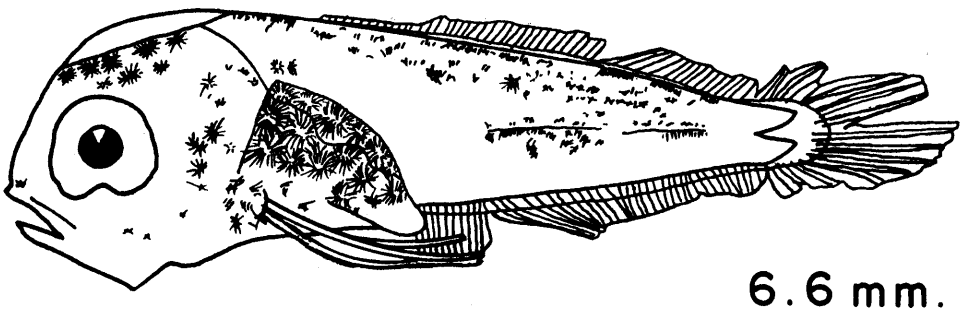
2.1 mm.



2.1 mm.



2.2 mm.



6.6 mm.

SPARIDAE

Stenotomus chrysops - Scup

Spawning:

May - July.

Eggs:

Average diameter: 0.94 mm.[2]; range: 0.89 - 0.99 mm.[2].

Average oil globule diameter: 0.18 mm.[2]; range: 0.16 - 0.20 mm.[2].

Identifying characteristics: The egg diameter is similar to, but the oil globule diameter is considerably less than, that of the silver hake. In late stage eggs the pigmentation on the scup embryo and oil globule is very sparse while that on the silver hake embryo and oil globule is characteristic of the prolarvae.

Prolarvae:

Average hatching length: Approximately 2 mm.[1].

Identifying characteristics: The vent, which opens at the margin of the finfold, is located a short distance from the posterior margin of yolk sac, but less than half the length of the body from the anterior end. Small groups of melanophores are scattered over the dorsal area of the head, the dorso-lateral aspects of the body, and on the oil globule.

Postlarvae:

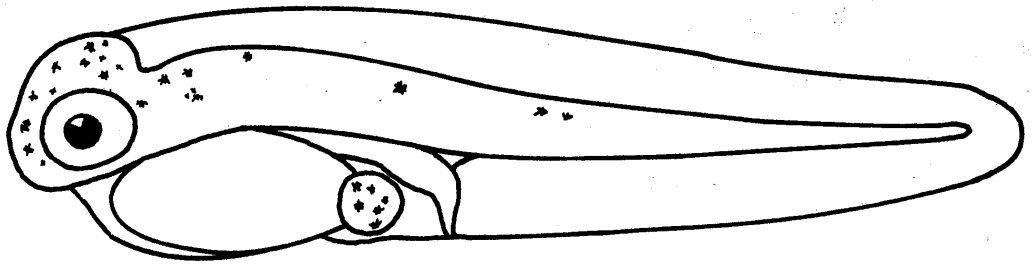
Identifying characteristics: After yolk sac absorption the distribution of melanophores changes markedly. A few small areas of pigmentation occur on the dorsal aspect of the head and lateral aspect of the anterior portion of the trunk region. There is a conspicuous pigment spot on the anterior edge of the vent (tends to fade on preservation) and a series of pigment spots along the ventral margin of the postanal region. At approximately 5 mm. the pigment spot on the vent disappears, but the characteristic series of ventral spots along the tail is more prominent. The ventral row of pigment spots is conspicuous on larvae up to about 10 mm, at which time the dorsal, anal, and caudal fins have become well differentiated.

References:

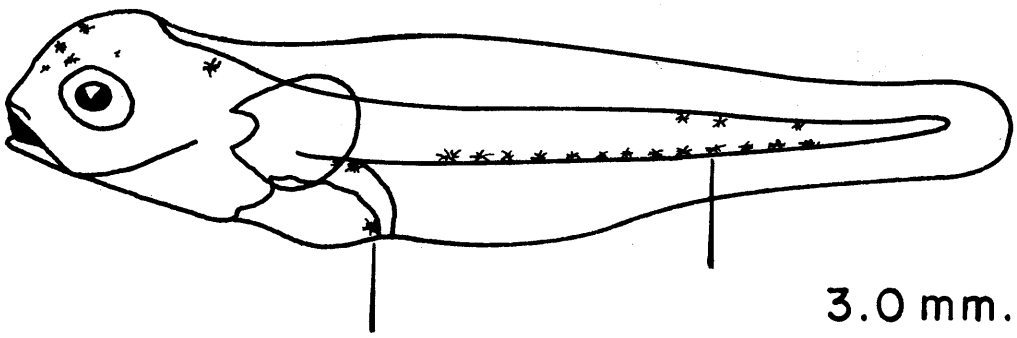
1. Kuntz, A. and L. Radcliffe, 1917.

2. Wheatland, S.B., 1956.

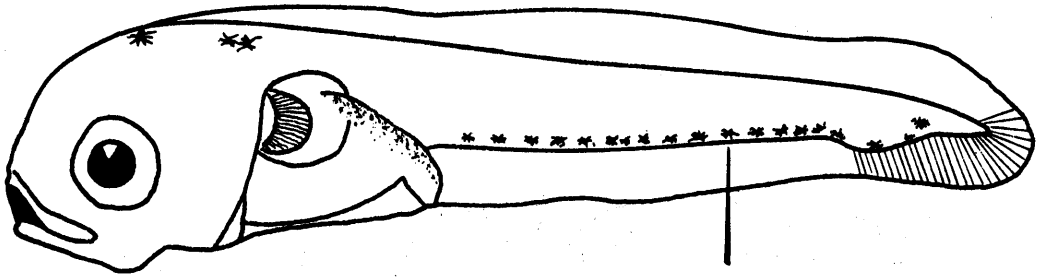
SCUP



2.0 mm.



3.0 mm.



5.5 mm

LABRIDAE

Tautoga onitis - Tautog

Spawning:

Mid-May - mid-July.

Eggs:

Average diameter: 1.03 mm.; range: 0.89 - 1.15 mm.

Identifying characteristics: The egg diameter range overlaps that of the cunner making positive separation of early stage eggs of these two species impossible. In late stage eggs the tautog embryo has an irregular line of light pigmentation encircling the front and sides of the head while the cunner embryo has little or no pigmentation on the head.

Prolarvae:

Average hatching length: Approximately 3 mm.[1].

Identifying characteristics: The melanophores on newly hatched larvae are confined to the dorsal and dorso-lateral aspects of the body. The finfolds and posterior portion of the caudal region of the body are unpigmented (in the cunner the pigmentation extends to the tail). The vent, which opens at the margin of the finfold, is located approximately one-half the distance between the snout and the tip of the tail as in the cunner. However, the distance from the posterior margin of the yolk sac to the vent is proportionately greater in the tautog (18 per cent of the total length) than in the cunner (11 per cent of the total length). In 24-hour-old larvae the number of melanophores has increased materially and they cover the entire anterior end of the body. The pigmentation terminates sharply about midway between the vent and the tip of the tail.

Postlarvae:

Identifying characteristics: The pigmentation pattern remains similar to that of the prolarvae, although the melanophores increase in size and number up to about 10 mm., at which time the dorsal, anal, and caudal fins are well differentiated.

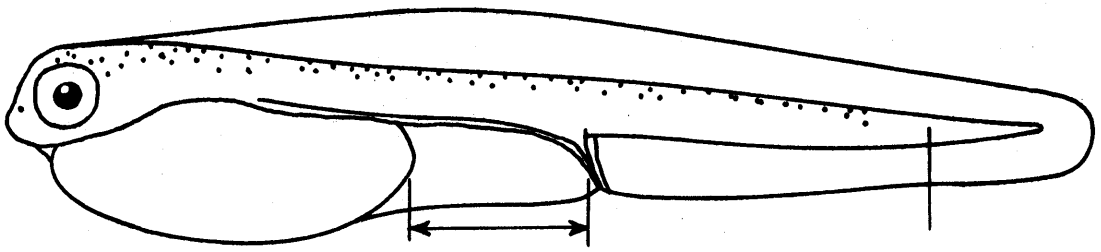
References:

1. Agassiz, A., and C.O. Whitman, 1885.

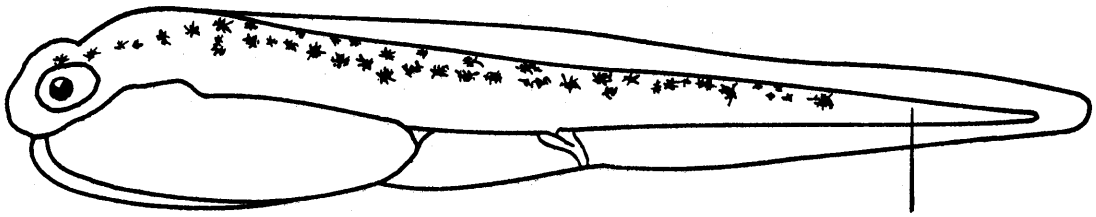
2. Kuntz, A., and L. Radcliffe, 1917.

3. Wheatland, S.B., 1956.

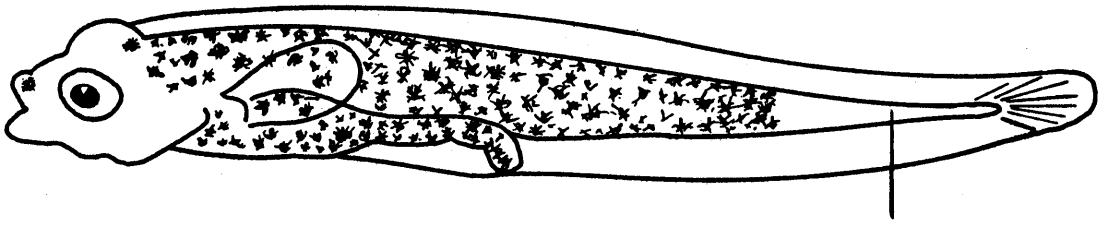
TAUTOG



2.9 mm.



3.1 mm.



4.2 mm.

LABRIDAE

Tautogolabrus adspersus - Cunner

Spawning:

May - August.

Eggs:

Average diameter: 0.85 mm.; range: 0.78 - 0.97 mm.

Identifying characteristics: The egg diameter range overlaps that of the tautog making positive identification impossible. In late stage cunner eggs the lack or sparseness of pigmentation on the head region and the smaller size and number of melanophores on the body of the embryo serve to distinguish this species.

Prolarvae:

Average hatching length: 2.90 mm.; range: 2.33 - 3.43 mm.

Identifying characteristics: The melanophores of newly hatched larvae are small and limited almost entirely to the dorsal and dorso-lateral aspects of the body and extend to the tail (in the tautog the posterior region of the body is unpigmented). The vent, which opens at the margin of the finfold, is located approximately mid-way between the head and tail as in the tautog. However, the distance between the posterior margin of the yolk sac and the vent is proportionately less in the cunner (11 per cent of the total length) than in the tautog (18 per cent of the total length). Soon after the larvae hatch the pigmentation undergoes a marked change as some of the melanophores aggregate to form spots, one at the turn of the gut where it descends to the margin of the finfold, a second ventrally half-way between the vent and the tip of the tail, and a third near the tail tip.

Postlarvae:

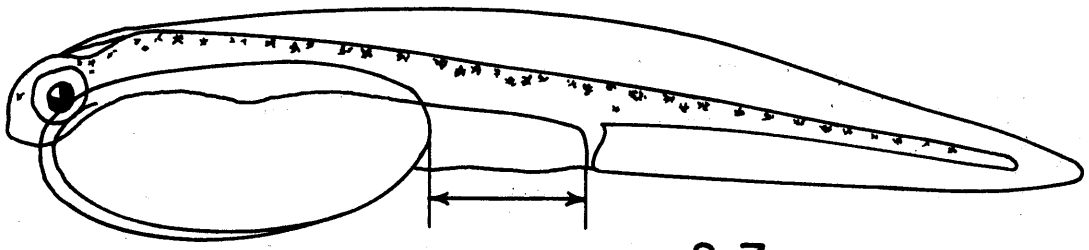
Identifying characteristics: By the time yolk sac absorption is complete, there is a definite band of pigmentation over the gut, a single large melanophore on the back of the head, a dorso-ventral pair of large melanophores half-way between the vent and the tail, and an aggregate on the ventral side of the tail tip. This general pattern persists to approximately 8 mm. at which time the dorsal, anal, and caudal, fin rays are readily discernible.

References:

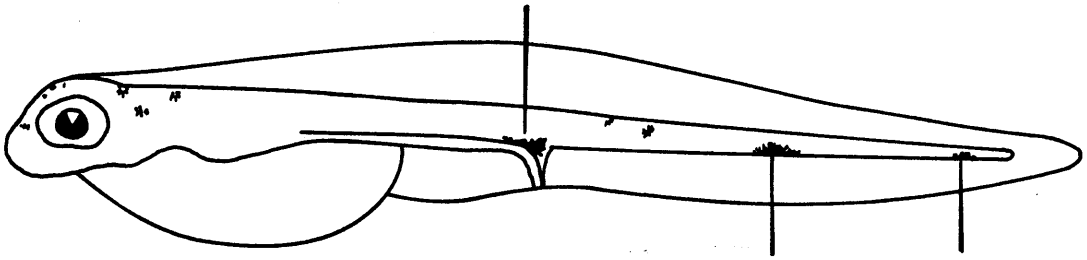
1. Agassiz, A. and C.O. Whitman, 1885 (described as Ctenolabrus adspersus and Pleuronectes americanus).

2. Kuntz, A. and L. Radcliffe, 1917.

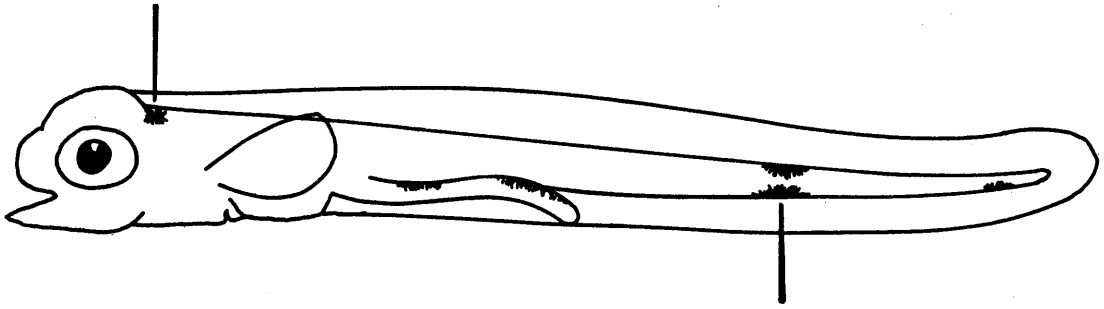
CUNNER



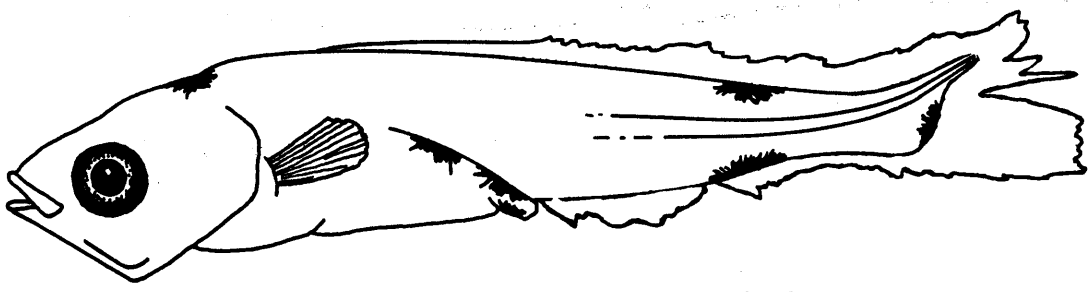
2.7 mm.



2.8 mm.



3.5 mm.



4.9 mm.

SCOMBRIDAE

Scomber scombrus - Atlantic mackerel

Spawning:

May - July.

Eggs:

Average diameter: 1.15 mm.; range: 0.98 - 1.37 mm.

Average oil globule diameter: 0.29 mm.; range: 0.26 - 0.31 mm.

Identifying characteristics: The egg and oil globule diameter overlap that of the cusk, but mackerel eggs have a pigmented pale yellow oil globule while the oil globule of the cusk is pinkish and unpigmented.

Prolarvae:

Average hatching length: 3.31 mm.; range: 2.46 - 3.83 mm.

Identifying characteristics: The vent opens at the margin of the finfold. There are scattered stellate melanophores on the forehead, around the eye, and on the dorsal aspect of the neck. Beginning above the center of the yolk sac there is a series of 10 to 12 melanophores lying between the epaxial myomeres. The postanal pigment consists of scattered stellate and club-shaped melanophores. The large pigmented oil globule is very conspicuous for some time after hatching.

Postlarvae:

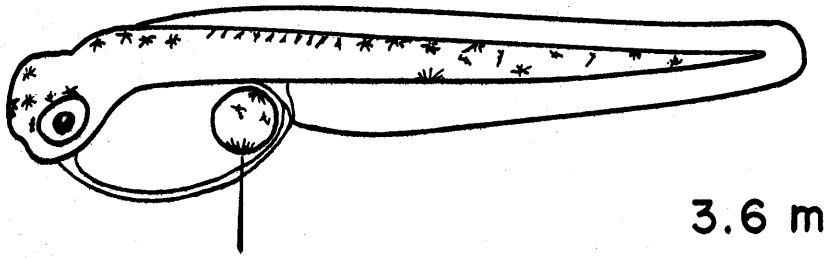
Identifying characteristics: At the time of yolk sac absorption there are several large stellate melanophores on the dorsal aspect of the head and neck and heavy pigmentation over the gut. The postanal pigmentation consists of a dorsal and a ventral row of pigment spots. In early postlarvae the ventral row of spots extends farther forward (approximately three-fourths the distance from the tail to the vent) than the dorsal row. In later postlarval stages, the pigment becomes more extensive and strongly dedevloped in these different regions. This pigmentation pattern is similar to that of the postlarval redfish, but differs in that melanophores on the tail are more widely spaced in the mackerel. In addition, the mackerel has a rounded tail of finfold (square in the redfish) and has prominent canine type teeth by 5 mm. (small teeth by about 15 mm. in redfish). The dorsal and anal fin rays are discernible at about 9 mm. and specimens larger than 12 mm. have all their fin rays and are identifiable on these characters alone.

References:

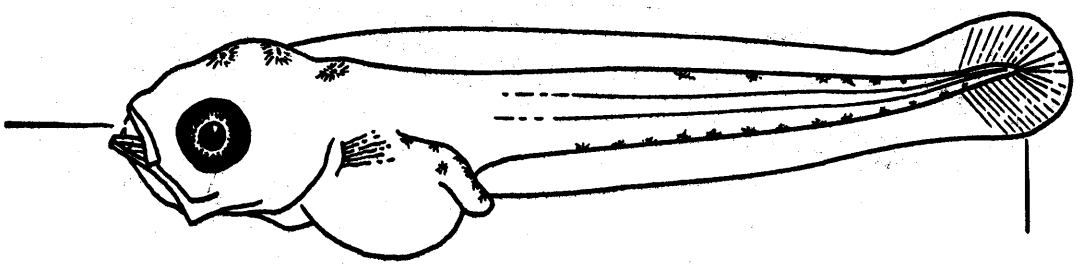
1. Bigelow, H.B. and W.C. Schroeder, 1953.

2. Sette, O.E., 1943.

ATLANTIC MACKEREL



3.6 mm.



4.4 mm.

SCORPAENIDAE

Sebastes marinus - Redfish or ocean perch

Spawning:

May - August.

Eggs:

The redfish is ovoviviparous.

Prolarvae:

Average extrusion length: 7.0 mm.; range: 6.5 - 7.3 mm.

Identifying characteristics: The vent opens at the margin of the finfold. There are one to four large melanophores on the dorsal surface of the head and rather heavy pigmentation on the dorso-lateral surface of the gut. The postanal pigmentation consists of a ventral row of small, closely spaced dots beginning a considerable distance posterior to the vent and terminating about an equal distance from the tip of the tail, and a shorter dorsal row of four to seven large stellate melanophores. In addition, there is usually a ventral caudal pigment spot consisting of one or a few melanophores which extends into the finfold. The ventral melanophores are smaller and more closely spaced than those in the early postlarval mackerel. The prolarval redfish have a square tail of finfold (round in mackerel) and a small unpigmented oil globule (large and pigmented in mackerel).

Postlarvae:

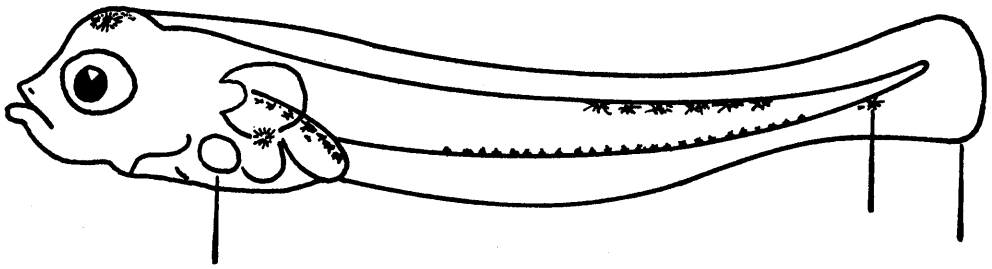
Identifying characteristics: Although more pronounced, the pigmentation pattern remains about the same up to a length of 10 - 12 mm. At about 7 mm. the caudal portion of the finfold becomes more rounded and the caudal fin rays readily discernible. By 10 mm. the characteristic head and opercular spines are well developed, but teeth are not apparent until about 15 mm. (5 mm. in mackerel).

References:

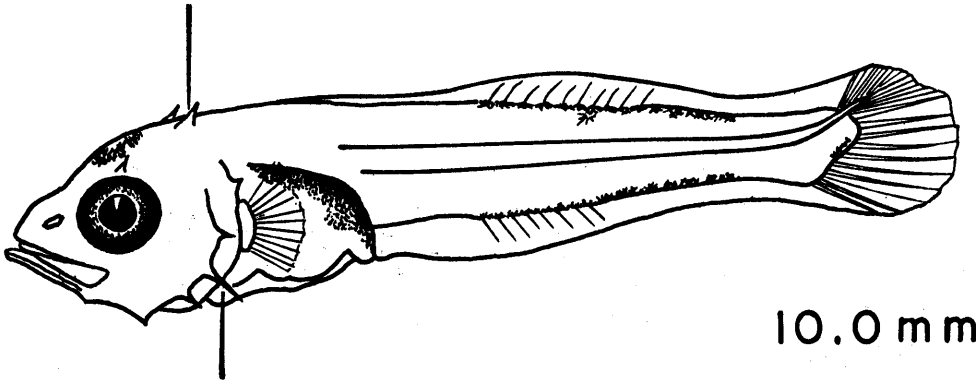
1. Bigelow, H.B. and W.C. Schroeder, 1953.

2. Taning, Å.V., 1961.

REDFISH



6.9 mm.



10.0 mm.

COTTIDAE

Myoxocephalus octodecemspinosus - Longhorn sculpin

Spawning:

November - February.

Eggs:

Demersal.

Prolarvae:

Average hatching length: 6.84 mm.; range: 6.27 - 7.29 mm.

Identifying characteristics: The vent opens at the margin of the fin-fold immediately behind the yolk sac. The postanal pigment consists of a ventral row of small melanophores beginning at the vent and terminating just short of the tail tip. There are large melanophores scattered over the dorso-lateral aspect of the yolk sac and four to five melanophores on each side of the nape. The large unpigmented oil globule, which ranges from 0.42 - 0.51 mm. at time of hatching, is still readily discernible up to the time of yolk sac absorption. The robust size and distinctive pigmentation pattern make this species easily separable from all other prolarvae considered in this paper.

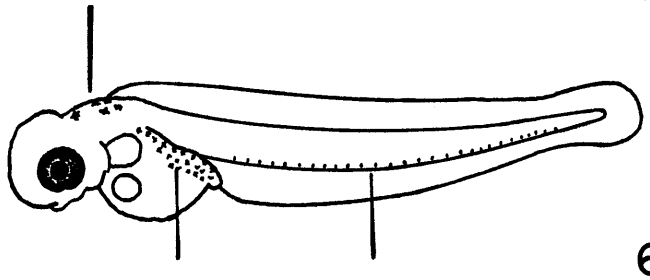
Postlarvae:

Identifying characteristics: The yolk and oil globule are absorbed at about 7.5 mm. With the exception of additional scattered pigmentation in the region of the gill opening, the typical pro-larval pigmentation pattern persists until larvae go to the bottom (approximately 10 mm.). At about 8.5 mm. a pair of head spines and four preopercular spines appear and the caudal and pectoral fin rays are apparent. The dorsal and anal fin rays are discernible at about 10 mm., but it is not until about 15 mm. and after the larvae have taken to the bottom that the characteristic long uppermost cheek spine and high first dorsal fin are apparent.

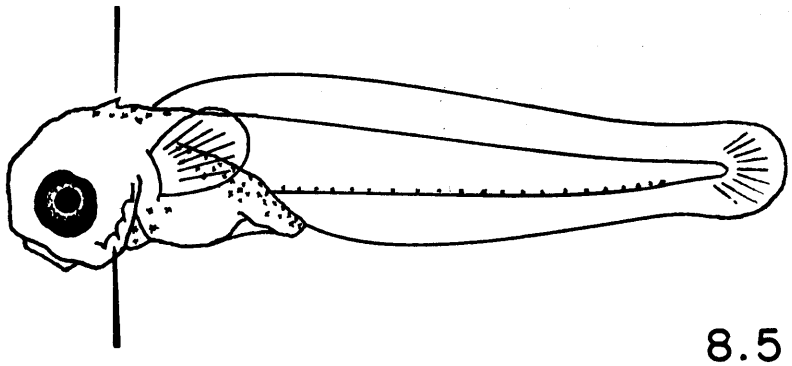
References:

None.

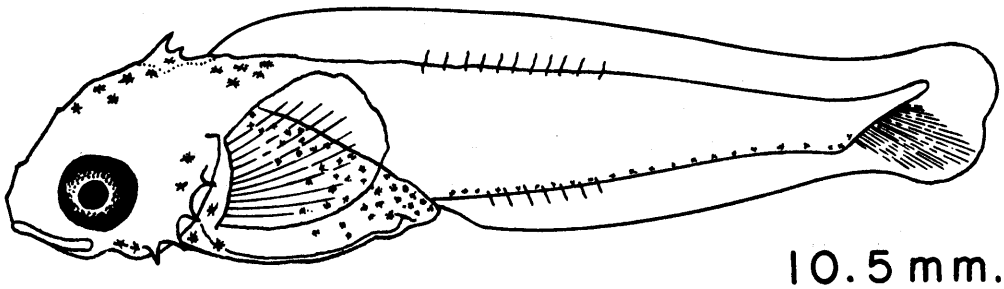
LONGHORN SCULPIN



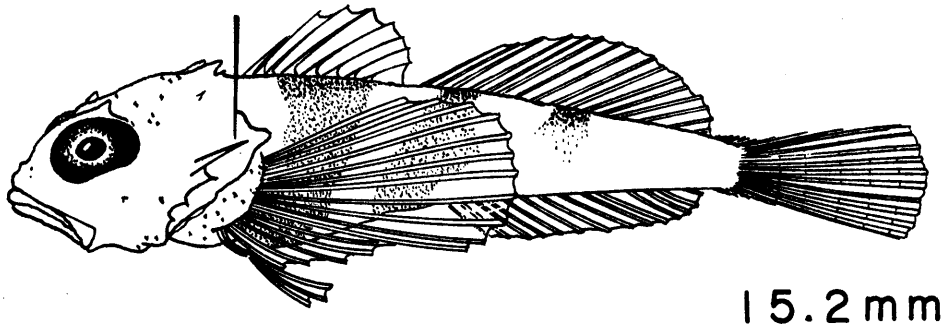
6.8 mm.



8.5 mm.



10.5 mm.



15.2 mm.

AMMODYTIDAE

Ammodytes dubius[2/] - Northern sand lance

Spawning:

November - February ?

Eggs:

Demersal.

Prolarvae:

Not collected, but most likely the hatching length and pigmentation pattern are similar to those of *A. hexapterus* as described by Williams, Richards and Farnworth (1964).

Postlarvae:

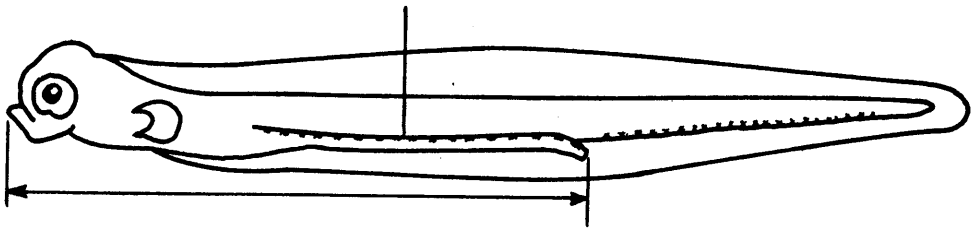
Identifying characteristics: The vent, which opens at the base of the finfold, is located slightly posterior to the midpoint of the body (in the snake blenny the vent opens at the margin of the finfold and anterior to the midpoint of the body). There is a row of about 18 stellate melanophores along the dorsal surface of the gut (pigmentation is below the gut in the rock gunnel). Postanal pigmentation consists of a ventral row of closely spaced dots extending from the vent to a short distance anterior to the tip of the tail and a less distinct dorsal row of pigment bars, which vary considerably in number and time of appearance. Also, short bars of pigmentation occur dorsally in this region, however, these are quite variable in their time of appearance and number. By the time the caudal fin rays are developed (approximately 14 mm.), one to five stellate melanophores on top of the head and a vertical row of small melanophores at the base of the caudal fin are readily discernible. This basic pigmentation pattern persists beyond 30 mm. The anal and dorsal fin rays are discernible in larvae of about 13 mm., but the tail does not begin to assume its forked outline until upward of 22 mm.

References:

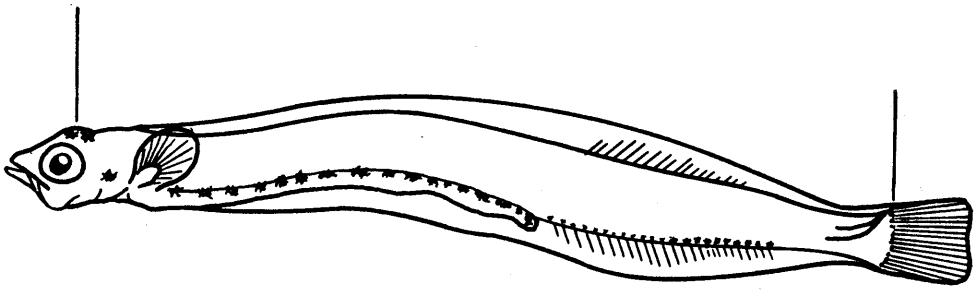
1. Macer, C.T., 1967.
2. Norcross, J.J., W.H. Massmann, and E.B. Joseph, 1961.
3. Richards, S.W., 1965.
4. Wheatland, S.B., 1956.
5. Williams, G.C., S.W. Richards, and E.G. Farnworth, 1964.

2/ -- We have assumed all sand lance larvae collected in offshore waters to be *A. dubius*, but possibly some *A. hexapterus* have been included. To our knowledge the larval pigmentation of these two species is similar. For a discussion of the nomenclatural confusion and the distribution and meristic characteristics of these two species, see Richards, Perlmutter, and McAneny (1963).

NORTHERN SAND LANCE



6.0 mm.



15.7 mm.

PHOLIDAE

Pholis gunnellus - Rock gunnel

Spawning:

November - March ?

Eggs:

Demersal.

Prolarvae:

Average hatching length: Approximately 9 mm.[1].

Identifying characteristics: The vent, which opens at the margin of the finfold, is located at the midpoint of the body (in the snake blenny the vent is considerably anterior to the midpoint of the body). There is a well-marked ventral row of small pigment spots extending along the intestine from below the base of the pectoral fins to the vent (in the snake blenny and sand lance the preanal pigmentation runs along the dorsal surface of the intestine). There are three or four stellate melanophores on the dorsal surface of the intestine near the vent and a ventral row of pigment spots on the tail extending from just forward of the vent to the tip of the tail.

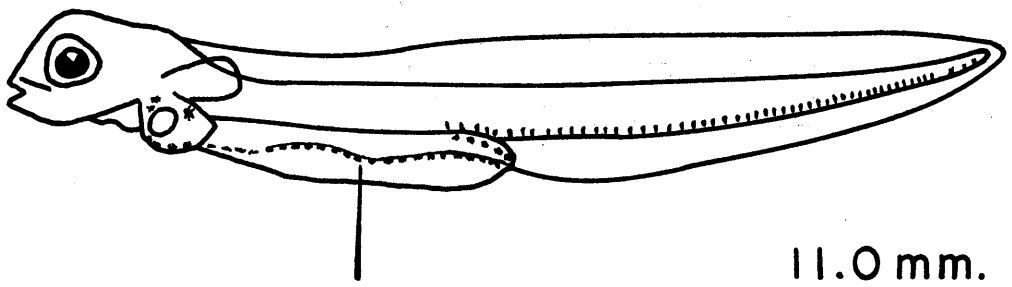
Postlarvae:

Identifying characteristics: The distinctive row of pigment spots along the ventral surface of the gut is readily discernible up to the time of metamorphosis. Larger postlarvae have four or five stellate melanophores on the dorsal surface of the gut just posterior to the pectoral fins. The fin rays are complete at about 30 mm. at which time the characteristic dorsal fin spots of the adult are first noticeable.

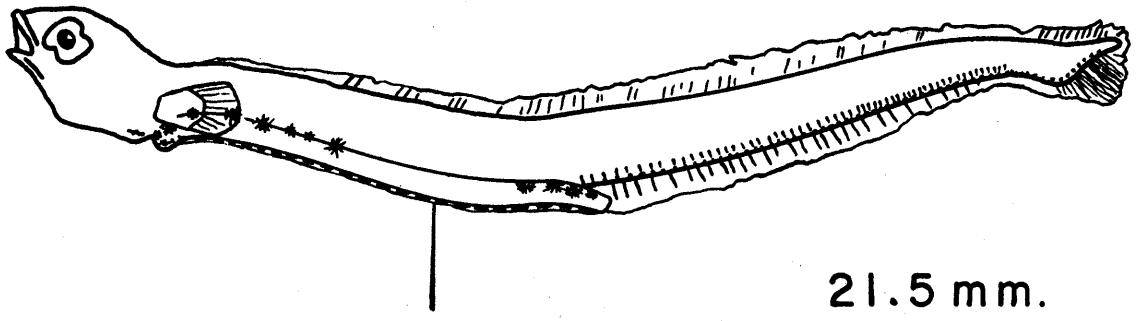
References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.
2. Ehrenbaum, E., 1905.
3. M'Intosh, W.C. and A.T. Masterman, 1897.

ROCK GUNNEL



11.0 mm.



21.5 mm.

STICHAEIDAE

Lumpenus lumpretaeformis - Snake blenny

Spawning:

October - April ?

Eggs:

Demersal.

Prolarvae:

Not known.

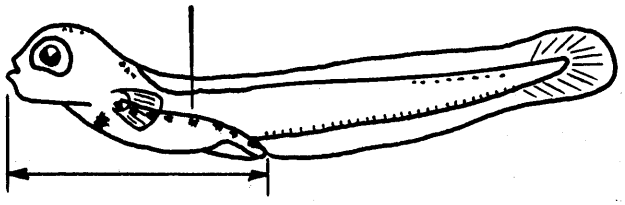
Postlarvae:

Identifying characteristics: The vent, which opens at the margin of the finfold, is located considerably anterior to the midpoint of the body (in the rock gunnel and sand lance the vent is located near the midpoint of the body). There is a large conspicuous pigment spot on the base of each pectoral fin, and a double row of six to nine distinct melanophores along the dorsal surface of the intestine (the rock gunnel has a row of small pigment spots below the intestine). Postanal pigmentation consists of a ventral row of rather fine melanophores extending from the vent and terminating a short distance from the tip of the tail. This characteristic pigmentation is evident in specimens up to about 40 mm. in length, although the pigment spots above the intestine tend to interfuse in older larvae.

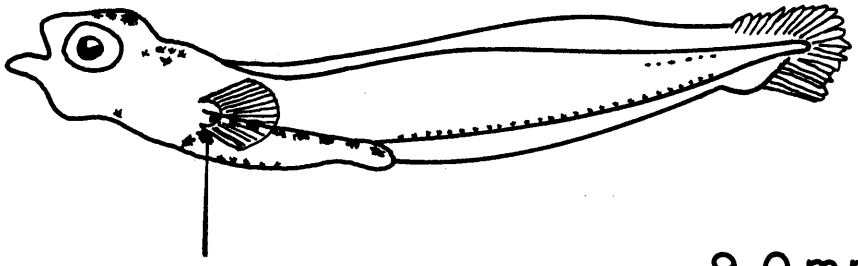
References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.

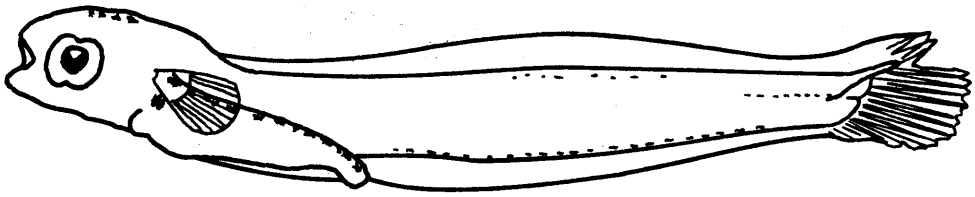
SNAKE BLENNY



6.9mm.



9.0mm.



13.5mm.

STROMATEIDAE

Poronotus triacanthus - Butterfish

Spawning:

June - August.

Eggs:

Average diameter: 0.77 mm.; range: 0.75 - 0.79 mm.

Average oil globule diameter: 0.20 mm.; range: 0.17 - 0.21 mm.

Identifying characteristics: The egg and oil globule diameters are similar to those of the squirrel hake, and fourbeard rockling but in butterfish eggs there is no pigmentation on the yolk sphere and the pigmentation on the oil globule and late stage embryo is finer and less conspicuous.

Prolarvae:

Average hatching length: 1.72 mm.; range: 1.68 - 1.75 mm.

Identifying characteristics: The vent, which opens at the margin of the finfold, is located a short distance from the posterior margin of the yolk sac and a little behind the midpoint of the body. At hatching the pigmentation is sparse and confined to the dorsal and dorsolateral surfaces of the body in two rows of small melanophores extending from the head to the tail. Within 48 hours of hatching a row of fine melanophores appears along the body at the base of the ventral finfold posterior to the vent, but it is not until shortly before complete yolk sac absorption that this characteristic ventral row of melanophores is pronounced.

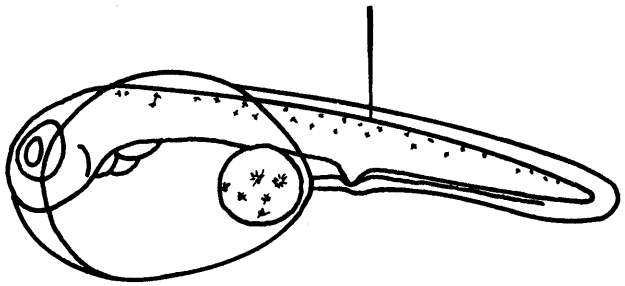
Postlarvae:

Identifying characteristics: Postlarvae are characterized by their short deep form and the ventral row of postanal pigment spots. In addition, there are one or two large stellate melanophores on top of the head, a row of melanophores along the dorsal surface of the gut, large scattered melanophores on the ventral margin of the gut, and one or more melanophores along the posterior margin of the opercle. The dorsal, anal, and caudal fin rays are readily discernible at about 5 mm. The only other deep-bodied larva having a ventral row of pigment spots is the scup. In the scup, however, the spots are close together (about one on each myomere), while on the butterfish they are more widely separated.

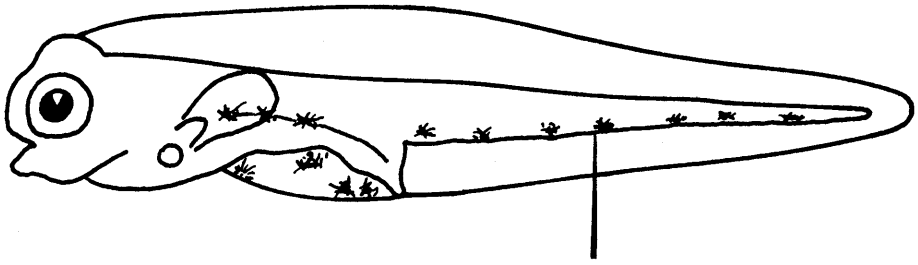
References:

1. Colton, J.B. and K.A. Honey, 1963.

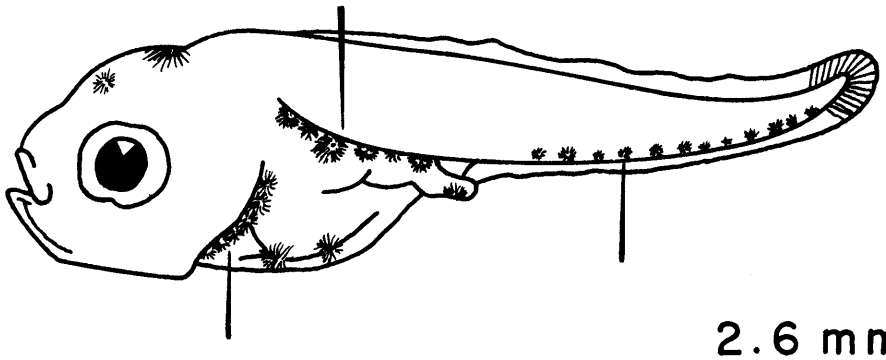
BUTTERFISH



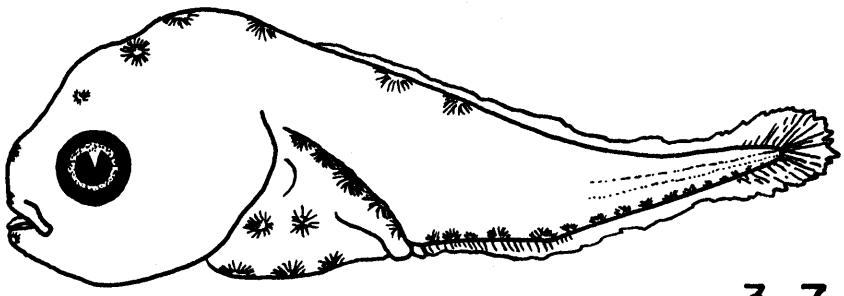
1.7 mm.



2.5 mm



2.6 mm.



3.7 mm.

BOTHIDAE

Paralichthys dentatus - Summer flounder

Spawning:

Mid-October - mid-April.

Eggs:

Average diameter: 1.04 mm.; range: 0.93 - 1.13 mm.

Average oil globule diameter: 0.22 mm.; range: 0.20 - 0.26 mm.

Identifying characteristics: The summer flounder is the only species having these egg and oil globule sizes which spawns from late fall to early spring (the fourspot, windowpane, scup, silver hake, and offshore hake are late spring and summer spawners). In addition, the egg capsule of the summer flounder is noticeably thick (approximately 1/40 the total egg diameter) when viewed under transmitted light and there is no readily discernible pigmentation on the oil globule or late stage embryo.

Prolarvae:

Average hatching length: 3.1 mm.; range: 2.5 - 3.6 mm.

Identifying characteristics: The vent, which opens at the margin of the finfold, is located approximately halfway between the snout and the tip of the tail. In newly hatched larvae the scattered pigment is extremely faint and confined to the finfold and postanal part of the body. The head, trunk, yolk sac, and tail tip are devoid of pigment. By 24 hours the pigment spots have increased in number and size and dendritic melanophores are scattered over the body and dorsal and ventral finfolds from the vent to a short distance anterior to the tip of the tail.

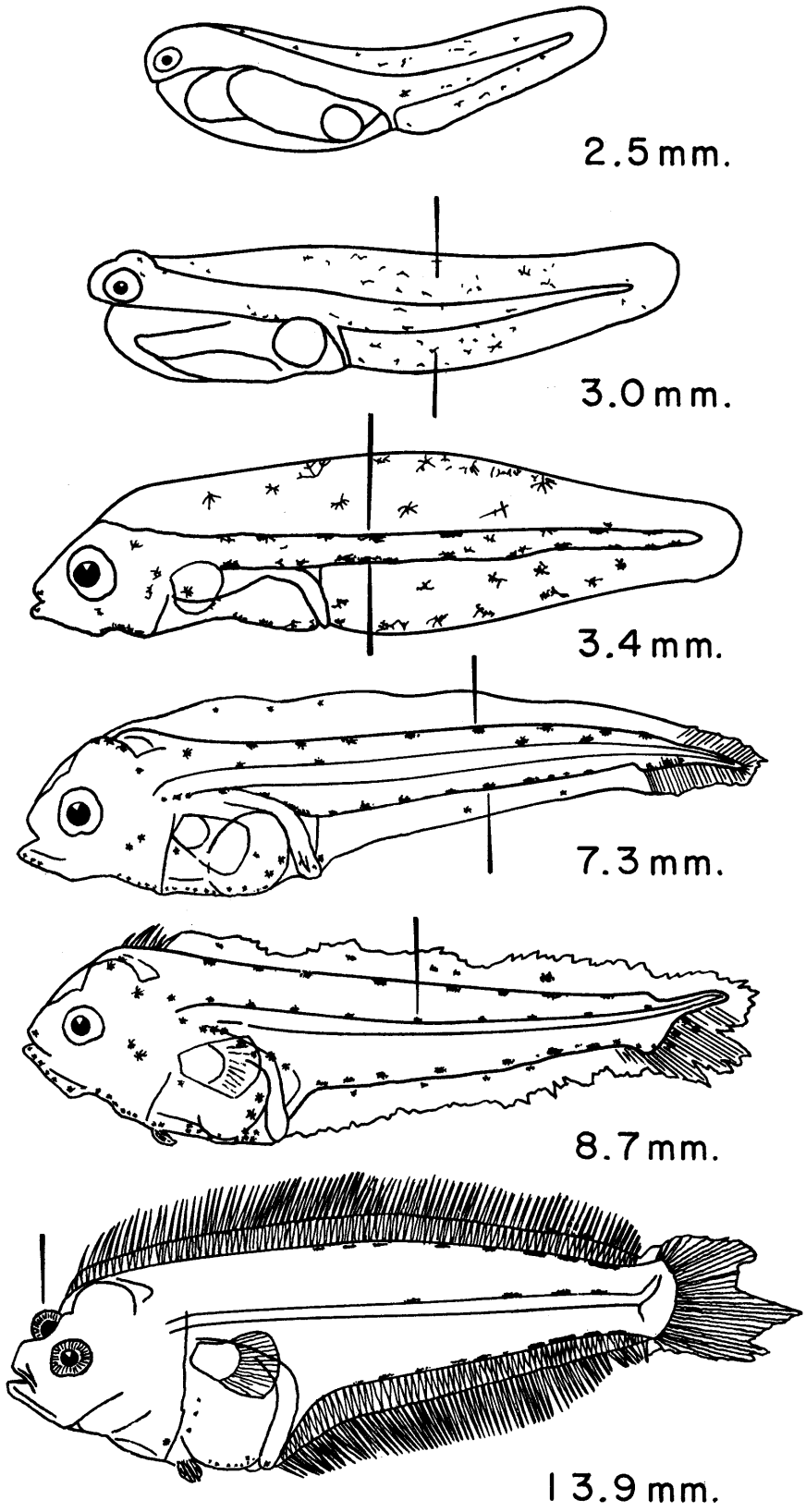
Postlarvae:

Identifying characteristics: At the time of yolk sac absorption the dendritic melanophores on the dorsal and ventral finfolds are large and conspicuous. In addition, there is a row of about 7 to 10 stellate melanophores running along the dorsal and ventral edge of the trunk and tail. In later stages there is a third row of 7 to 9 melanophores along the lateral line and conspicuous small pigment spots along the ventral edge of the head and gut. By 14 mm. the right eye has migrated to the dorsal edge of the snout and the finrays are present in their final number. At this stage the three rows of pigment spots are obvious only in the posterior tail region. From this stage on, the dorsal finray number (85 to 94) serves to separate the summer flounder from the fourspot (72 to 81). Deubler (1958) describes postlarval summer flounder (9-15 mm.) as having a well-defined band of black pigment along the border of the anterior four-fifths of the dorsal fin and the anterior two-thirds of the anal fin. This pigmentation was not evident in the preserved specimens we examined.

References:

1. Deubler, E. E., 1958.

SUMMER FLOUNDER



BOTHIDAE

Paralichthys oblongus - Fourspot flounder

Spawning:

May - July.

Eggs:

Average diameter: 1.04 mm.; range: 0.91 - 1.12 mm.

Average oil globule diameter: 0.17 mm.

Identifying characteristics: The egg diameter overlaps that of the silver hake and offshore hake, but the oil globule is unpigmented and considerably smaller. Late stage fourspot eggs may be separated from those of the scup in that the melanophores are uniformly scattered over the embryo and yolk mass, while in the scup embryonic pigmentation is confined to the head region and oil globule.

Prolarvae:

Average hatching length: 2.9 mm.; range: 2.7 - 3.2 mm.

Identifying characteristics: The vent, which opens at the margin of the finfold, is located approximately halfway between the snout and the tip of the tail. Stellate melanophores are evenly scattered on the head, trunk, and yolk sac. Slightly more than midway from the vent to the tail tip there is a diffuse band of melanophores extending onto the dorsal and ventral finfold. The remainder of the finfold and extreme tip of the tail are usually devoid of pigment. Prolarval winter flounder have a similar postanal vertical band of pigmentation, but in this species the vent is located approximately one-third the distance back from the snout to the tail tip.

Postlarvae:3/

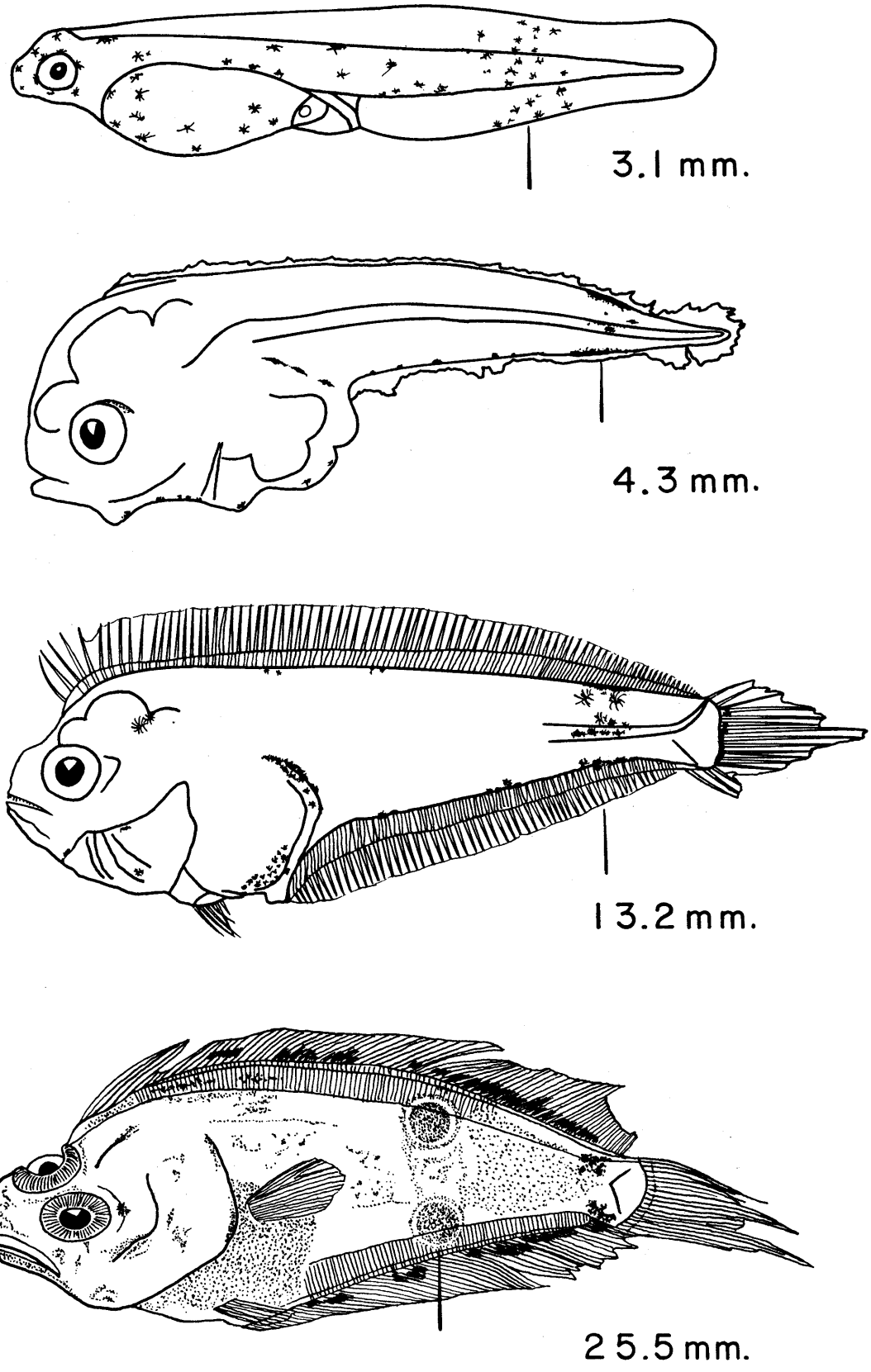
Identifying characteristics: By the time the yolk sac is absorbed the postanal pigment band is conspicuous and remains so until the fin rays are all formed. In addition, there is pigmentation over the gut and scattered stellate melanophores along the ventral margin of the gut and tail. The caudal fin rays are discernible at about 6 mm. The numbers of dorsal and anal fin rays are final at about 12 mm. and before the right eye begins to migrate. From this stage on the dorsal fin ray number (72 to 81) serves to separate the fourspot from the summer flounder (85 to 94). By 25 mm. the right eye has migrated to the dorsal edge of the snout and the anterior pair of the four characteristic eye spots readily discernible.

References:

1. Miller, D. and R.R. Marak, 1962.

3/-- Unpublished studies by Miss S. Leonard of the Virginia Institute of Marine Science suggest that possibly the 4.3 mm. and 13.2 mm. larvae illustrated are Gulf Stream Flounder (Citharichthys arctifrons) rather than fourspot. Unfortunately, fin ray counts or vertebral numbers do not serve to separate these two species.

FOURSPOT FLOUNDER



BOTHIDAE

Scophthalmus aquosus - Windowpane

Spawning:

May - August.

Eggs:

Average diameter: 1.1 $mm.^3$; range: 0.9 - 1.3 $mm.^3$.

Oil globule diameter range: 0.2 - 0.3 $mm.^3$.

Identifying characteristics: The spawning season and the egg and oil globule diameters overlap those of the silver hake and offshore hake, but the windowpane spawns principally in shoal water (less than 25 fms.) west of Cape Cod, an area not frequented by the latter two species during spawning. The oil globule of the windowpane is considerably larger than that of the fourspot flounder.

Prolarvae:

Hatching length: Approximately 2 mm.

Identifying characteristics: The smallest larva we have collected was 2.3 mm. The vent opens at the margin of the finfold and the prolarvae are characterized by rather heavy pigmentation from behind the head to about midlength, the remainder of the tail being completely free of pigment.

Postlarvae:

Identifying characteristics: At the time of yolk sac absorption the larvae already manifest the characteristic deep bodied form of the adults. The pigmentation pattern is similar to that of the prolarvae, although the melanophores are larger and the contrast between the dark body and unpigmented tail is more pronounced. The right eye has begun to move to the left side in larvae as small as 6.5 mm. and migration is complete at about 13 mm. The dorsal and anal fin ray complements are complete and the ventral fins are formed at about 8.5 mm. Late postlarval windowpane are separable from all other Bothidae in that the left ventral fin is as wide at the base as it is at the tip, simulating a detached segment of the anal fin.

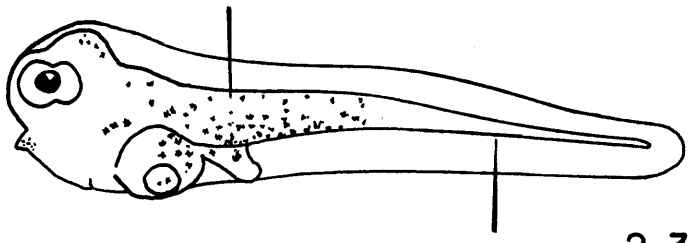
References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.

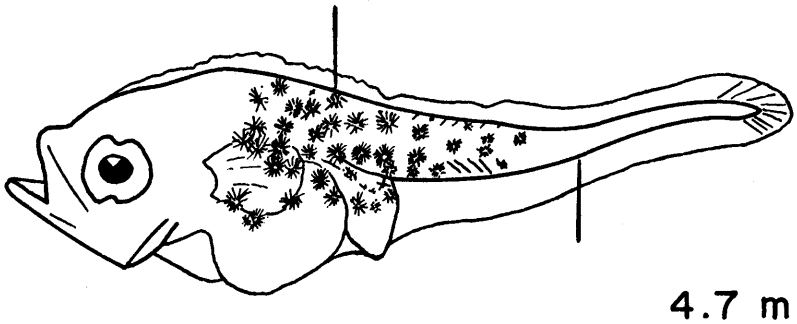
2. Moore, E., 1947.

3. Wheatland, S.B., 1956.

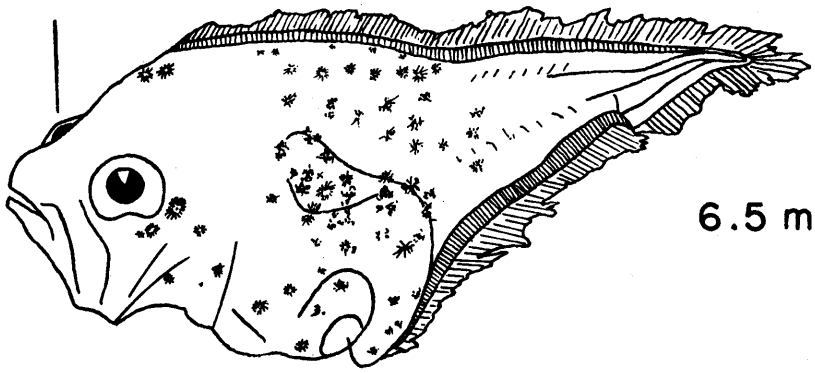
WINDOWPANE



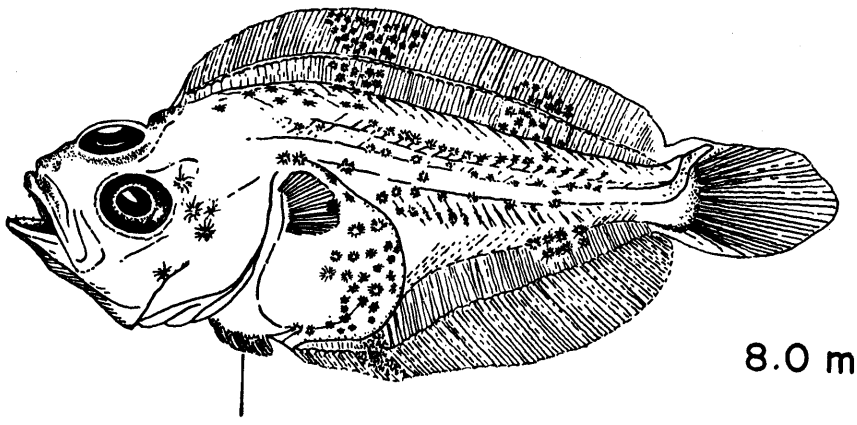
2.3 mm.



4.7 mm.



6.5 mm.



8.0 mm.[1]

PLEURONECTIDAE

Glyptocephalus cynoglossus - Witch flounder

Spawning:

March - August.

Eggs:

Average diameter: 1.25 mm.; range: 1.14 - 1.36 mm.

Identifying characteristics: Overlap in size range and spawning season with haddock and cod, but no pigmentation on late stage embryo.

Prolarvae:

Average hatching length: 4.82 mm.; range: 3.52 - 5.59 mm.

Identifying characteristics: There is an aggregate of pigment over the gut and a second aggregate posteriorly on the dorsal surface of the gut. The postanal pigmentation consists of three vertical bars of fine melanophores which extend onto the dorsal and ventral finfold (the American plaice has three similar vertical bars, but no pigment on the finfold). There is little or no pigmentation between the postanal bars in the witch flounder, whereas in the American plaice there is usually scattered pigmentation between the bars. In addition, the vent, which opens at the margin of the finfold, is located immediately behind the yolk sac in the witch flounder, while in the plaice there is a space between the yolk sac and the vent.

Postlarvae:

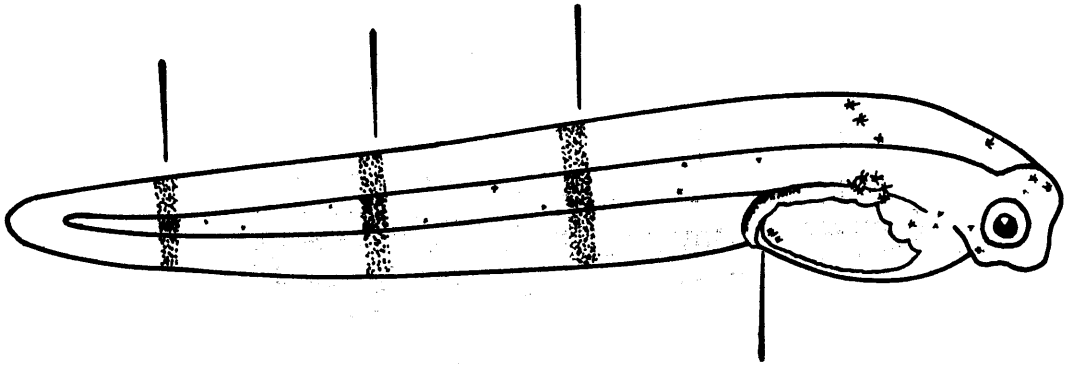
Identifying characteristics: The three vertical postanal bars are readily discernible in larvae up to about 15 mm. at which time the dorsal and anal fin rays are apparent. The concave ventral profile of the throat region immediately separates the witch flounder from plaice of this length. Larvae 20 mm. and longer may be separated from all other Pleuronectidae larvae by their high dorsal (100 - 115) and anal (87 - 100) fin ray counts. Metamorphosis is not complete (left eye moved to right side of head) until about 35 mm. Damaged specimens of witch flounder and plaice may be readily distinguished on the basis of their vertebral numbers (witch flounder - 12 abdominal and 46 caudal, American plaice - 13 abdominal and 32 caudal).

References:

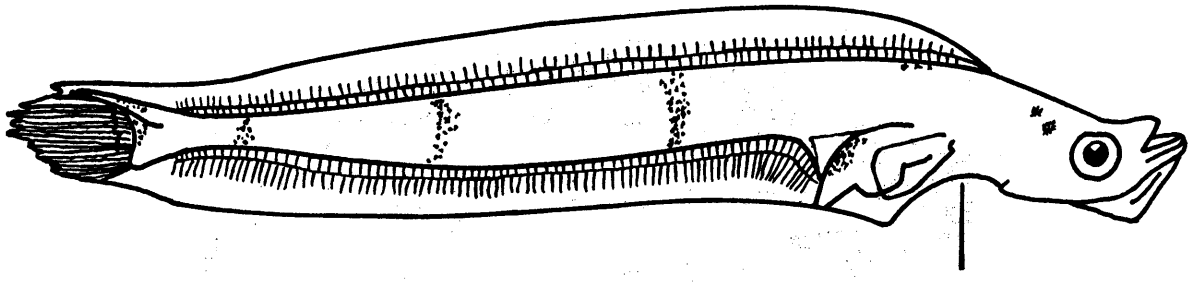
1. Bigelow, H.B. and W.C. Schroeder, 1953.

2. Ehrenbaum, E., 1905.

WITCH FLOUNDER



4.7mm



14.5mm.

PLEURONECTIDAE

Hippoglossoides platessoides - American plaice

Spawning:

March - May.

Eggs:

Average diameter: 2.28 mm.: range: 1.50 - 2.77 mm.

Identifying characteristics: Large egg with very broad perivitelline space.

Prolarvae:

Average hatching length: 5.24 mm.; range: 4.14 - 6.34 mm.

Identifying characteristics: Although not so distinct, the basic pigmentation pattern is similar to that of the witch flounder and consists of five groups of pigment; one on the gut, one at the vent, and three vertical bars of postanal pigmentation. The postanal pigmentation differs from that of the witch flounder, however, in that the vertical bars do not extend onto the finfold, there is usually scattered pigmentation between the bars, and there is an accessory cluster of pigment spots on the ventral edge between the vent and the first postanal bar. In addition, there is a definite space between the yolk sac and the vent in the prolarval plaice (none in the witch flounder).

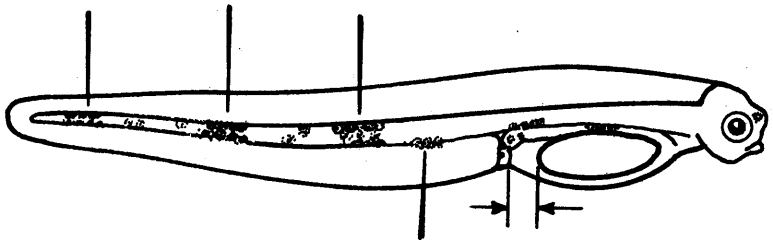
Postlarvae:

Identifying characteristics: The five pigment aggregates become progressively less distinct as the larvae increase in length. The dorsal and anal fin rays are apparent at about 12 mm. and their complements are complete at about 18 mm. at which time the left eye has commenced to migrate. At this stage the plaice may be distinguished from the witch flounder in having a larger mouth and no concavity in the throat region, lower dorsal (79 - 96) and anal (64 - 77) fin ray counts, a shorter, deeper body, and a proportionately greater distance from the snout to the vent (plaice - approximately one-third the total length, witch flounder - approximately one-fourth the total length). Metamorphosis is usually complete at about 30 mm., but often not until 40 mm. Damaged specimens may be readily distinguished from witch flounder on the basis of their vertebral numbers (American plaice - 13 abdominal and 32 caudal, witch flounder - 12 abdominal and 46 caudal).

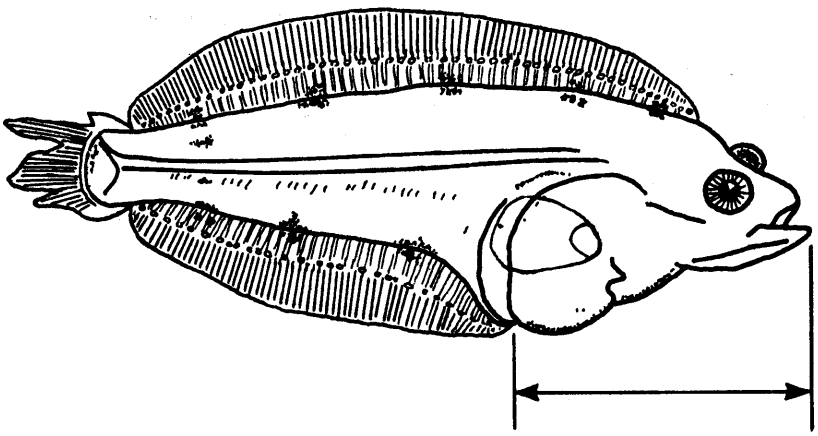
References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.

AMERICAN PLAICE



5.2 mm.



19.5 mm.

PLEURONECTIDAE

Limanda ferruginea - Yellowtail flounder

Spawning:

Mid-March - August.

Eggs:

Average diameter: 0.88 mm.; range: 0.79 - 1.01 mm.

Identifying characteristics: The egg diameter and spawning time overlap those of the cunner and tautog, although yellowtail spawn further offshore than those two species. Late stage yellowtail eggs are distinguishable by a faint ventral row of postanal pigmentation on the embryo while the embryonic pigment on the cunner and tautog is dorsal. Bigelow and Schroeder (1953) describe the surface of the yellowtail flounder egg as being covered with very minute striations. Such striations have not been apparent in any of the eggs we have examined.

Prolarvae:

Average hatching length: 2.75 mm.; range: 2.00 - 3.52 mm.

Identifying characteristics: The vent, which opens at the margin of the finfold, is located immediately behind the yolk sac. In addition to the distinctive ventral row of very fine postanal pigment granules, there is light pigmentation on the vent, one or two small patches of pigment on the dorsal edge near the posterior end of the postanal region, and usually a very fine scattering of pigment on the head.

Postlarvae:

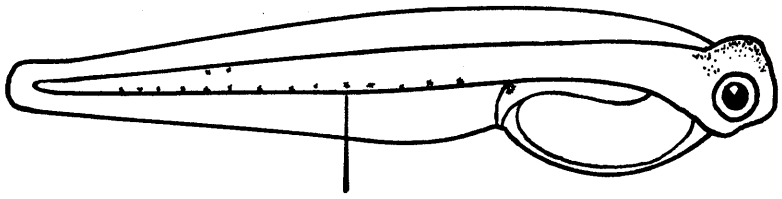
Identifying characteristics: Shortly after yolk sac absorption, the overall pigmentation increases and is characterized postanally by four conspicuous ventral bars of melanophores, in between the second and third of which is a less pronounced scattering of light pigment. Opposite the second and third ventral bar is a dorsal bar and a lighter mid-line bar. There are large stellate melanophores along the dorsal surface of the intestine and a row of smaller melanophores along the ventral edge of the gut. Caudal rays are formed at about 10 mm. At 14 mm. the left eye has started to migrate and the dorsal and anal fin ray complements are complete (dorsal: 75 - 85, anal: 56 - 63). Late postlarval yellowtail and winter flounder resemble one another and have the same number of abdominal vertebrae (11), but the yellowtail has more dorsal and anal fin rays and attains a greater length before metamorphosis is complete.

References:

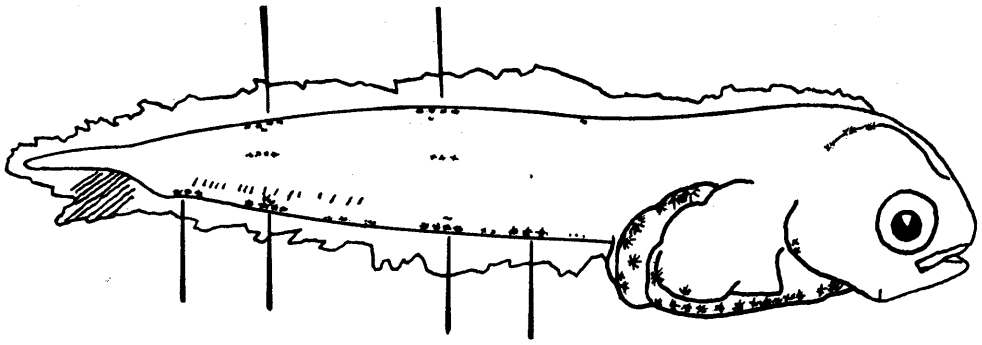
1. Bigelow, H.B. and W.C. Schroeder, 1953.

2. Perlmutter, A., 1939.

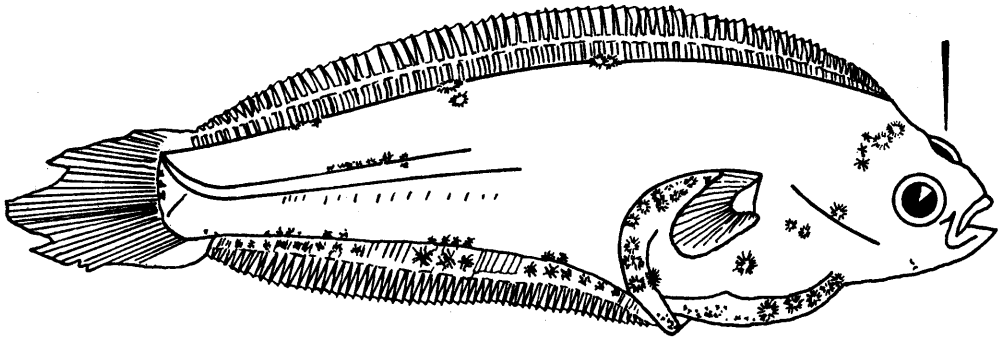
YELLOWTAIL FLOUNDER



2.7 mm.



5.9 mm.



14.2 mm.

PLEURONECTIDAE

Pseudopleuronectes americanus - Winter flounder

Spawning:

January - mid-May.

Eggs:

Demersal.

Prolarvae:

Average hatching length: 3.2 mm.; range: 2.8 - 3.5 mm.[1,4].

Identifying characteristics: Prolarvae are characterized by a broad vertical band of pigment cells bisecting the postanal region and extending onto the dorsal and ventral finfold. The vent is heavily pigmented and there are a few scattered stellate melanophores on the dorsal aspect of the head and neck. A dorsal row of small melanophores extends from above the vent to the vertical pigmentation band and a ventral row of small melanophores extends from the vent to about three-quarters the length of the postanal region.

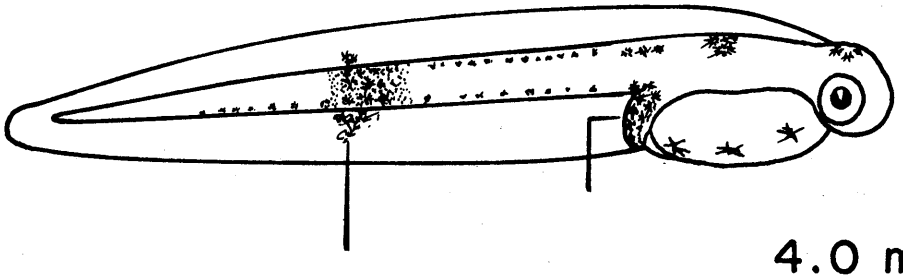
Postlarvae:

Identifying characteristics: The yolk is absorbed at about 5 mm. At this stage there is pigmentation below the gut and two rows of postanal pigment, one ventral and the other along the lateral line, both of which terminate a short distance from the tip of the tail. Fin rays are clearly visible at about 7 mm. and metamorphosis is complete (left eye moved to right side of head) at about 9 mm. (yellowtail at about 14 mm., witch flounder from 40 to 50 mm.). At this stage the small mouth and number of fin rays (dorsal, 60 - 76, anal, 45 - 58) serve to separate the winter flounder from other Pleuronectidae.

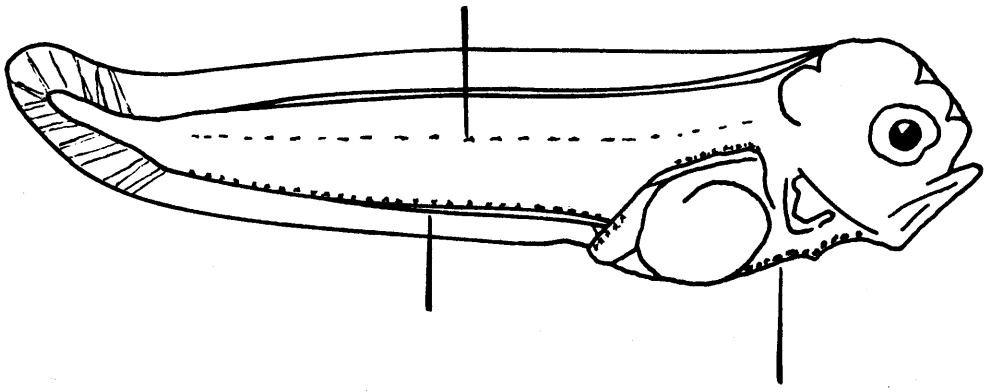
References:

1. Bigelow, H.B. and W.C. Schroeder, 1953.
2. Breder, C.M., 1923.
3. Perlmutter, A., 1939.
4. Wheatland, S.B., 1956.

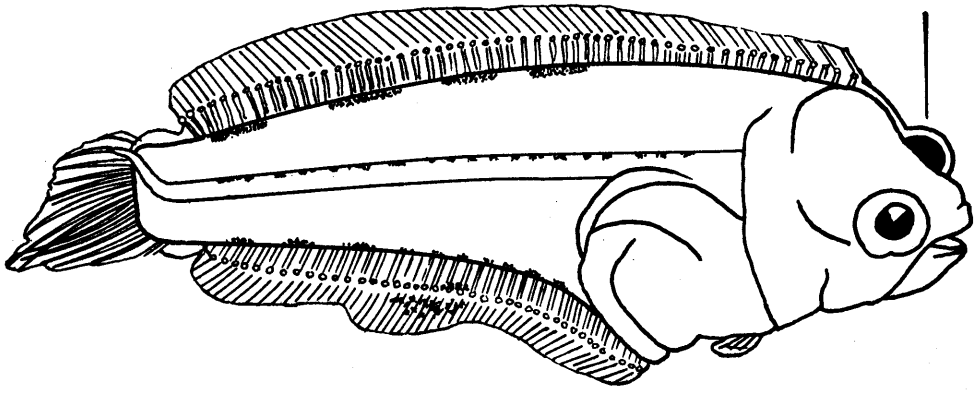
WINTER FLOUNDER



4.0 mm.



5.4 mm.



6.9 mm.

ACKNOWLEDGEMENTS

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