

Notes on Some of the More Common Larval Fishes
of the Gulf of Maine

Laboratory Reference No. 64-~~4~~

Introduction

This is not a key in the accepted sense of the term. The method of using this paper as a key is to flip through the illustrations until several likely looking prospects are found, and to proceed from that point by deciding which description best fits the specimen. This seems to be the method generally adopted in using an ordinary key after a slight familiarity with the material is acquired.

Concerning the information given on spawning times, hatching sizes, numbers of pigment granules, etc., it must be remembered that the size or number given represents the average condition. Since variability seems to be one of the few characteristics of living things on which we can count, it is logical to expect that some specimens may be different than the examples given in the text. This is unfortunate but must be lived with.

Most of the larval stages of fishes have a number of rather variable features by which they may be identified rather than a single immutable one. It is not necessary that a fish match every feature of the one given as an example. If it matches most of them that should be considered as sufficient for identification.

General body shape, although distinctive, is not of value in identification because specimens are so often curled or damaged. Appendages are not especially helpful because they are often missing or are damaged in handling. The type and arrangement of pigmentation serves as the best single key character, but as helpful as pigmentation is, it is subject to variation and tends to fade with time.

Spawning:

The spawning times given, cover the range to be expected in an average year in the Gulf of Maine and South to Montauk.

Eggs:

Eggs are extremely difficult to identify, especially in the early stages. Many are separable by size, presence or absence of an oil globule, etc., but many are so similar in these features that positive identification is all but impossible. The most simple method of overcoming this difficulty is to preserve and measure some of the eggs and allow the remainder to hatch. The hatched material is, of course, more easily identified.

Prolarvae:

Hatching sizes given for prolarvae are the extremes that would be likely to be encountered. The average size of the eggs, and hence the average size of the larvae, tends to decrease as the spawning season progresses.

Postlarvae and Juveniles:

The definition of a juvenile is rather loosely used in this key. When the postlarvae develops to the extent at which it possesses at least one adult characteristic by which it can be positively identified, it is termed a juvenile.

The Illustrations:

The illustrations are camera lucida type pen and ink drawings of preserved specimens done to the same scale, with the exception of several late postlarvae. No particular attention has been paid to internal detail since it is of little value in identification. Myomeres have been left out for the same reason. Shading and stippling have been avoided. The only concession to convention has been in rendering the pupils of the eyes black although they are not so in the actual specimens. The configuration of the chromatophores was copied as closely as possible, although there may be some variation from specimen to specimen. Although yellow pigment is present in many species, it fades so rapidly that it seemed best to leave it out. Only the black pigment is included in the drawings. The specimens illustrated represent, as closely as was practicable, the individual most typical of that species.

The Bibliography:

A separate bibliography is included with the description of each species. The bibliography is not intended to be complete but only includes those references having illustrations that may be helpful as additional aids to identification.

Herring Clupea harengus (Linnaeus)

Spawning:

Through the fall into early winter

Eggs:

Demersal, without oil globule
Size range 1.0-1.4 mm.

Prolarvae:

Average hatching size 5.5 mm.

Identifying characteristics:

A long slender larva with the vent opening three-fourths of the way back on the tail.

Note: It is unlikely that we would get any prolarval herring in meter net tows on our spring cruises.

Postlarvae:

Size range from 6-40 mm.

Identifying characteristics:

A line of about 9-11 bar-shaped chromatophores located just above the gut and running about halfway back on the gut changing to a somewhat broken line running on the ventral side of the gut to the vent.

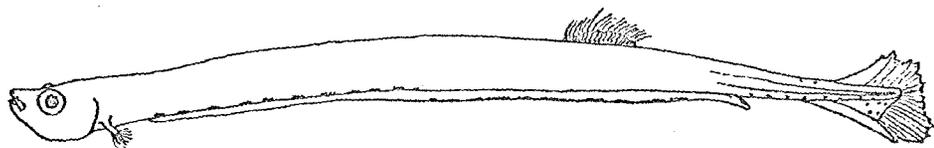
One to several spots on the gut at the vent. A ventral row of dots from the vent out onto the tail, with a light scattering of chromatophores on the tail itself.

Bibliography:

Ehrenbaum, E.

1905-09. Eier und Larven von Fischen Nordisches Plankton.

Good illustrations of larvae pp. 364-365. Text in German.



HERRING 14.5 mm.



Sand Launce Ammodytes americanus (De Kay)

Spawning:

December through February

Eggs:

Demersal - size not recorded

European launce (*A. tobianus*) has an oval egg, 0.72-0.92 mm. in greatest diameter, with a yellow oil globule 0.25-0.31 mm.

Prolarvae:

Hatching size about 6.5 mm.

Identifying characteristics:

A row of chromatophores just dorsal to the gut. Vent about halfway back and opens at the base of the finfold rather than at the margin.

Postlarvae:

Size range from 7.0-30.0 mm.

Identifying characteristics:

From 1-5 large stellate chromatophores on top of the head. A row of about 18 large stellate chromatophores just dorsal to the gut, followed by a closely spaced row of about 23 small dots from the vent towards the tail and a vertical row of small dots just at the base of the caudal fin. There is usually additional scattered pigmentation more concentrated at the caudal end. The vent opens slightly more than halfway back. By 15 mm, a few fin rays are evident, and the caudal fin is well developed. The basic pigment pattern described persists beyond 30 mm.

Juveniles:

Identifying characteristics:

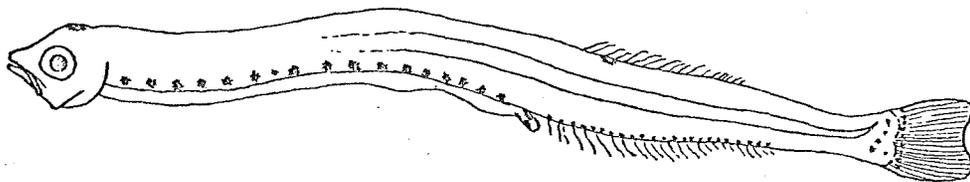
Long slender with sharply pointed nose and lower jaw projecting far beyond upper. Single long dorsal fin, with ventrals lacking.

Bibliography:

Ehrenbaum, E.

1905-09. Eier und Larven von Fischen Nordisches Plankton.

Illustrations of European lancee (A. tobianus). Not particularly helpful.



AMMODYTE 15.7 mm. 

Bibliography:

Bigelow, H. B. and W. W. Welsh

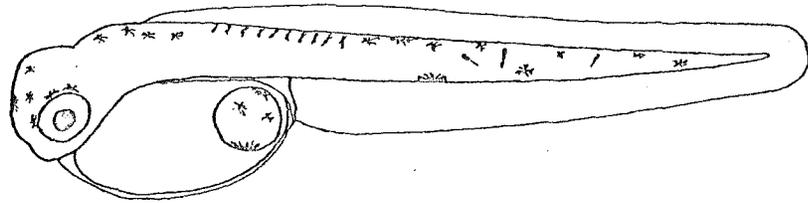
1924. Fishes of the Gulf of Maine. Bull. of the U.S. Bur. Fish.
Vol. 40, Part I.

Description of eggs and larvae p. 208. Illustrations p. 189
Fig. 92 b-g.

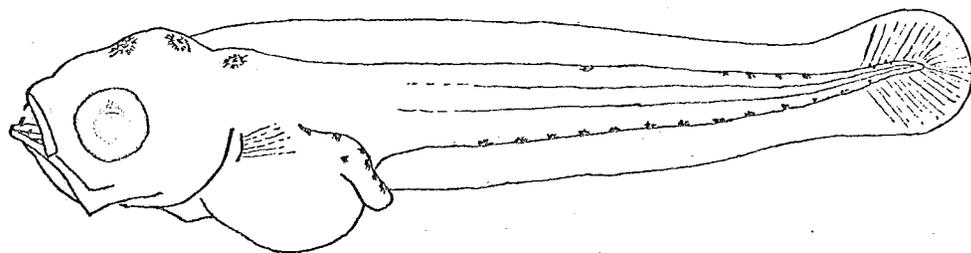
Sette, Oscar E.

1950. Biology of the Atlantic Mackerel (*Scomber scombrus*) of North
America. Part I. Fishery Bull. U.S. F. W. S. Vol. 50.

Description of eggs and larvae pp. 166-172. No illustrations!



MACKEREL 3.6 mm. H



MACKEREL 4.4 mm. ←

Mackerel Scomber scombrus (Linnaeus)

Spawning:

May through July

Eggs:

Pelagic with large pigmented oil globule
Average size 1.18 mm., range 0.97-1.38 mm.
Oil globule size 0.29, range 0.26-0.31 mm.
Identifying characteristics:

The mackerel has the largest oil globule of any egg in this size range.

Prolarvae:

Hatching size 3.1-3.3 mm.
Identifying characteristics:

Scattered stellate chromatophores on forehead, around the eye and on the dorsal part of the neck. Beginning over the central part of the yolk-sac on the dorsal side is a series of ten to a dozen chromatophores which seem to lay between the epaxial myosepta. Posterior to these are more scattered stellate chromatophores and several odd-looking club-shaped chromatophores. The large oil globule is very conspicuous for some time after hatching.

Postlarvae:

Size range from 4-12 mm.
Identifying characteristics:

By the time yolk-sac absorption takes place, there is a reasonably well-formed dorsal and ventral row of pigment on the tail, several large stellate chromatophores on the head and neck, and heavy pigmentation over the gut. The post-larval mackerel differs from the post-larval redfish as follows: Chromatophores on tail, more widely spaced, lacks large square tail of finfold, has large canine type teeth at 5 mm., redfish has none at this size. Fin rays begin to be evident at about 10 mm.

Juveniles:

Identifying characteristics:

Fish larger than 12 mm. have all their fin rays and are identifiable on those characteristics alone.

Redfish Sebastes marinus (Linnaeus)

Spawning:

May through September

Eggs:

Redfish are ovoviviparous and their eggs would not normally be found in the plankton.

Prolarvae:

Average size 6 mm.

Identifying characteristics:

A few scattered chromatophores on the back of the head. Rather heavy pigmentation over the gut, with a single ventral row of rather small chromatophores running from just behind the vent to near the base of the tail tip, the row usually ending with a large chromatophore extending out onto the finfold. Also, a dorsal row of small chromatophores starting halfway back on the tail and ending above the last small ventral chromatophore. Lower jaw prognathous.

Postlarvae:

Size range 6-10 mm.

Identifying characteristics:

The distribution of pigment remains about the same through 10-12 mm. The caudal portion of the finfold is squared off rather than rounded with fin rays faintly visible shortly after yolk-sac absorption. At about 7 mm. the caudal becomes more rounded and the fin rays more apparent. By 10 mm. the opercular spines are well developed, the caudal rays fairly well formed and some of the dorsal and anal fin rays.

Juveniles:

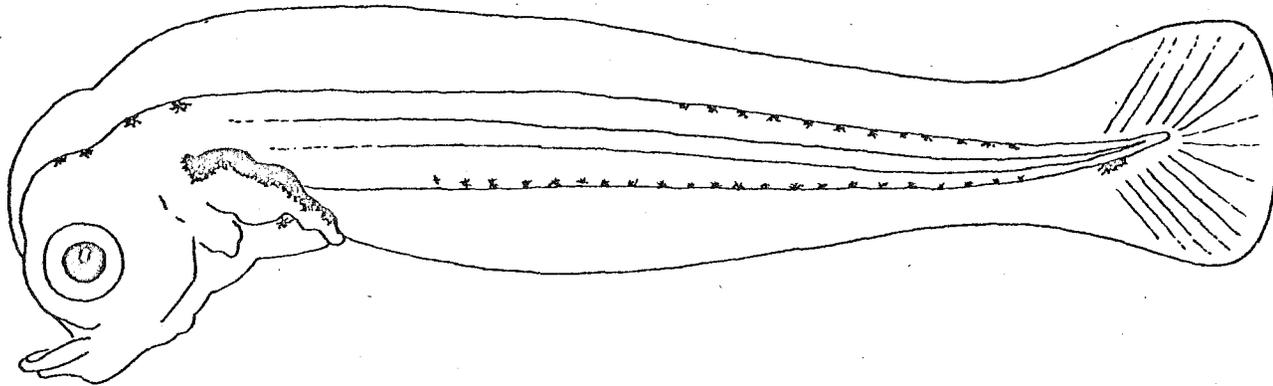
Identifying characteristics:

A single spine over each eye, a pair on the back of the head, 3-4 preopercular spines, combined with the number of dorsal fin rays, (14-15 spiny rays, 13-15 soft rays), distinguish the juvenile redfish.

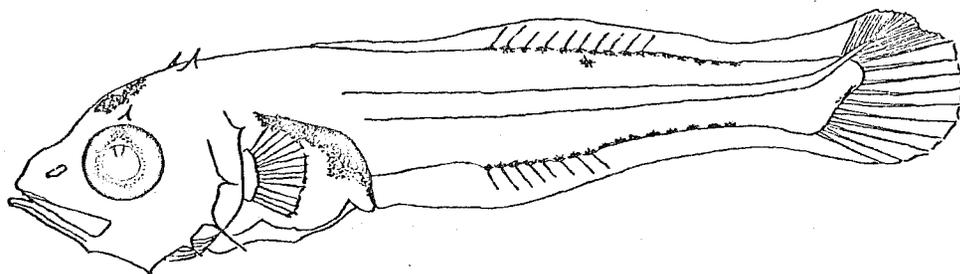
Bibliography:

Bigelow, H. B. and W. W. Welsh

1924. Fishes of the Gulf of Maine. Bull. of the U. S. Bu. Fish. Vol. 40
Description of larvae p. 12, Illustrations p. 311, Figs. 143-147.



REDFISH 5.6 mm. —



REDFISH 10 mm. ———

Cunner Tautoglabrus adpersus (Walbaum)

Spawning:

June through August

Eggs:

Pelagic without oil globule

Average size 0.85 mm., range 0.78-0.97 mm.

Identifying characteristics:

The spawning time and egg sizes of the cunner overlaps with that of the yellowtail flounder, the yellowtail eggs tending to be slightly larger. Cunner eggs, however, are most frequently taken in shoal water, while yellowtail eggs would be more generally distributed offshore. In later stage eggs when the larvae are fairly well developed, the cunner shows pigmentation on the dorsal surface while the yellowtail larvae shows none.

Prolarve:

Hatching size 2.90 mm., range 2.33-3.43 mm.

Identifying characteristics:

Small stellate chromatophores scattered over the head, trunk, and tail, mostly confined to the dorsal half of the body. The vent opens at the outer margin of the fin-fold about halfway back, and considerably beyond the yolk mass proper. Before the yolk is completely absorbed the pigment pattern changes rather radically from the scattered condition to definite aggregations of pigment. The scattered pigmentation persists longest at the cephalic end. A single aggregate is located at the turn of the gut where it descends to the margin of the fin-fold. A second aggregate is located ventrally halfway between the vent and the tail, and a third aggregate near the tail tip.

Postlarvae:

Size range 3.5-10 mm.

Identifying characteristics:

By the time yolk-sac absorption is complete, there is a definite band of pigment over the gut, a single rather large chromatophore on the back of the head, a dorso-ventral pair halfway between the vent and the tail, and a single aggregate on the ventral side of the tail tip. This general pattern persists to at least 8 mm, at which time the fin rays are nearing completion.

Juveniles:

Identifying characteristics:

The general arrangement of fins, spiny and soft rays, and number of rays are sufficient to determine the species in sizes over 10 mm.

Bibliography:

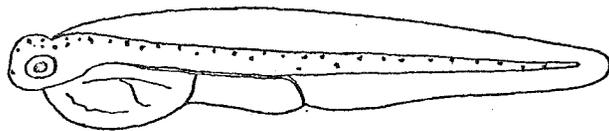
Agassiz, A. and Whitman

1885. Studies from the Newport Marine Laboratory XVI. The Development of Osseous Fishes I. The Pelagic Stages of Young Fishes. Memoirs Mus. Comp. Zool. Harvard College, Vol. XIV, No. 1, Part 1.

Two excellent plates of cunner eggs and larvae, plates IX and XVI. Plate XVI is misidentified as Pseudopleuronectes americanus.

Kuntz, Albert and Lewis Radcliffe

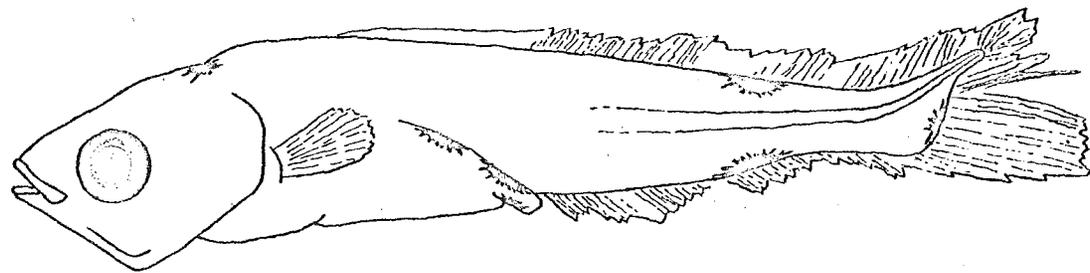
1916. Notes on the Embryology and Larval Development of Twelve Teleostean Fishes. Bull. Bureau Fisheries, Vol. 35, pp. 99-102. Figs 18-29.



CUNNER (JUST HATCHED) 2.7 mm. H



CUNNER (30 HRS. AFTER HATCHING) 2.8 mm. H



CUNNER 4.9 mm. ⇐

Yellowtail Flounder Limanda ferruginea (Storer)

Spawning:

March through July

Eggs:

Pelagic without oil globule

Average size 0.88 mm., range 0.79-1.01 mm.

Identifying characteristics:

Egg size and spawning time overlaps with cunner, the cunner eggs averaging somewhat smaller, and will be found more inshore than off. In later stage eggs, the yellowtail larvae is recognizable by its absence of dorsal pigmentation.

Prolarvae:

Average hatching size 2.75 mm., range 2.00-3.52 mm.

Identifying characteristics:

Directly after hatching, prolarvae with a faint ventral row of very fine pigment granules. A very fine scattering of pigment may or may not be apparent on the head and one or two small patches on the tail.

Postlarvae:

Range from 4-14 mm.

Identifying characteristics:

As the size of the postlarvae increases the overall pigmentation increases so that by about 5.5 mm. the arrangement of the pigment suggests four vertical bars, the first at the pectoral fin and the remainder evenly spaced along the tail. There is also a row of pigment along the dorsal margin of the gut cavity, and some scattered pigment on the back of the head. Caudal rays have formed at about 10 mm. At 14 mm. the left eye has started to migrate and the fin ray number is final, (dorsal 76-85, ventral 56-63).

Juvenile:

Identifying characteristics:

Pigmentation about midway between postlarvae and adult. Identifiable by fin ray count.

Bibliography:

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

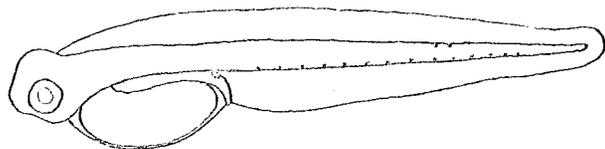
1953. Fishes of the Gulf of Maine. Fish. Bull. U. S. F. W. S. #74,
Vol. 53.

Description and illustrations of eggs and larvae pp. 271-275.

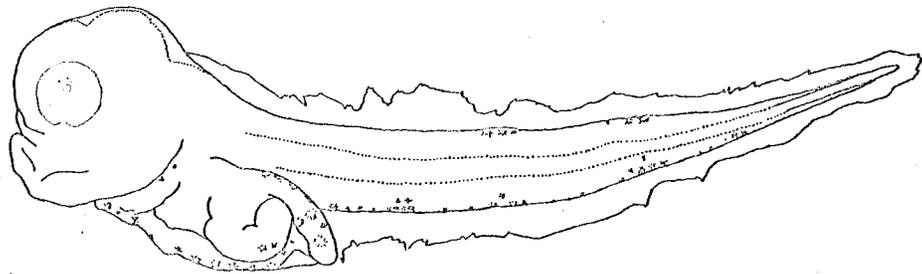
Perlmutter, A.

1939. Survey of the Salt Waters of Long Island. Suppl. 28th Ann.
Rep. N. Y. Cons. Dept. Pt. 2.

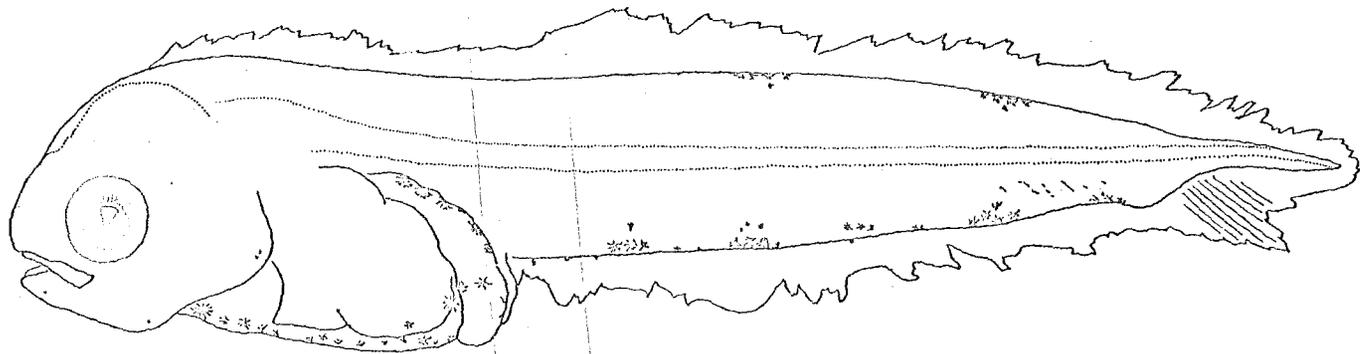
Description of eggs and larvae pp. 11-71. Illustrations of
larvae Fig. 4. Not especially good figures.



YELLOWTAIL 2.7 mm. 14



YELLOWTAIL 4.1 mm. —



YELLOWTAIL 5.9 mm. —

Witch Flounder Glyptocephalus cynoglossus (Linnaeus)

Spawning:

March through August

Eggs:

Pelagic without oil globule

Average size 1.25 mm., range 1.14-1.36 mm.

Identifying characteristics:

Slightly smaller than cod-haddock. In late stage embryos no pigmentation is visible.

Prolarvae:

Average hatching size 4.82 mm., range 3.52-5.59 mm.

Identifying characteristics:

One aggregate of pigment over center of yolk-sac, a second aggregate at the vent, and three bars on the tail. The completeness of the 5 bars depends on length of time the larvae has been preserved. The two anterior aggregates are the first to fade. On fresh specimens the pigment extends out onto the fin folds. There is no space apparent between yolk-sac and vent.

Postlarvae:

Size range from 6 to about 35 mm.

Identifying characteristics:

Five pigment bars extending out onto fin fold. Not as robust as American dab of same size, and with a definite concavity between lower jaw and gut. Dorsal and anal fin rays apparent at 15 mm. Larvae from 20 mm. on may be identified by high fin-ray count, (dorsal 100-115, anal 87-100). Eye migrates at about 35 mm.

Juveniles:

Identifying characteristics:

The witch flounder has highest fin-ray count of any of our flounders. 100-115 D, 87-100 A.

Bibliography:

Bigelow, H. B. and Schroeder

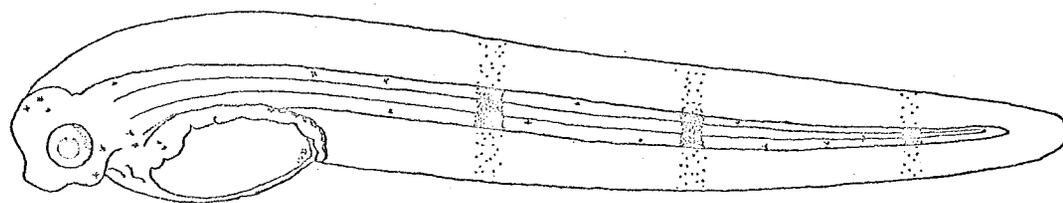
1953. Fishes of the Gulf of Maine. Fish. Bull. U. S. F. W. S. #74
Vol. 53.

Descriptions of eggs and larvae with 4 figures pp. 287-288.

Ehrenbaum, E.

1905-09. Eier und Larven von Fischen Nordisches Plankton.

Illustrations p. 75.



WITCH FLOUNDER 4.7 mm. H

American Dab Hippoglossoides platessoides (Fabricius)

Spawning:

March through May

Eggs:

Pelagic eggs without oil globule

Average size 2.28 mm., range 1.50-2.77 mm.

Identifying characteristics:

Perivitelline space very broad.

Prolarvae:

Average hatching size 5.24 mm., range 4.14-6.34 mm.

Identifying characteristics:

One aggregate of pigment over center of yolk-sac. A second aggregate at vent and three distinct bars on tail. Pigment does not extend out onto the finfold, and there is often scattered pigmentation between the vertical bars. A definite space is apparent between the yolk-sac and the vent.

Postlarvae:

Size range from 6 mm. to 20 mm.

Identifying characteristics:

Five pigment bars, becoming less distinct in older specimens, with pigment scattered between. No concavity behind lower jaw. Dorsal and anal fin rays apparent at 11-12 mm. Larvae from 15-20 mm. much more robust than witch flounders of the same size. Eye migrates at 20 mm.

Juveniles:

Identifying characteristics:

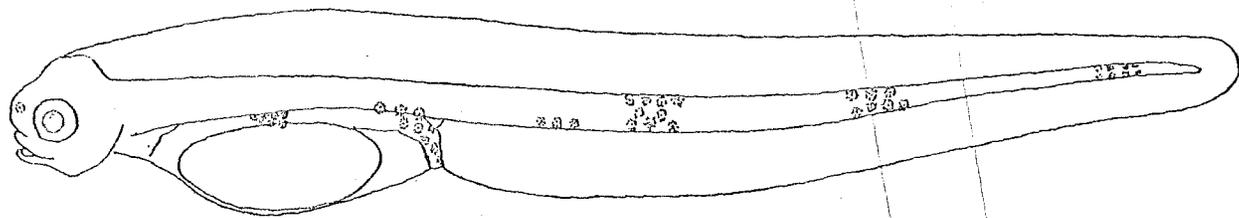
Easily identified by fin ray counts, nearly straight lateral line, large mouth, and rounded caudal fin.
Dorsal 76-96, Ventral 64-77.

Bibliography:

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

1953. Fishes of the Gulf of Maine. Fish. Bull. U.S. F. W. S. #74
Vol. 53.

Description p. 262, Illustration p. 262, figs. 129-133.



AMERICAN DAB 5.2 mm. 1-1

Butterfish Poronotus triacanthus (Peck)

Spawning:

June through August? Actually we suspect that spawning in any given location is quite short, perhaps only about two weeks.

Eggs:

Pelagic with single unpigmented oil globule.

Average size about 0.7-0.8 mm.

Oil globule 0.17-0.20 mm.

Note: We have not personally collected any eggs which we could positively identify as those of the butterfish. The measurements therefore are not our own but are taken from Bigelow & Schroeder.

Prolarvae:

We have no accurate information on the butterfish prolarvae!
The hatching size should be about 2.3 mm.

Postlarvae:

Size range 2.4-4.0 mm.

Identifying characteristics:

The postlarval butterfish are the broadest per unit of length of any postlarvae in this size range. One or two large stellate chromatophores on top of the head. A row of stellate chromatophores along the dorsal margin of the gut. Some large scattered chromatophores on the ventral margin of the gut. One or more chromatophores along the posterior margin of the opercle and finally a ventral row of rather smallish dots on the tail, which tend to coalesce with age. Caudal rays have begun to form at 2.6 mm. and a few of the dorsal and anal rays can be seen at 3.7 mm.

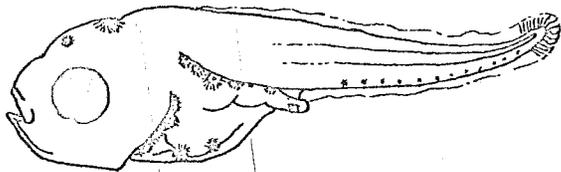
Juvenile:

Identifying characteristics:

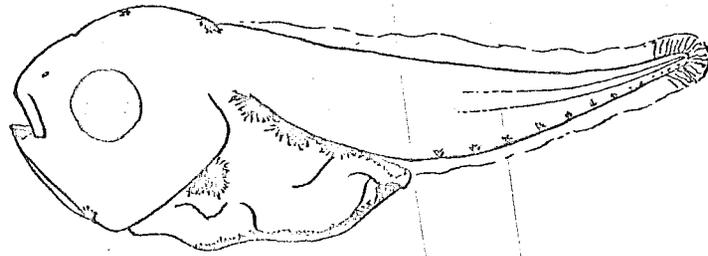
A 4-5 mm. butterfish is unmistakable. The fin rays are complete at about 5 mm. The typical silvery color is apparent at this size in fresh specimens. The pigment pattern is essentially the same as the postlarvae.

Bibliography:

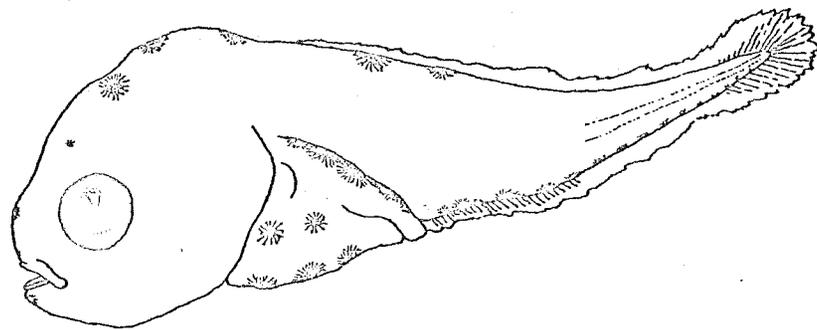
The literature on the eggs and larvae of the butterfish is somewhat confused. For that reason no references are included.



BUTTERFISH 2.6 mm. H



BUTTERFISH 3.1 mm. H



BUTTERFISH 3.7 mm. H

Red Hake Urophysis chuss (Walbaum)

Spawning:

May through August

Eggs:

Pelagic with pigmented oil globule

Average size 0.76 mm., range 0.63-0.97 mm.

Oil globule 0.19 mm., range 0.15 - 0.22 mm.

Identifying characteristics:

Size of egg and oil globule are the only distinctive characteristics in early stage eggs. In the late stage eggs the pigmentation is the same as prolarvae.

Prolarvae:

Average hatching size 2.04 mm., range 1.76-2.29 mm.

Identifying characteristics:

Large stellate chromatophores scattered over the body. One large spot on forehead between the eyes, several on the trunk over the gut cavity. The chromatophores on the tail are located on the dorsal and ventral sides and often extend out onto the finfold, and are often in dorso-ventral pairs.

Postlarvae:

Range from 3-10 mm.

Identifying characteristics:

After absorption of the yolk-sac, the pigmentation of the larvae changes markedly (see drawing of postlarvae). A single blob of pigment on the back of the head, a line of pigmentation over the gut, and a dorso-ventral pair of spots about halfway down the tail. At about 6 mm, the pigment tends to become more scattered, but the same general pattern can still be made out. The ventral fins at this stage are quite long (reaching at least to the vent), and are heavily pigmented at the tips only. At 10 mm. the fin rays are formed and the general body form is close enough to the adult that they are easily identifiable.

Juveniles:

We are not positive of the identification of the silvery pelagic fry of the red hake. Until we are positive we identify them as hake sp. Juvenile red hake have the same general body conformation as the adults, however, the coloration is dark blue above shading to silver towards the

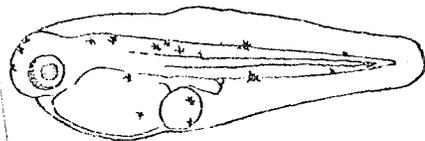
ventral side. The coloration apparently remains this way until the young fish take to the bottom.

Bibliography:

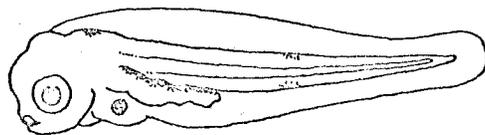
Kunts, Albert and Lewis Radcliffe

1916. Notes on the Embryology and Larval Development of Twelve Teleostean Fishes. Bull. Bur. Fisheries Vol. 35.

Illustrations pp. 113-114, fig. 58-65. These are misidentified as butterfish!



RED HAKE (JUST HATCHED) 1.9 mm. H



RED HAKE (36 HRS.) 2.1 mm. H

Four-bearded Rockling Enchelyopus cimbrius (Linnaeus)

Spawning:

April through August

Eggs:

Pelagic with pigmented oil globule

Average size 0.82 mm., range 0.74-0.89

Oil globule average size 0.16 mm., range 0.13-0.20 mm.

Identifying characteristics:

May be confused with red hake eggs. In later stage eggs, pigmentation of developing larvae same as prolarvae. (see prolarvae)

Prolarvae:

Average hatching size 2.03 mm., range 1.63-2.42 mm.

Identifying characteristics:

Pigmented spot on top of head over eyes. A bar from over the gut up to the dorsal surface. A lateral band of pigment over gut cavity. A vertical dark bar across the tail about half way between vent and tail and a small patch on the base of the tail near the tip extending onto the fin fold.

Postlarvae:

Size range from 3 mm. -15 mm.

Identifying characteristics:

Pigmentation same as prolarvae up to about 8 mm. Ventrals large and heavily pigmented, with the individual rays connected by fin membrane.

Juveniles:

Identifying characteristics:

Same as adult except coloration silvery shading to bluish black on dorsal surface.

Bibliography:

Battle, Helen I.

1930. Effects of Extreme Temperatures and Salinities on the Development of Enchelyopus cimbrius (L.). Contrib. Canadian Biol., N. Ser., Vol. 5, No. 6.

Descriptions of eggs page 8 Illustrations Fig. 2
" " larvae pp. 11-12 Illustrations Fig. 3

Bigelow, H. B. and W. Schroeder

1953. Fishes of the Gulf of Maine. Fishery Bull. of F. W. S. Vol. 53.

Description of eggs and larvae pp. 236 Illustrations of egg and larval stages p. 235 Fig. 114, b-f.

Dannevig, Alf

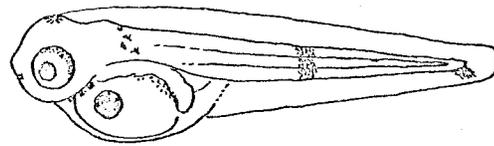
1918. Canadian Fish Eggs and Larvae. Canadian Fisheries Expedition 1914-15 Biology of the Atlantic Waters of Canada.

p. 236 Figs. 21-22.

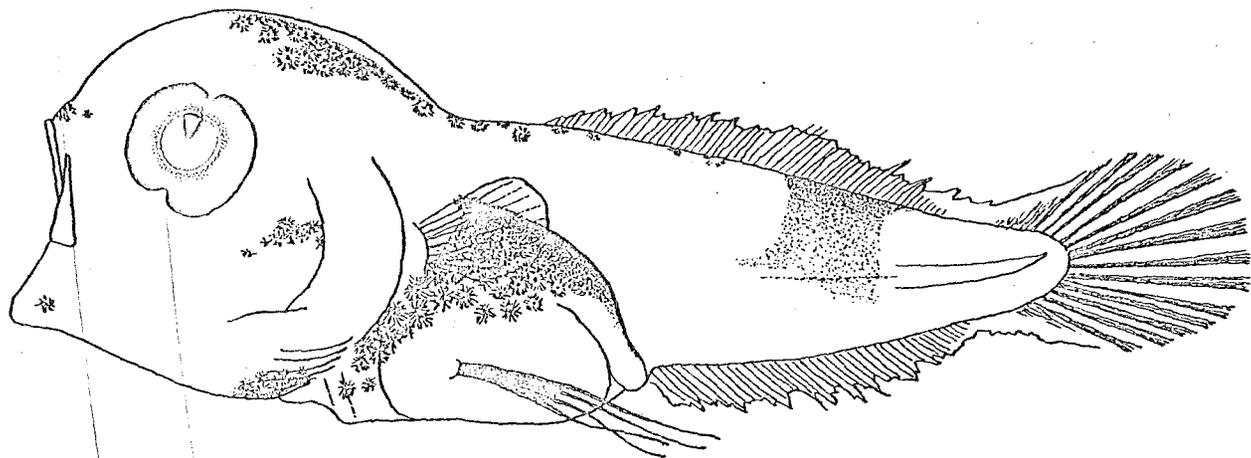
Ehrenbaum, E.

- 1905-09. Eier und Larven von Fischen Nordisches Plankton.

Illustrations of eggs and larvae pp. 231-232.



ROCKLING 2.2 mm. H



ROCKLING 6.9 mm. —

Whiting Merluccius bilinearis (Mitchill)

Spawning:

May to October

Eggs:

Pelagic with pigmented oil globule

Average size 0.91 mm., range 0.84-1.02 mm.

Oil globule 0.26 mm., range 0.19-0.31 mm.

Identifying characteristics:

Size of egg and oil globule are the only distinctive characters in early stage egg. In late stage egg the two pigmented bands on the tail serve as additional distinguishing characters.

Prolarvae:

Average hatching size 3.02 mm., range 2.64-3.52 mm.

Identifying characteristics:

A sparse scattering of chromatophores on head and trunk region with 2 evenly spaced bands made up of scattered chromatophores on the tail region. These bands are difficult to distinguish on specimens that have been preserved for a few months.

Postlarvae:

Size range from 3.5 mm. to 10 mm.

Identifying characteristics:

Scattered pigment on head appears to coalesce into four or five dorsal spots on face and head, a dark band of pigment over gut and a partial bar dorsally behind the vent followed by two more or less complete bars on the tail. A single row of conical teeth is apparent at 7.5 mm.

Juvenile:

Identifying characteristics:

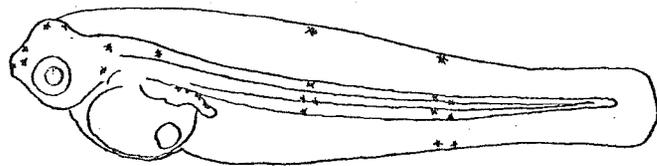
From about 10 mm. up the general form of the fins is complete and they are recognizable as whiting on this basis.

Bibliography:

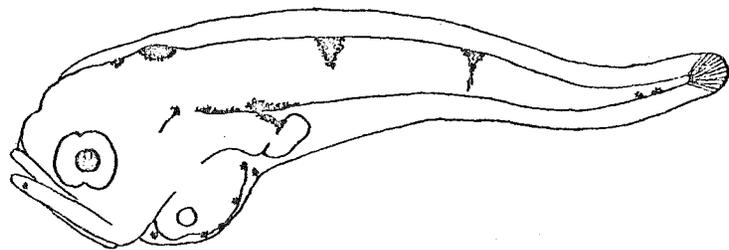
Kuntz, Albert and Lewis Radcliffe

1916. Notes on the Embryology and Larval Development of Twelve Teleostean Fishes. Bull. Bureau of Fisheries Vol. 35,

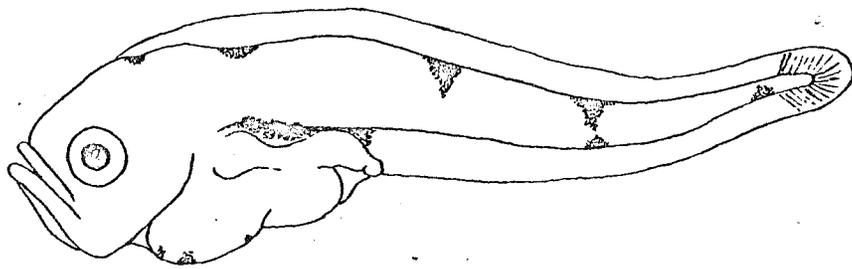
An excellent description, with eight figures from egg to 23 mm. juvenile, pp. 109-112.



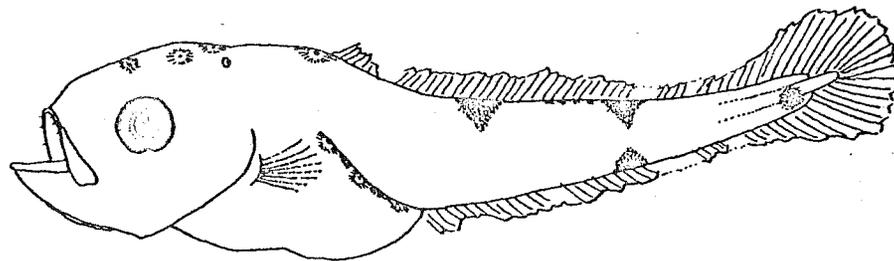
WHITING 2.9 mm. H



WHITING 3.3 mm. H



WHITING 3.8 mm. H



WHITING 7.5 mm. —

Cusk Brosme brosme (Müller)

Spawning:

April through June

Eggs:

Pelagic with a pink oil globule

Average egg size 1.31 mm., range 1.15-1.41 mm.

Average oil globule size 0.27 mm., range 0.21-0.31 mm.

Identifying characteristics:

Size overlaps with haddock, cod and witch flounder for this time of year, but is easily separable by the presence of a pink oil globule.

Prolarvae:

Average hatching size 4.01 mm., range 2.99-4.62 mm.

Identifying characteristics:

The pigmentation in the prolarvae is finely granular rather than large stellate chromatophores giving the appearance of dense even color. The pigment is arranged as follows: A light scattering on the anterior portion of the head, a patch centrally located over the gut, a complete band of fine granules across the tail halfway back followed by another which may be complete or constricted at the center, both of which do not extend onto the finfold, and finally pigmentation on the tip of the tail, confined mostly to the finfold and giving the appearance of the feathers on an arrow. The vent opens at the base of the finfold rather than the margin.

Postlarvae:

Size range from 5-35 mm.

Identifying characteristics:

From 5-21 mm. the pigment pattern remains constant and the pelvics become greatly attenuated with each fin ray separate and heavily pigmented.

From 16 mm. on they are identifiable as cusk by the single long dorsal and anal fins.

Juveniles:

Identifying characteristics:

Same as adults. Single dorsal, rounded caudal and chin barbel separate it from any of its relatives.

Bibliography:

Bigleow, H. B. and W. W. Welsh

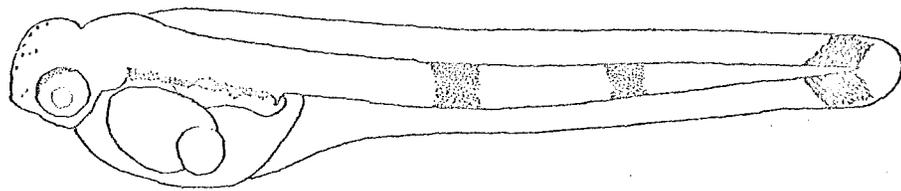
1924. Fishes of the Gulf of Maine. Bull. of the U.S. Bur. Fish.,
Vol. 40, part I.

Description of eggs and larvae p. 466. Illustrations
Fig. 231-234.

Schmidt, Johs.

1905. On the Larval and Post-Larval Stages of the Torsk, *Brosmius*
brosme (Müller)

Description of larvae from 3.95 mm. to 54 mm. pp. 1-7.
Excellent illustrations of larvae plate I, figs. 1-12.



CUSK 4.0 mm. H

Haddock Melanogrammus aeglefinus (Linnaeus)

Spawning:

February through the middle of May

Eggs:

Pelagic without oil globule

Average size 1.46 mm., range 1.10-1.67 mm.

Identifying characteristics:

None except size in early stages. In later stages pigmented like prolarvae.

Prolarvae:

Average hatching size 4.08 mm., range 3.08-4.99 mm.

Identifying characteristics:

A scattering of chromatophores on the back of the head. Heavily pigmented over the gut, and a ventral row of rather fine chromatophores extending from the vent to the tail tip. The vent opens at the base of the finfold rather than at the margin.

Postlarvae:

Range from 5-10 mm.

Pigmentation remains about the same as on the prolarvae, tending to become more scattered with age. Same identifying characteristics as prolarvae.

Juveniles:

Haddock, cod and pollock may all be confused in the size range from 10-25 mm.

Identifying characteristics:

20 abdominal vertebrae.

Bibliography:

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

1953. Fishes of the Gulf of Maine. Fish. Bull., U. S. F. W. S. Bull.
#74, Vol. 53,

Description of eggs, larvae and illustrations pp. 199-213.

Dannevig, Alf

1918. Canadian Fish Eggs and Larvae. Canadian Fisheries Expedi-
tion 1914-15. Biology of Atlantic Waters of Canada.

Ehrenbaum, E.

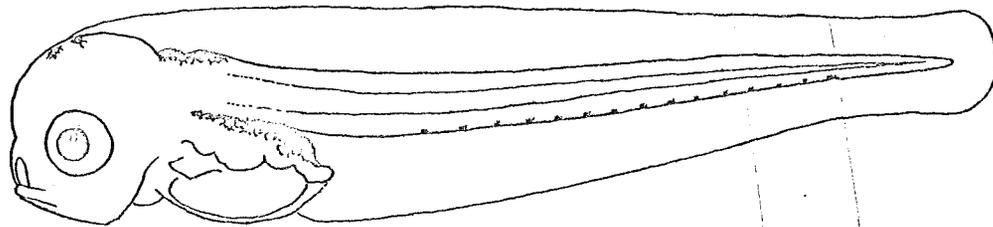
1905-09. Eier und Larven von Fischen Nordisches Plankton.

Good illustrations of larvae pp. 220-221, fig. a-k.
Text in German.

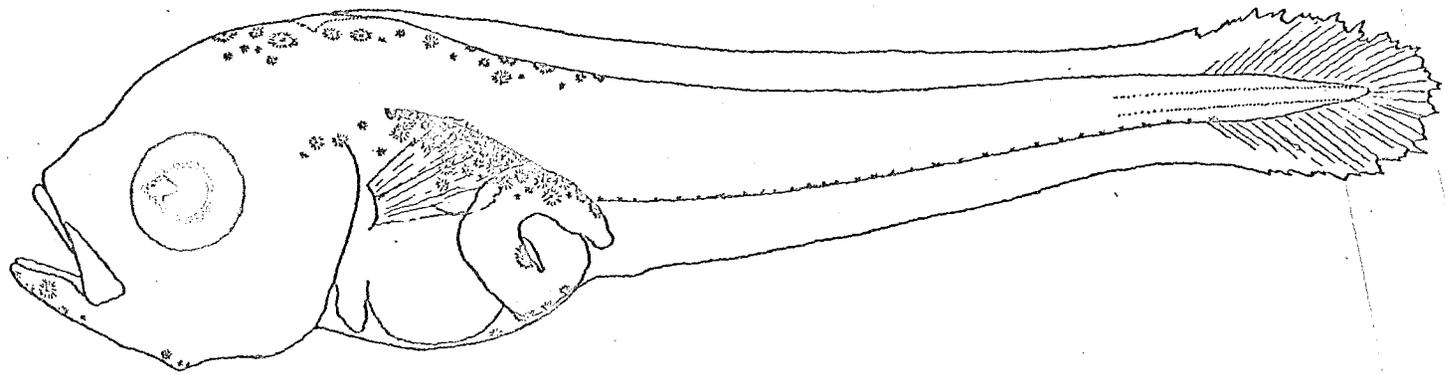
Schmidt, Johs.

1905. The Pelagic Post-larval Stages of the Atlantic Species of Gadus
Meddelelser fra Kommissionen for Havundersogelser
Serie: Fiskerie #4.

Excellent descriptions of larval and juvenile stages pp. 31-36.
Nine excellent drawings of fish from 6-43 mm. Plate II
figs. 10-17.



HADDOCK 4.8 mm. —



HADDOCK 7.8 mm. —

Cod Gadus callarias (Linnaeus)

Spawning:

Season greatly attenuated with beginning and end poorly defined. From about December through April, with maximum in January through February.

Eggs:

Pelagic without oil globule

Average size 1.52 mm., range 1.36-1.72 mm.

Identifying characteristics:

None in early stages but pigmented like prolarvae in later stages.

Prolarvae:

Average hatching size 4.42 mm., range 3.30-5.19 mm.

Identifying characteristics:

A scattering of chromatophores on the back of the head. Heavily pigmented over the gut and a pair of dorso-ventral bars evenly spaced on the tail. Vent opens at the base of the finfold rather than at the margin.

Postlarvae:

Range from 5-10 mm.

Identifying characteristics:

Basic pigmentation pattern remains the same to about 10 mm., although it tends to become more diffused with increase in size. Beyond 10 mm. the 2 pairs of bars on the tail are apt to become too diffused to distinguish.

Juveniles:

Identifying characteristics:

Cod, haddock, and pollock are easily confused in sizes over 10 mm. The most reliable method of identification in this case is to count the abdominal vertebrae. The cod has 17-20 abdominal vertebrae.

Bibliography:

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

1953. Fishes of the Gulf of Maine. Fish. Bull. U. S. F. W. S. #74,
Vol. 53.

Description of eggs and larvae and illustrations pp. 187-188.

Dannevig, Alf

1918. Canadian Fish Eggs and Larvae. Canadian Fisheries Expedition 1914-15, Biology of Atlantic Waters of Canada.

Illustrations of cod larvae Plate III No. 16-18.

Ryder, J. A.

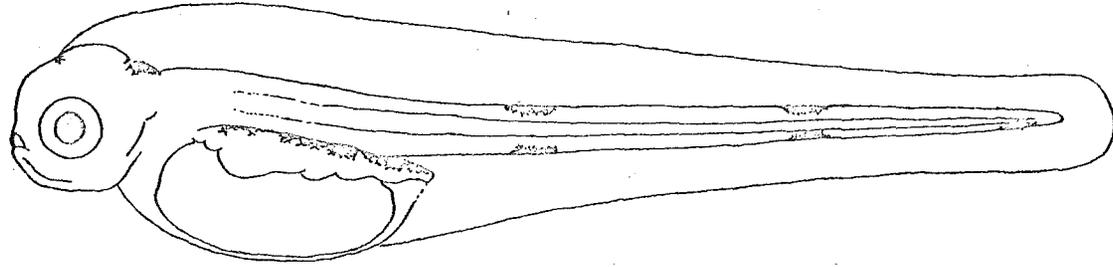
1882. Embryology of Osseous Fishes. Rept. U. S. Fish. Comm.

148 pages on the development of the cod egg with 11 plates of eggs and larvae pp. 455-603.

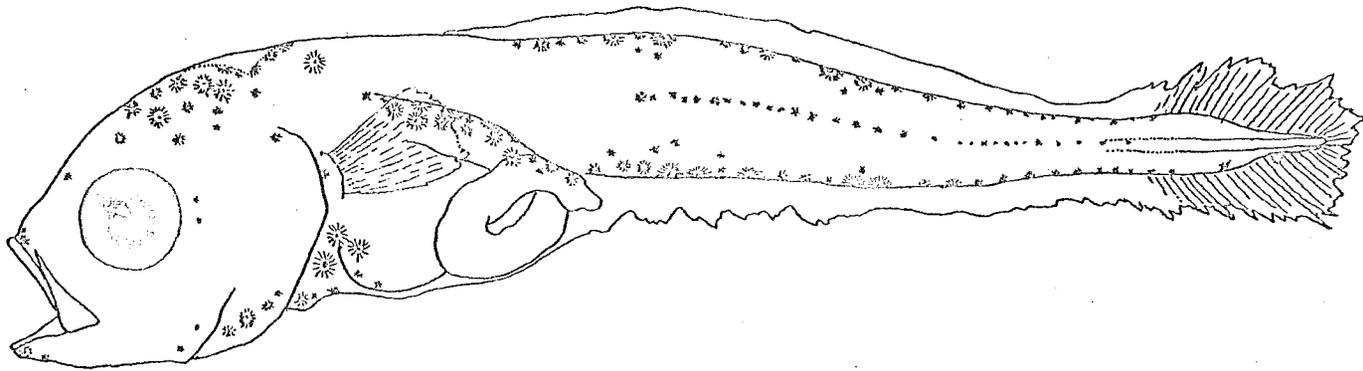
Schmidt, Johs.

1905. The Pelagic Post-larval Stages of the Atlantic Species of Gadus. Meddelelser fra Kommissionen for Havundersogelser Serie: Fiskerie #4.

Excellent description of cod larvae and juveniles pp. 9-12. Nine illustrations, Plate I, figs. 1-9.



COD 4.8 mm. H



COD 7.8 mm. —