

Lophiiformes

Selected meristic characters in species belonging to the order Lophiiformes whose adults or larvae have been collected in the study area. Classification sequence follows Pietsch, 1984. Counts in parentheses are unusual. Lophiiforms have 8 or 9 caudal fin rays (except 10 in *Neoceratias spinifer*). Vertebral counts in Ceratioidei are based on a very limited number of observations. Sources: Bertelsen, 1951; 1984; 1986; Bertelsen and Pietsch, 1996; Bertelsen, Pietsch and Lavenberg, 1981; Bertelsen and Struhsaker, 1977; Caruso, 1983; 1986; 1989; 2003; Caruso and Pietsch, 1986; Pietsch, 1984; 1986a; 1986b; Richards and Bradbury, 2006; Scott and Scott, 1988; Uyeno *et al.*, 1983.

Suborder – Family <i>Species</i>	Vertebrae	Dorsal Fin Rays	Anal Fin Rays	Pectoral Fin Rays	Pelvic Fin Rays
Lophioidei – Lophiidae					
<i>Lophius americanus</i>	26–31	VI, 9–12	8–10	25–28	I, 5
<i>Lophius gastrophysus</i>	26–27	VI, 9–10	8–9	22–26	I, 5
<i>Lophius piscatorius</i> ²	30–31	VI, 11–12	9–10	23–27	I, 5
Antennarioidei – Antennariidae					
<i>Antennarius radius</i>	20	I,I,I, (12) 13	(7) 8	(12) 13 (14)	I, 5
<i>Antennarius ocellatus</i>	20	I,I,I, (12) 13	(7) 8	(11) 12	I, 5
<i>Antennarius striatus</i>	18–19	I,I,I, 11–12	(6) 7	(10)11 (12)	I, 5
<i>Histrio histrio</i>	18–19	I,I, (11) 12 (13)	(6) 7 (8)	(9) 10 (11)	I, 5
Chaunacioidei – Chaunacidae					
<i>Bathychaunax roseus</i>	19	I, 10–12	(5) 6	13–15	I, 4
<i>Chaunax stigmaeus</i>	19	I, 10–12	5–7	11–14	I, 4
<i>Chaunax suttkusi</i>	19	I, 11–12	5–7	10–13	I, 4
Ogcocephaloidei – Ogcocephalidae					
<i>Dibranchus atlanticus</i>	(17) 18 (19)	II, 5–7	4	13–15	I, 5
<i>Dibranchus tremendus</i>	(18) 19 (20)	II, (4) 5–7	4	12–14	I, 5
<i>Halieutichthys aculeatus</i>	(16) 17–18 (19)	II, 4–6	4	16–18	I, 5
<i>Ogcocephalus corniger</i>	18–19	II, 3–5	3–4	10–12	I, 5
Ceratioidei – Caulophrynidae					
<i>Caulophryne jordani</i>	19	16–19	14–18	16–18	3–4 ¹
Neoceratiidae					
<i>Neoceratias spinifer</i>	24	11–13	10–12	13–15	0
Melanocetidae					
<i>Melanocetus johnsoni</i>	21	13–17	4	17–23	0
<i>Melanocetus murrayi</i>	21	12–14	4	15–18	0
Himantolophidae					
<i>Himantolophus albinareus</i>	about 19	5–6	4	16	0
<i>Himantolophus brevirostris</i>	about 19	5–6	4–5	15–18	0
<i>Himantolophus groenlandicus</i>	about 19	5–6	4–5	15–18	0
<i>Himantolophus maui</i>	about 19	5–6	4	–	0

¹ Larvae and males – females lose pelvic fin during development

² Reported once, continental slope off New England (Haedrich and Merrett, 1988); no other reports in study area

Lophiiformes

Suborder – Family <i>Species</i>	Vertebrae	Dorsal Fin Rays	Anal Fin Rays	Pectoral Fin Rays	Pelvic Fin Rays
Oneirodidae					
<i>Chaenophryne draco</i>	19	6–8	4–6	15–19	0
<i>Chaenophryne longiceps</i>	19	6–8	5–6	16–19	0
<i>Danaphryne nigrifilis</i>	–	5–6	5	17	0
<i>Dolopichthys allector</i>	19?	6	6	20	0
<i>Dolopichthys karsteni</i>	–	5–9	5–6	18–22	0
<i>Dolopichthys pullatus</i>	–	5–9	5–6	18–22	0
<i>Leptacanthichthys gracilispinis</i>	–	5	5	18–23	0
<i>Lophodolus acanthognathus</i>	about 19	5–7	4–6	17–20	0
<i>Microlophichthys microlophus</i>	19?	5–7	4–6	17–23	0
<i>Oneirodes eschrichtii</i>	19?	6	4	13–19	0
<i>Oneirodes macrosteus</i>	–	6	4	15–17	0
<i>Oneirodes schmidti</i>	–	5–6	4	15–16	0
<i>Pentherichthys atratus</i>	19?	6–7	5–6	21–24	0
<i>Phyllorhinichthys micractis</i>	–	5	5	21–24	0
<i>Spiniphryne gladisfenae</i>	–	5	5	16	0
Thaumatoichthyidae					
<i>Lasiognathus intermedius</i>	20–22	5	5	17	0
<i>Lasiognathus beebei</i>	–	–	–	–	–
Ceratiidae					
<i>Ceratias holboelli</i>	–	(3) 4 (5)	4	17–18	0
<i>Ceratias uranoscopus</i>	–	(3) 4 (5)	4	16–17	0
<i>Cryptosaras couesi</i>	20	4	4	15–18	0
Gigantactinidae					
<i>Gigantactis longicirra</i>	22	8–9	6–7	15–18	0
<i>Gigantactis perlatus</i>	22	5–7	5–7	16–19	0
<i>Gigantactis vanhoeffeni</i>	22	5–7	5–7	17–19	0
Linophrynidae					
<i>Haplophryne mollis</i>	19	3–4	3–4	15–16	0
<i>Linophryne algibarbata</i>	19	3	2–3	14–16	0
<i>Linophryne arborifera</i>	19	3	3	14–19	0
<i>Linophryne bicornis</i>	19	3	3	–	0
<i>Linophryne brevibarbata</i>	19	3	3	16–17	0
<i>Linophryne coronata</i>	19	3	2–3	13–14	0
<i>Linophryne lucifer</i>	19	3	2	14–15	0

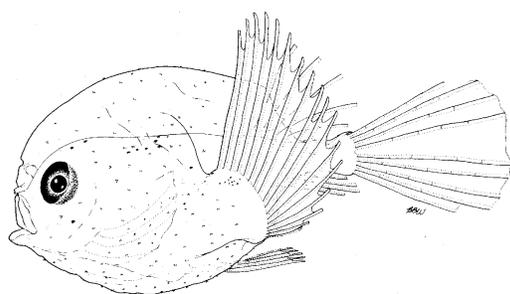
Lophiiformes

Lophiidae – This family includes 25 species contained in 4 genera. Most are tropical, but 2 species (and rarely a third) occur within the study area. Larvae of *Lophius americanus* are commonly collected over continental shelf depths (and deeper) but larvae of *L. gastrophysus* have not yet been reported from north of 35°N. *Lophius* spawning is characterized by the release of gelatinous "rafts" containing the off-round eggs. The first 2 dorsal fin rays become displaced far forward on the head, and the anteriormost is modified into a "lure" for attracting prey.

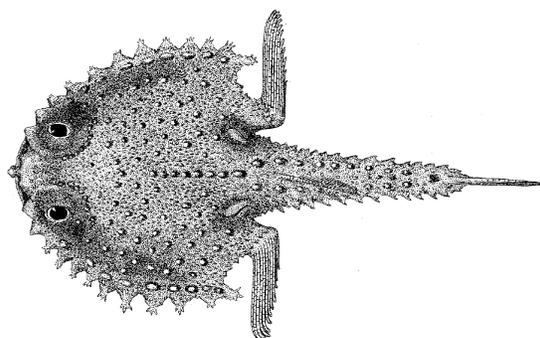
Antennariidae – There are 41 species in 12 genera in this mostly tropical family, and many are associated with reef habitats. Eggs are either contained in gelatinous "rafts" or are attached to various substrates. Larvae are typically deep-bodied and inflated, and some go through a special juvenile stage known as a "scutatus". Adults are sedentary predators that are characterized by the anteriormost dorsal spine modified into a "lure" to attract prey.

Chaunacidae – This family contains 2 genera with up to 12 species. Early stages are almost unknown. Eggs are undescribed, but the ovaries are scrolled (as in other lophiiforms), suggesting the release of eggs in gelatinous "rafts". One described larva, unidentified to species, has an inflated body covered with dermal "spinules", early forming fin rays, and a large head (Pietsch, 1984).

Ogcocephalidae – This mostly tropical family includes 62 species contained in 9 genera. Four species, in 3 genera, have been reported from the present study area, either as adults or early stages. They may be distinguished from other lophiiform families by low numbers of dorsal and anal fin spines and rays (see table of meristic characters). Eggs are undescribed in this group, but the presence of scrolled ovaries (as in other lophiiforms) suggest that they release eggs in gelatinous "rafts". The few larvae that have been described have inflated bodies with large heads (HL >50% of SL) and pectoral fins. The illicium is formed by about 5.0 mmTL; other fin rays are complete at 3.1 mmTL. Pectoral fins are large and fan-shaped and the pelvic fin bases are elongate. Dermal spinules form on skin at about 12 mm. Adults are dorso-ventrally flattened and move on the bottom using pectoral and pelvic fins. They use a modified dorsal spine (an illicium), positioned under an overhanging rostrum, as a "lure" to attract prey. See also *Halieutichthys aculeatus* pages.



10.4 mmTL (North Carolina specimen)
Genus and species unidentified.
Betsy B. Washington (Pietsch, 1984)



Dibranchius atlanticus (Adult, dorsal view)
D.R. Harriott (Scott and Scott, 1988)

Ceratioidei – Fishes in this suborder exhibit extreme sexual dimorphism. The males are dwarfed by the females and lack an external illicium (present in females). Males also have denticular teeth on the tips of the jaws and have well-developed eyes and/or olfactory organs, in contrast to the females (Bertelsen, 1984). Males attach themselves to females in several families, thus ensuring fertilization of eggs, which are released in "egg-rafts" or "veils". The degree to which this sexual parasitism occurs varies between families (Pietsch, 1976). Adult ceratioid fishes occur worldwide in waters ranging from tropical to subpolar, but larval stages have only been collected from warm waters, between 40°N and 35°S. Fishes in this suborder are bathypelagic; transforming and adult stages occur at depths below 2,000 m. Larvae occur in depths <200 m. Most ceratioids in the North Atlantic are summer spawners and larvae are epipelagic for several months.

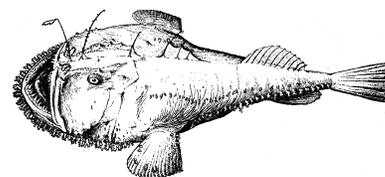
(Key to ceratioid families based on larval characters constructed after Bertelsen, 1951; Bertelsen and Struhsaker, 1977; Bertelsen, Pietsch and Lavenberg, 1981; Pietsch, 1979; Pietsch and Seigal, 1980; Pietsch and Van Duzer, 1980)

Lophiiformes**Ceratioidei:** Variation in degree of sexual parasitism (after Pietsch, 1976):

Degree of Parasitism	Definition	Families (<i>Genera</i>)
Obligatory	<ul style="list-style-type: none"> – Non-parasitized females never with developed ovaries – Free-living males never with developed testes, undergo no post-transformation growth and gut always empty 	Ceratiidae Linophryinae Neoceratiidae (?)
Facultative	<ul style="list-style-type: none"> – Male jaws appear unsuited to prey capture – Non-parasitized and parasitized females may have developed ovaries – Free-living males unknown – Male jaw mechanism unknown 	Caulophryinae Oneirodidae (<i>Leptacanthichthys</i>)
Non-parasitic	<ul style="list-style-type: none"> – Non-parasitized females may have developed ovaries – Free-living males have developed testes and undergo considerable post-transformation growth (food found in stomach of melanocetid males) – Male jaws appear suited to prey capture 	Melanocetidae Himantolophidae Gigantactinidae Oneirodidae (<i>Oneirodes</i> , <i>Chaenophryne</i> , <i>Microlophichthys</i>)
Undescribed	<ul style="list-style-type: none"> – Not well-known – a single free-living male (31.0 mm) described from 1 of 2 genera 	Thaumatchthyidae

Ceratioidei: Key to families based on larval characters:

- I. Entire head and body densely pigmented, except pectoral fin base and end of caudal peduncle **Thaumatchthyidae**
- II. Pigment not heavy; pectoral fins very large; pelvic fins present or absent
 - A. Pelvic fins present in larvae and adult males; high dorsal fin ray count (14–22) **Caulophryinae**
 - B. Pelvic fins absent; low dorsal fin ray count (4–10) **Gigantactinidae**
- III. Pigment not heavy; pectoral fins relatively short; no pelvic fins
 - A. More than 10 dorsal fin rays
 1. Dorsal fin rays 12–17; anal fin rays 3–5; body short and plump **Melanocetidae**
 2. Dorsal fin rays 11–13; anal fin rays 10–13; body slender **Neoceratiidae**
 - B. Ten or fewer dorsal fin rays
 1. Body 'humpbacked'; females with 2 or 3 caruncles on back anterior to dorsal fin; caudal fin rays 8–9 **Ceratiidae**
 - a. Well pigmented; 3 caruncles on back; caudal fin rays 8 *Cryptopsaras couesi*
 - b. Unpigmented; 2 caruncles on back; caudal fin rays 9 *Ceratias* sp.
 2. Body straight (not 'humpbacked'); no caruncles; caudal fin rays 9
 - a. Females with illicium-like second cephalic ray; dorsal fin rays 5–6; anal fin rays 4; caudal fin rays 9 (does not occur in study area) **Diceratiidae**
 - b. Larvae with small, papilliform hyoid barbel below head; dorsal fin rays 5–7; anal fin rays 5–6; caudal fin rays 9 (does not occur in study area) **Centrophryinae**
 - c. Body elongate; branchiostegal rays 4–5; dorsal fin rays 3 (2–4); anal fin rays (2) 3; caudal fin rays 9 **Linophryinae**
 - d. Skin on head and trunk highly inflated; branchiostegal rays 6; dorsal fin rays 5–6; anal fin rays 4–5; caudal fin rays 9 **Himantolophidae**
 - e. Body short and plump, variously pigmented; skin moderately inflated; dorsal fin rays 4–8; anal fin rays 4–7; caudal fin rays 9 **Oneirodidae**

Lophius americanus* Valenciennes, 1837*Lophiidae****Goosefish**

Range: Western North Atlantic Ocean from Gulf of St. Lawrence to Florida

Habitat: Demersal, in depths ranging from near-coastal to 948 m; substrate habitats range from soft mud to hard sand or pebbly with broken shell

Spawning: Spring through early fall; begins Mar–Apr off North Carolina; May off New England; Jun in Gulf of Maine

Eggs:

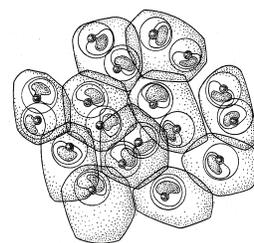
- Deposited in buoyant, gelatinous veils; eggs contained within 'cells'
- Diameter: 1.61–1.84 mm
- Chorion: smooth, transparent
- Yolk: homogeneous, amber
- Oil globule: single; 0.40–0.61 mm in diameter
- Perivitelline space: narrow

Meristic Characters

Myomeres:	28–30
Vertebrae:	26–31
Dorsal fin rays:	VI, 9–12
Anal fin rays:	8–10
Pectoral fin rays:	25–28
Pelvic fin rays:	I, 5
Caudal fin rays:	4+4 (PrC)

Larvae:

- Hatching occurs at 2.5–4.5 mm (first dorsal fin ray forming in finfold)
- Body initially very slender with bulging gut and very short preanus length
- Anterior dorsal (#2–4) and pelvic fin rays form early and become elongate
- Pectoral fin rays early-forming; fin large and fan-shaped
- Dorsal and anal fin rays last to form; all fin rays complete by 12 mmTL
- Prominent pigment includes evenly spaced blotches along tail, dense melanophores on dorsum of head and nape, bands of pigment on pectoral and extreme end of pelvic fin rays
- Transformation occurs at sizes >50 mmTL when elongate fin rays are lost and juveniles descend to bottom



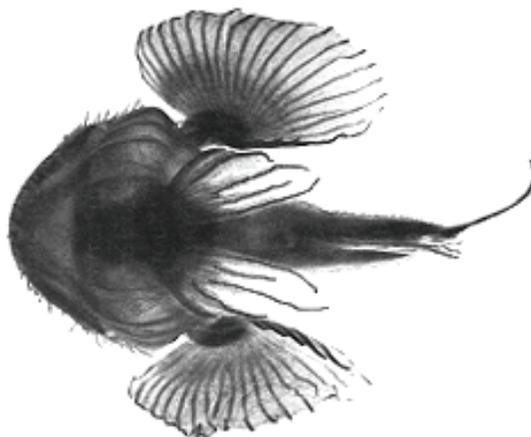
Note:

1. Early larvae of *Brosme brosme* (Lotidae) resemble *Lophius* larvae, but have about twice the number of myomeres, an accumulation of pigment at the extreme tip of notochord (not slightly anterior to tip), and lack the early-forming anterior dorsal fin rays
2. The first 3 dorsal spines are situated on the anterior head and function as a luring apparatus. The 1st spine (the illicium) and the 2nd spine share a single, supporting pterygiophore

Early Juvenile:**G. 76.0 mmSL****Ventral View**

(Modified after Caruso, 1983, fig. 4)

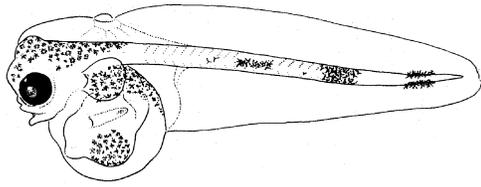
Note enlarged pelvic and pectoral fins; these will shrink, proportionately, with onset of juvenile stage



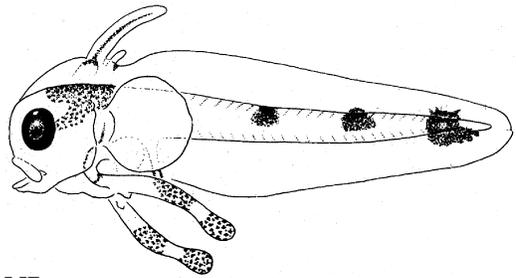
Figures: Adult: Bigelow and Welsh, 1925; Eggs: Procter *et al.*, 1928; **A:** Fahay, 1983; **B:** Bigelow and Schroeder, 1953 (redrawn); **C–D, F:** Tåning, 1923 (redrawn); **E:** Elizabeth Ray Peters (Martin and Drewry, 1978); **G:** Caruso, 1983 (modified)

References: Caruso, 1983; 2002a; 2002c; Fahay, 1983; Everly, 1995

Lophius americanus

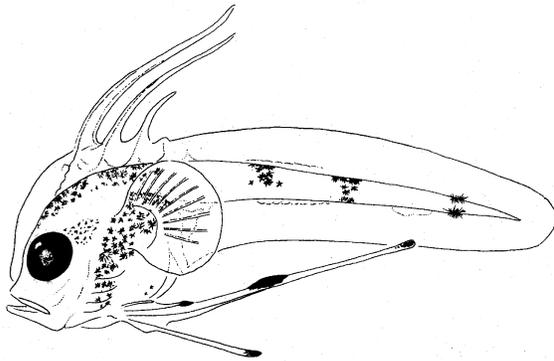


A. 5.0 mmNL

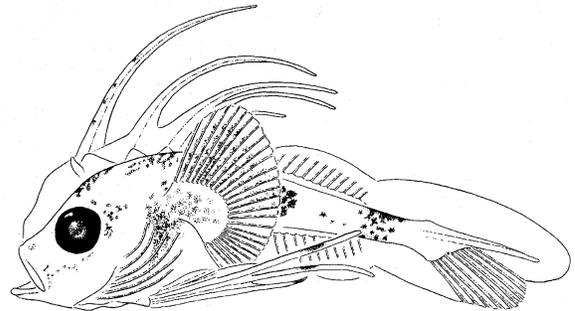


B. 5.5 mmNL

Pelvic fin rays pigmented to extreme tip

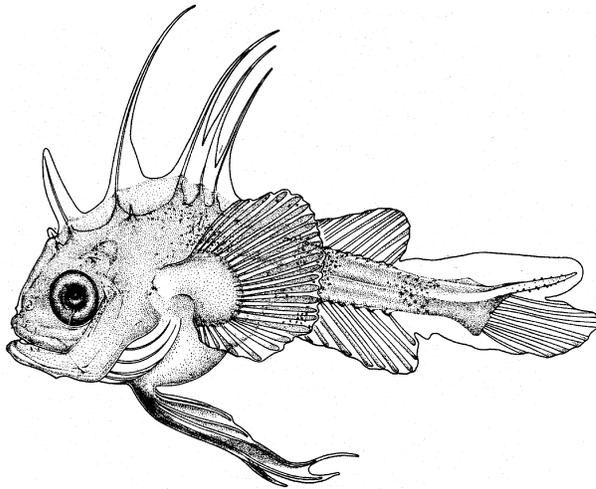


C. 6.5 mmNL



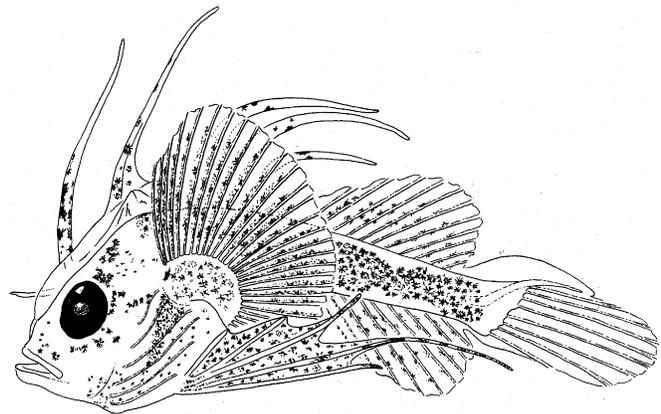
D. 10.5 mmNL

3 pigment accumulations along tail, the posteriormost well anterior to notochord tip

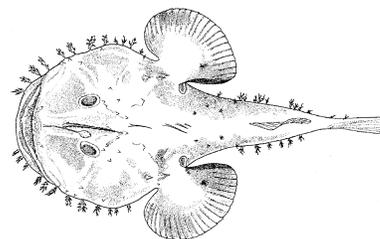


E. 12.0 mmTL

The 1st dorsal fin spine forms late (well after the other dorsal spines are formed) and becomes the illicium. It shares pterygiophore support with the 2nd spine



F. 16.0 mmTL

Lophius gastrophysus* Ribeiro, 1915*Lophiidae****Blackfin goosefish**

Range: Western Atlantic Ocean from Cape Hatteras to northern Argentina; more rarely along continental slope off northeast United States, as far north as southern New England

Habitat: Demersal in depths of 183–662 m; found in bottom temperatures of 7–22°C

Spawning: Undescribed

Eggs: – Undescribed; eggs presumably deposited in buoyant, gelatinous veils

Larvae:

- Hatching occurs at lengths of <3.3 mmNL (collected free-living, with large yolk mass)
- Body initially very slender with bulging gut and very short preanus length
- Anterior dorsal spines (#2–4) and pelvic fin rays form early and become elongate
- Pectoral fin large and fan-shaped; fin rays complete at 12.5 mmNL
- Dorsal and anal fin rays last to form; all fin rays complete by 12.5 mmNL
- Prominent pigment includes evenly spaced blotches along tail, dense melanophores on dorsum of head and nape, bands of pigment on pectoral and at 75% of length of pelvic fin rays
- Size at transformation undescribed; 1st dorsal spine forms late and becomes illicium, sharing pterygiophore support with 2nd dorsal spine

Meristic Characters

Myomeres:	about 26–27
Vertebrae:	26–27
Dorsal fin rays:	VI, 9–10
Anal fin rays:	8–9
Pectoral fin rays:	22–26
Pelvic fin rays:	I, 5
Caudal fin rays:	4+4 (PrC)

Note: 1. Selected differences in ontogenetic development between *Lophius gastrophysus* and *L. americanus*. Also see meristic characters:

Character	<i>Lophius gastrophysus</i>	<i>Lophius americanus</i>
First dorsal spine forms	About 10–11 mm	About 12–14 mm
Anal and dorsal fin rays complete	9.3 mm	10.5 mm
First appearance of canine teeth (both jaws)	4.2 mm	6.5 mm
Pigment at end of second dorsal spine	Begins 5.2 mm	Absent
Pigment at end of pelvic fin rays	At 75% of distance	At extreme tip (Fig. G)

G: 6.2 mmTL
Lophius americanus

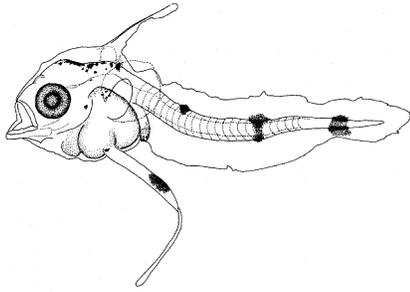
Larvae have not been reported from plankton collections off the United States, but may be found in the study area, especially in slope or Gulf Stream waters



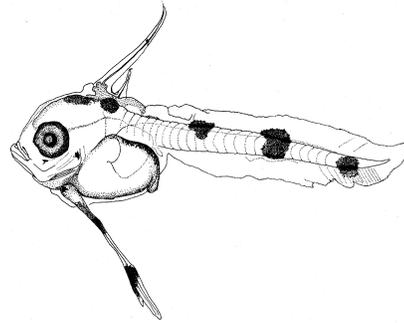
Figures: Adult: Caruso, 2002c; A–F: Kazuko Suzuki (Matsuura and Yoneda, 1986); G: Procter *et al.*, 1928

References: Matsuura and Yoneda, 1986; 1987; Caruso, 2002c

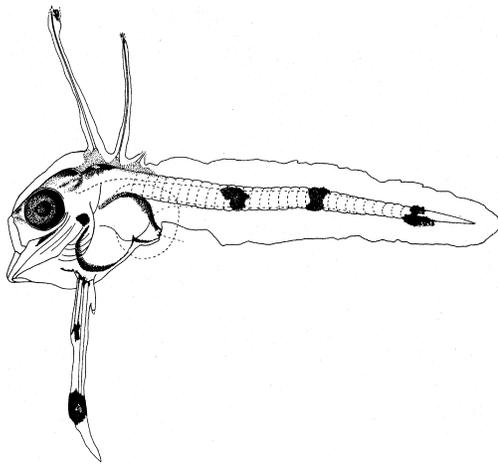
Lophius gastrophysus



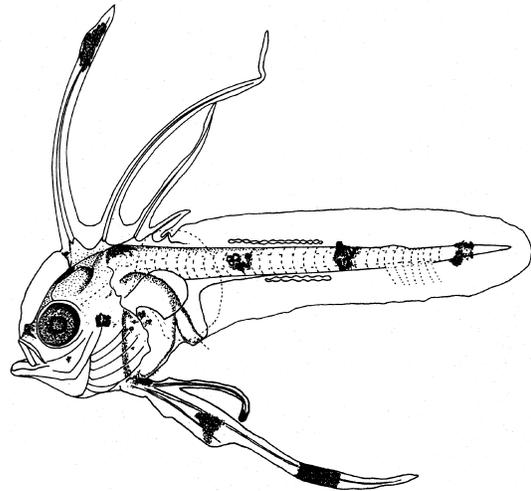
A. 3.8 mmNL



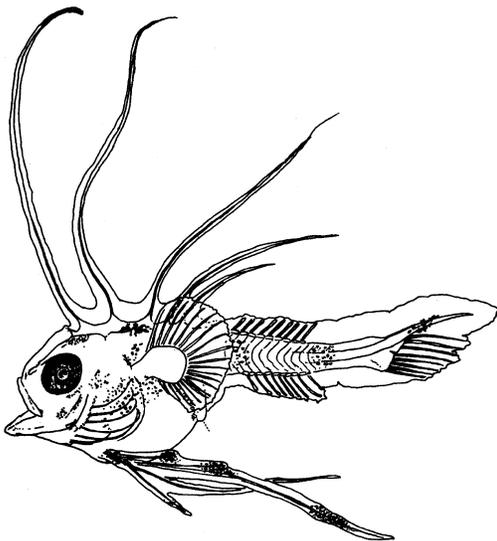
B. 4.5 mmNL



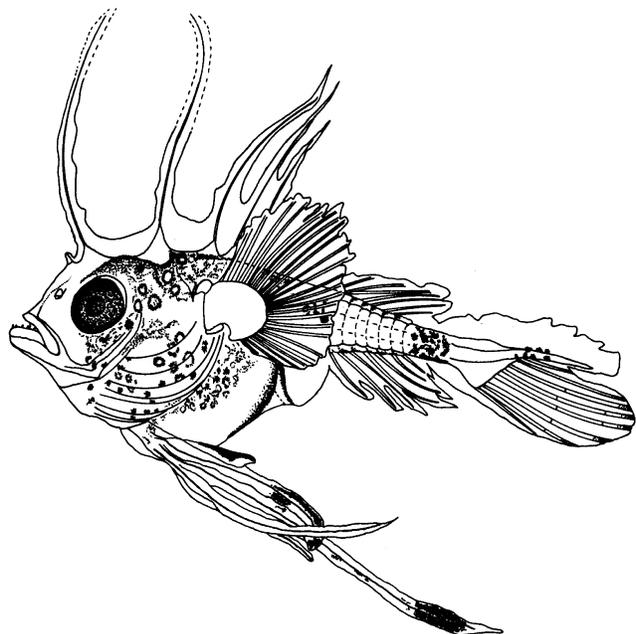
C. 5.6 mmNL



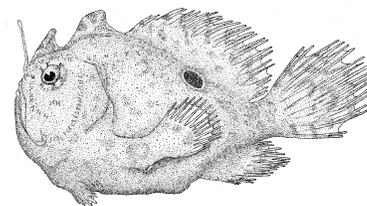
D. 7.8 mmNL



E. 9.2 mmNL



F. 14.9 mmNL

Antennarius radiosus* Garman, 1896*Antennariidae****Singlespot frogfish**

Range: Eastern and western North Atlantic Ocean; in the western Atlantic from Long Island, New York to Florida Keys and Gulf of Mexico

Habitat: Mud bottoms in depths of 20–160 m; young stages (<25 mm) are pelagic

Spawning: Undescribed

Eggs: – Undescribed; eggs presumably deposited in buoyant, gelatinous "rafts"

Larvae: – Early stages undescribed

Early Juvenile:

- Specialized early juvenile stage (the "scutatus") originally described as new genus and species (*Kanazawichthys scutatus*) by Schultz (1957)
- Pair of shield-like bony extensions of cranium reach posteriorly beyond level of opercle (Fig. B)
- Anterior margin of suspensorium expanded
- Head very large; 40–50% SL
- Body deep, appears 'inflated'
- Pectoral fin bases moderately stalked
- Anterior 2 dorsal fin spines modified into illicium
- Pigment evenly scattered over much of body, lighter on head

Meristic Characters

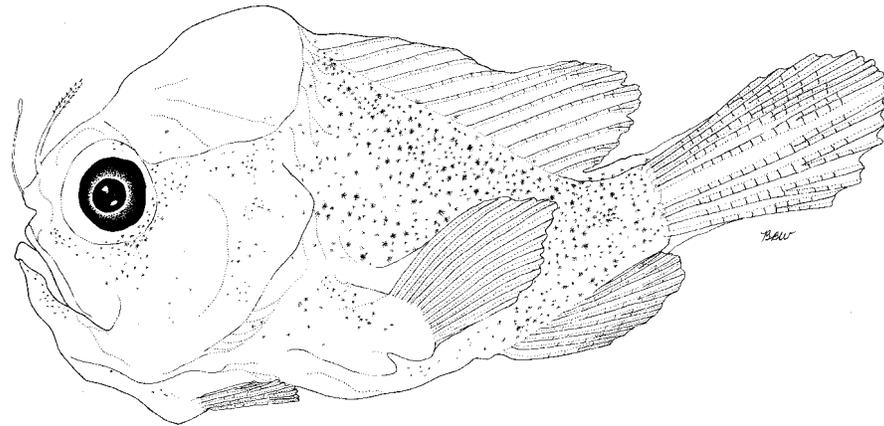
Myomeres:	about 20
Vertebrae:	20
Dorsal fin rays:	I, I, I, (12) 13
Anal fin rays:	(7) 8
Pectoral fin rays:	(12) 13 (14)
Pelvic fin rays:	I, 5
Caudal fin rays:	9

Note: 1. The "scutatus" stage appears to be restricted to this species, although small specimens of related species (e.g. the eastern Pacific *Antennarius avalonis*, 3.3–3.6 mmSL) exhibit similar morphological adaptations (Watson, 1996g).

Figures: Adult: Cathy L. Short (Pietsch and Grobecker, 1987); A: Betsy B. Washington (Pietsch, 1984) as 21.2 mmTL; B: Pietsch and Grobecker, 1987; C: Barbara Sumida MacCall (Watson, 1996g)

References: Pietsch, 1984; Pietsch and Grobecker, 1987; Watson, 1996g

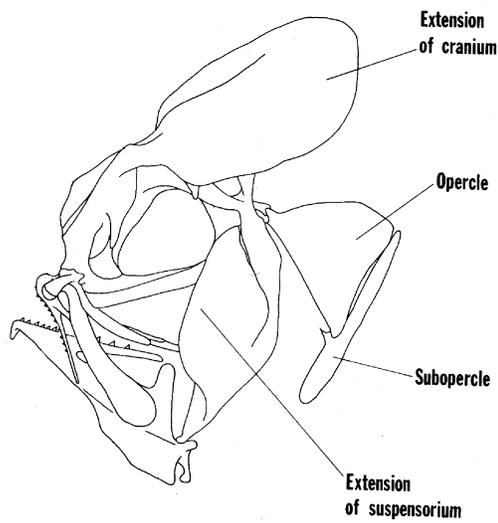
Antennarius radiosus



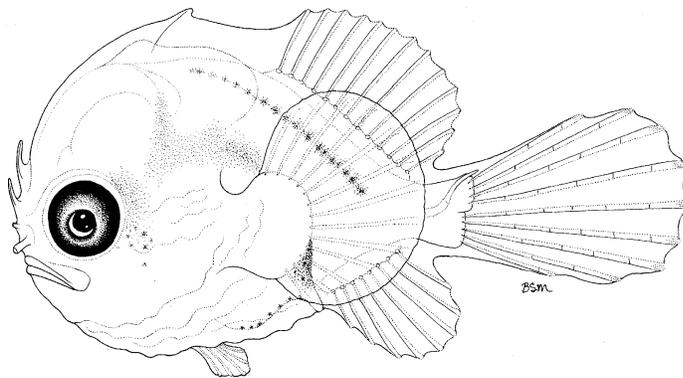
A. 16.2 mmSL ("scutatus" stage)

**B. 17.5 mmSL
(Lateral Skull)**

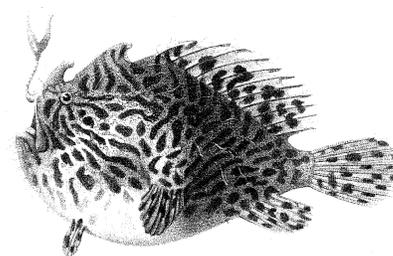
Note expanded
cranium and
suspensorium



Antennarius avalonis
(eastern Pacific)
included to demonstrate
characters in early
larvae of the genus
Antennarius



C. 3.6 mmSL

Antennarius striatus* (Shaw and Nodder, 1794)*Antennariidae**
Striated frogfish

Range: Widely distributed in Atlantic and Indo-Pacific oceans; in the western Atlantic from New Jersey and Bermuda through the Bahamas, Gulf of Mexico and Caribbean Sea to southern Brazil

Habitat: Grassy substrates with scattered objects (coral, conchs, etc.); also mud bottoms and near pilings; in depths from near-surface to 219 m

Spawning: Occurs near surface after courtship ritual; late Apr in Bahamas

Eggs:

- Deposited in buoyant, gelatinous veils
- Elliptical, light yellow
- Diameter: 0.70×0.65 mm
- Oil globules lacking

Larvae:

- Hatching occurs at 0.90–0.98 mm
- Early larvae similar to those of *Histrio histrio*
- Pigment in early larvae includes a "Y" shaped cluster of melanophores viewed dorsally from the posterior gut to eyes
- No other details of ontogeny are available

Note: 1. Selected early life history notes (as *Phrynelox scaber* (Cuvier)) are in Martin and Drewry (1978) and Rasquin (1958)

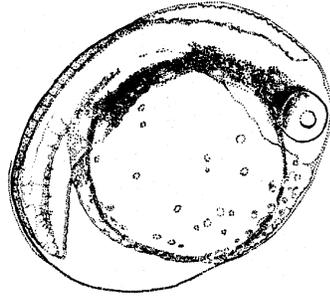
Meristic Characters

Myomeres:	about 18
Vertebrae:	18–19
Dorsal fin rays:	I, I, I, 11–12
Anal fin rays:	(6) 7
Pectoral fin rays:	(10) 11 (12)
Pelvic fin rays:	1, 5
Caudal fin rays:	9

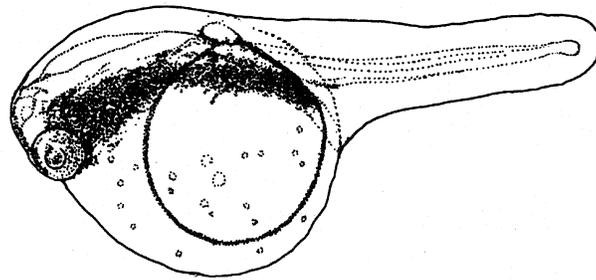
Figures: Adult: Valenciennes, 1842 (reproduced in Pietsch and Grobecker, 1987); **A–B:** Joan Ellis (Martin and Drewry, 1978, after Rasquin, 1958)

References: Rasquin, 1958; Martin and Drewry, 1978; Pietsch, 1984; Pietsch and Grobecker, 1987

Antennarius striatus



A. Embryo



**B. 0.96 mmTL
(Yolk-sac Larva)**

Histrio histrio* (Linnaeus, 1758)*Antennariidae****Sargassumfish**

Range: Atlantic, Indian and western Pacific oceans; in the western Atlantic from Gulf of Maine to Uruguay

Habitat: Strongly associated with floating sargassum weed; capable of dispersing as far as weed drifts; in study area occurs mostly in Gulf Stream

Spawning: Peaks in May–Jun and Oct–Jan; area east of Florida may be major spawning area; courtship and spawning between single males and females occur within masses of sargassum weed

Eggs:

- Deposited in buoyant, gelatinous veils within clumps of sargassum weed
- Chorion transparent, elliptical
- Diameter: $0.62\text{--}0.70 \times 0.53\text{--}0.60$ mm, become spherical after 2nd cleavage
- Yolk segmented
- Oil globules lacking

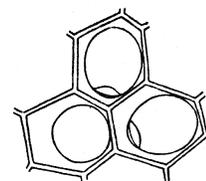
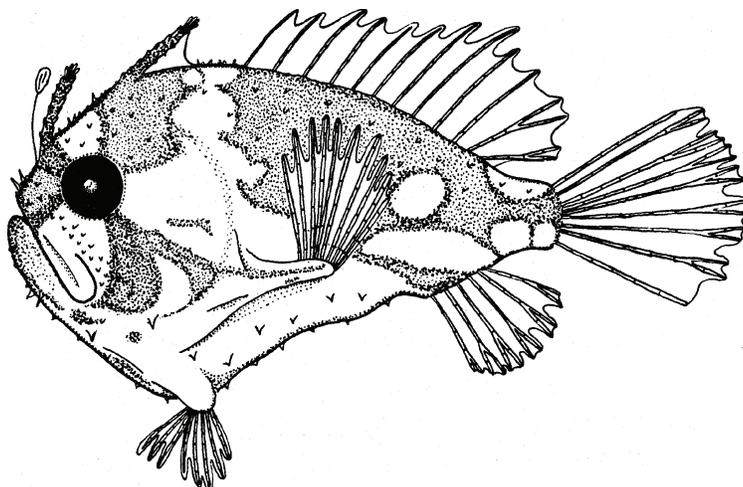
Larvae:

- Hatching occurs at 0.88–1.00 mmTL
- Head large, 33–50% of SL
- Sequence of fin ray formation: C, D, A – P₁, P₂ – D₁; dorsal spines last to form
- Anteriormost dorsal spine becomes illicium (at about 10 mmSL)
- Prominent pigment around head and midgut
- Changes during growth (5 to 10 mmSL) include elongation of pelvic fin base at about 9.0 mm, and fading of midgut pigment
- Transformation occurs at about 5.0 mmSL

Note: 1. Larvae <9.0 mm are pelagic, occurring in depths to 100 m, and are not necessarily associated with drifting weed beds. Larvae and juveniles >9.0 mm occur at the surface, and are invariably associated with weed beds.

Early Juvenile:**Meristic Characters**

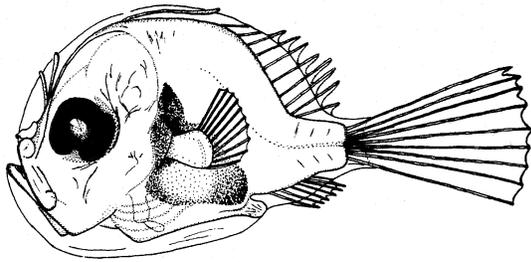
Myomeres:	about 19
Vertebrae:	18–19
Dorsal fin rays:	I, I, (11) 12 (13)
Anal fin rays:	(6) 7 (8)
Pectoral fin rays:	(9) 10 (11)
Pelvic fin rays:	I, 5
Caudal fin rays:	9 (7 branched)

**F. 15.0 mmSL**

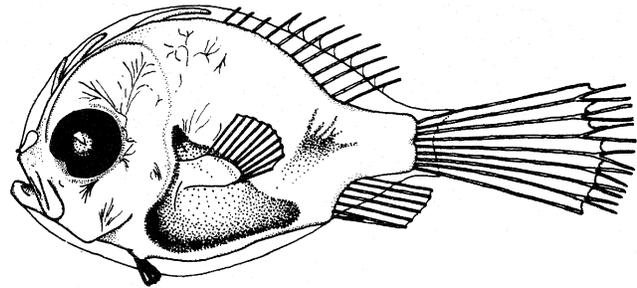
Figures: Adult: Chloe Lesley Starks (USNM); Eggs: Fujita and Uchida, 1959; A–F: Adams, 1960

References: Mosher, 1954; Adams, 1960; Pietsch and Grobecker, 1987; Pietsch, 2002a

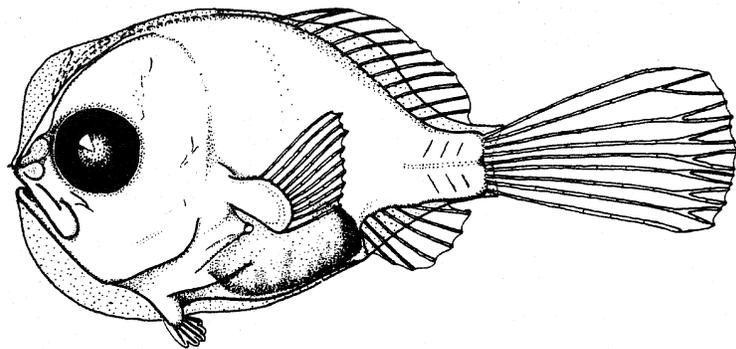
Histrio histrio



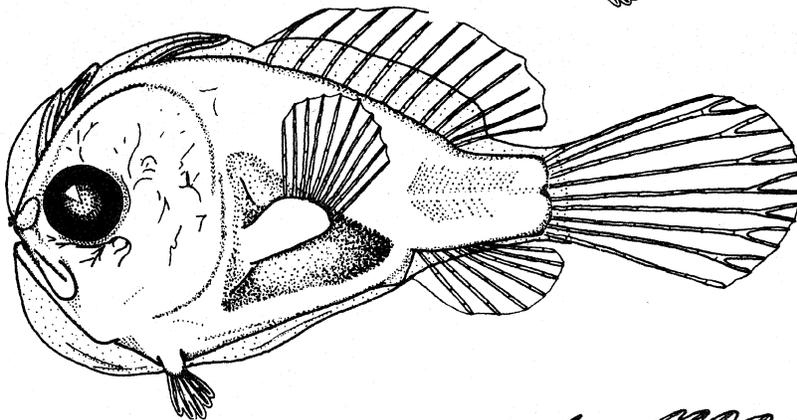
A. 2.0 mmSL



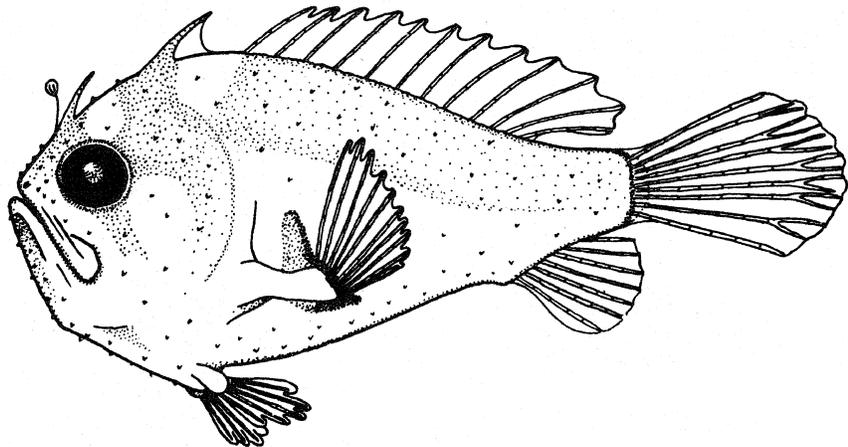
B. 3.4 mmSL



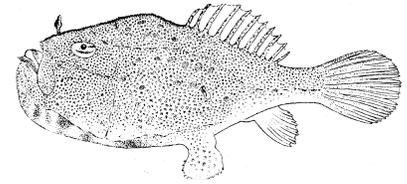
C. 4.0 mmSL



D. 5.0 mmSL



E. 10.0 mmSL

Chaunax stigmaeus* Fowler, 1946*Chaunacidae****Redeye gaper**

Range: Western North Atlantic Ocean from Emerald Bank, Nova Scotia to Norfolk Canyon and Atlantic City, New Jersey

Habitat: Demersal in depths of 90–699 m; larvae and young stages have been collected bathypelagically (Mead *et al.*, 1964)

Spawning: Undescribed

Eggs: – Undescribed; ovaries scrolled (as in other lophiiforms) suggesting that the eggs are deposited in buoyant, gelatinous veils or "rafts"

Larvae: – Description based on two larval specimens (specific identities unknown)
 – Head and anterior body inflated by transparent, gelatinous connective tissue
 – Posterior body tapers to long, narrow caudal peduncle
 – Head length >50% SL in all larval stages
 – Mouth small, oblique, terminal
 – All fin rays complete (including the illicium) by 4.3 mmTL
 – Skin covered with close-set dermal spinules in larvae 4.3–10.6 mmTL

Meristic Characters

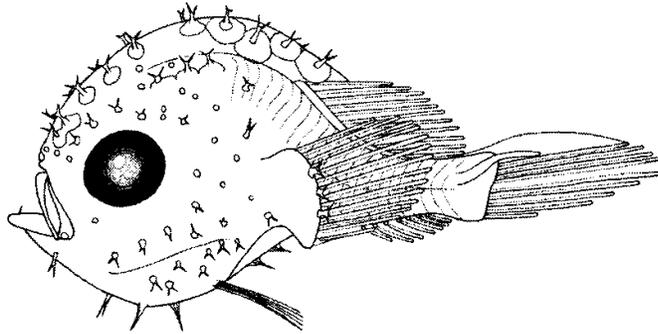
Myomeres:	about 19
Vertebrae:	19
Dorsal fin rays:	I, 10–12
Anal fin rays:	5–7
Pectoral fin rays:	11–14
Pelvic fin rays:	I, 4
Caudal fin rays:	8 (6 branched)

Note: 1. Early-forming meristic characters may be useful in identifying similar chaunacid larvae

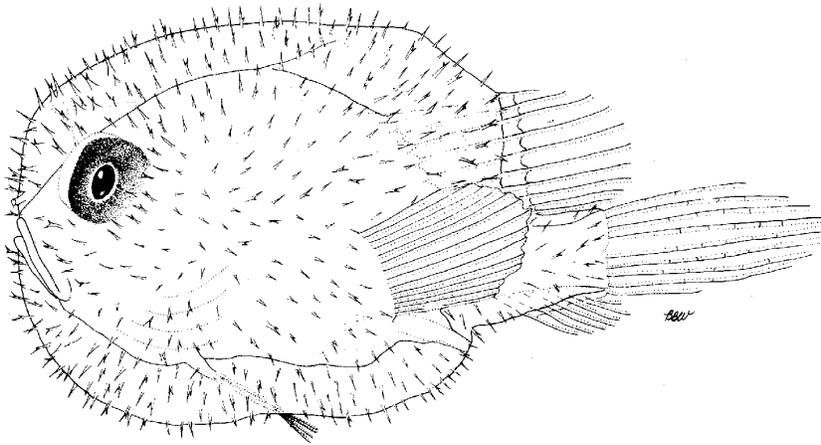
Figures: Adult: Fowler, 1946; **A:** Jack Javech (Jackson, 2006); **B:** Betsy B. Washington (Pietsch, 1984)

References: Mead *et al.*, 1964; Pietsch, 1984; Caruso, 2002b

Chaunax sp.



A. 2.6 mmSL



B. 9.8 mmTL

(Gulf of Mexico specimen)

Halieutichthys aculeatus* (Mitchill, 1818)*Ogcocephalidae****Pancake batfish**

Range: Western North Atlantic Ocean from Newfoundland to northern South America

Habitat: Demersal on substrates of hard sand, coral, sandy clay or sandy mud with shell debris, in depths of 31–421 m

Spawning: Undescribed in study area; May–Oct off Florida

Eggs: – Undescribed

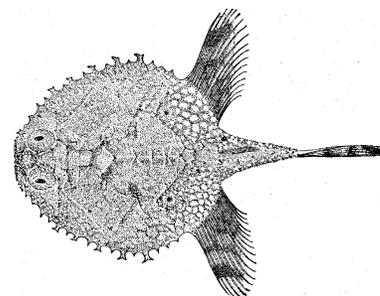
Larvae:

- Hatching occurs at sizes <2.0 mm
- Body slender with large head
- Skin becomes inflated around head and body
- Flexion occurs at about 2.6 mm
- Illicium (under overhanging rostrum) begins development at same size as notochord flexion
- Sequence of fin ray formation: P₁ – C, P₂ – D, A
- Pectoral, pelvic and caudal fin rays elongate
- Pigmentation includes melanophores in nape area, on dorsal surface of gut; later larvae develop pigment on sides of caudal peduncle, on pectoral and pelvic fins, on pelvic fin base and on side of head behind eye
- Transformation size varies from 11.5 to 25+ mm

Note:

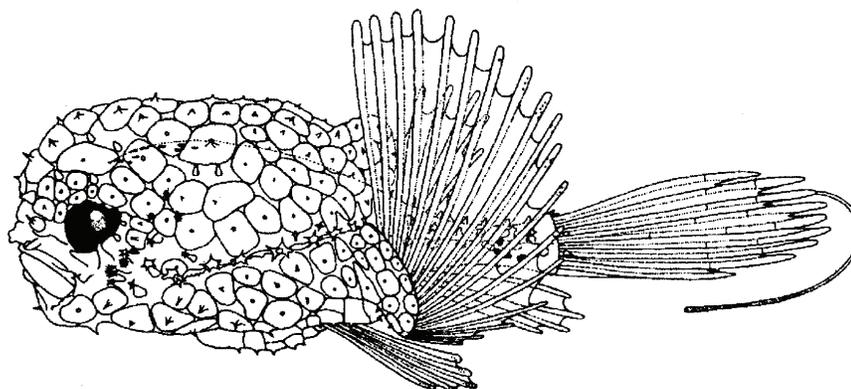
1. Low numbers of dorsal and anal fin rays distinguish ogcocephalids from larvae of other lophiiforms
2. Presence of pelvic fins distinguish larvae from all ceratioids except *Caulophryne jordani*

Early Juvenile:

**Meristic Characters**

Myomeres:	about 17–18
Vertebrae:	(16) 17–18 (19)
Dorsal fin rays:	II, 4–6
Anal fin rays:	4
Pectoral fin rays:	16–18
Pelvic fin rays:	I, 5
Caudal fin rays:	9 (5+4)

F. 12.0 mmSL

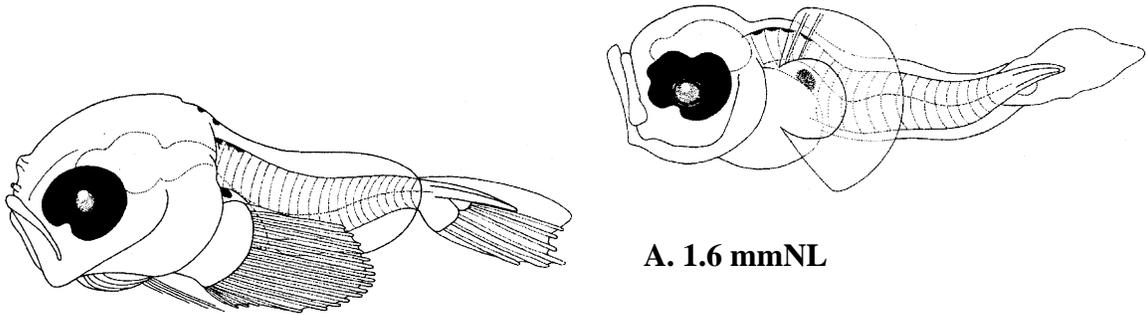


Note tubercles on dorsal and lateral surfaces of body.
Recently transformed juveniles retain elongate ray in caudal fin.

Figures: Adult: Goode and Bean, 1896; A–F: Richards and Bradbury, 2006

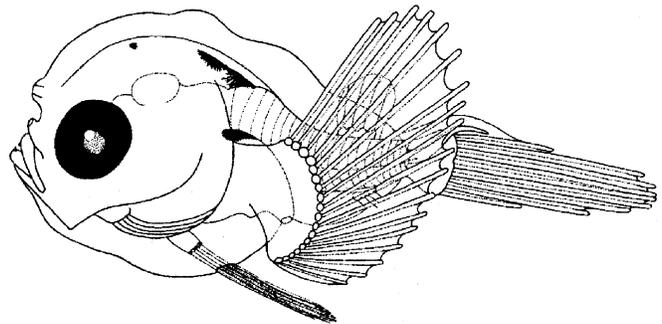
References: Bradbury, 1967; Pietsch, 1984; Watson, 1996g

Halieutichthys aculeatus



A. 1.6 mmNL

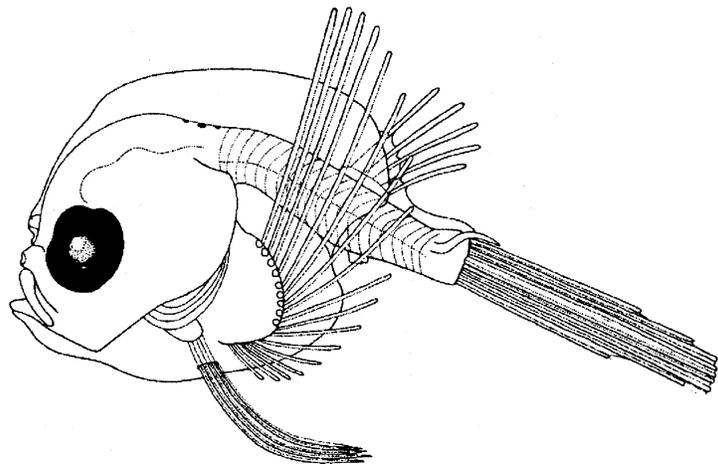
B. 2.1 mmNL



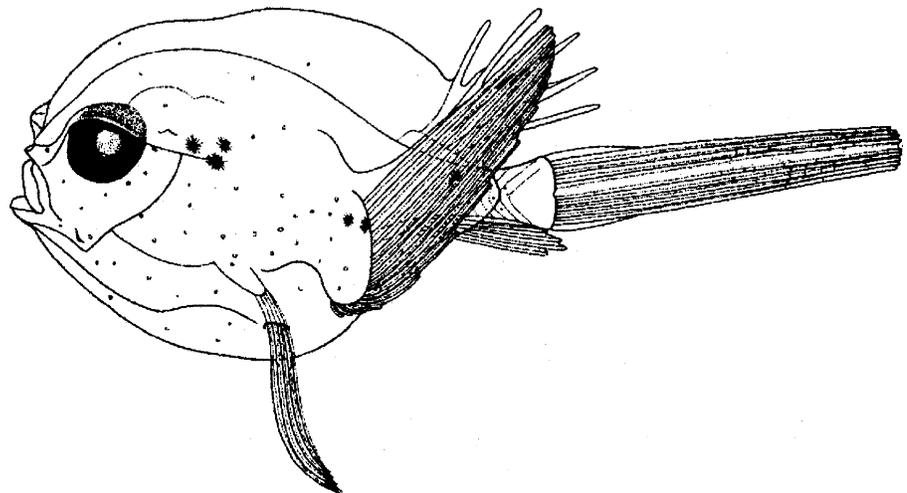
C. 2.6 mmSL

The larva of *Ogcocephalus parvus* has been described by Richards and Bradbury (2006); *O. parvus* occurs south of Cape Hatteras (to Brazil) but larvae may drift north in Gulf Stream

D. 3.0 mmSL



E. 5.5 mmSL



Caulophryne jordani* Goode and Bean, 1896*Caulophrynidae**

No common name

Range: Worldwide in all oceans; in the western North Atlantic from Greenland to Bermuda

Habitat: Meso- to bathypelagic in depths at least to 1,018 m

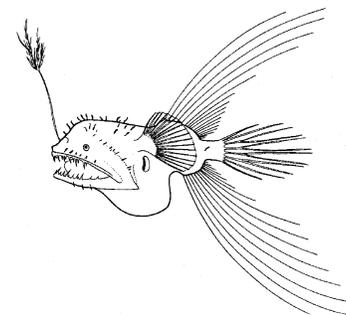
Spawning: Facultative sexual parasites; males usually attached to females; developed ovaries found in both parasitized and non-parasitized females; free-living males not known; male jaw mechanism undescribed; season undescribed

Eggs: – Undescribed

Larvae:

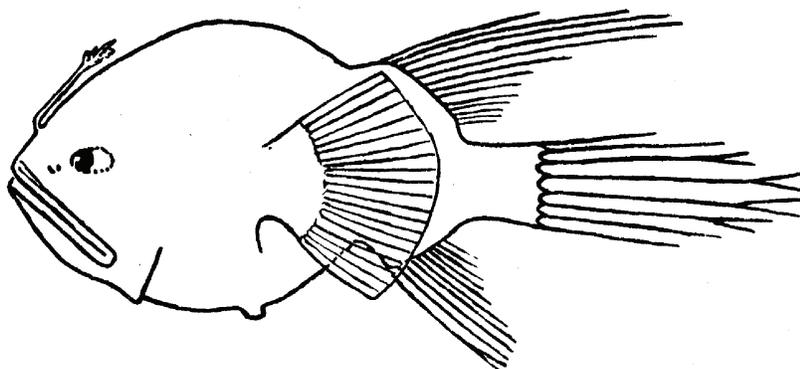
- Body short, skin very inflated
- Eyes relatively large
- Pelvic fin rays in larvae and adult males
- Other ceratioid genera lack pelvic fins
- Sequence of fin ray development: P₁, P₂, C – Illicium, D, A
- Pectoral fins very large and fan-shaped; reach beyond origins of dorsal and anal fins
- Illicium begins forming early, after pelvic and pectoral fin rays
- Note high dorsal fin ray count
- Pigmentation light; outer skin unpigmented, peritoneal pigment present; few spots over brain
- Dorsal pigment absent

Early Juvenile:

**Meristic Characters**

Myomeres:	about 19
Vertebrae:	19
Dorsal fin rays:	16–19
Anal fin rays:	14–18
Pectoral fin rays:	16–18
Pelvic fin rays:	3–4
Caudal fin rays:	8 (4+4)

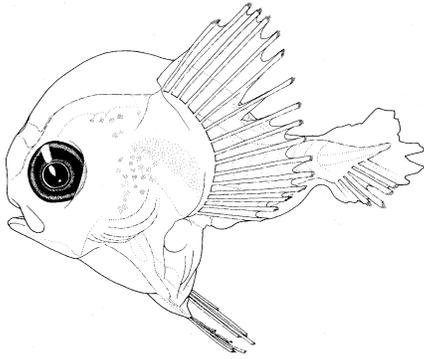
**E. 16.0 mmTL
(Transforming Female)**



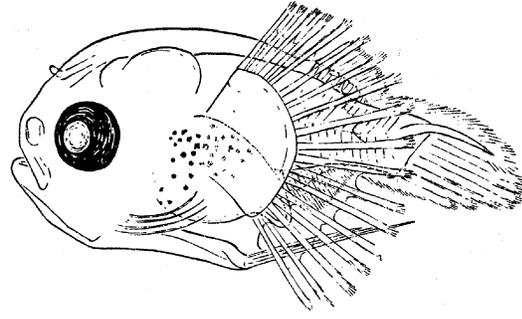
Figures: Adult: Pietsch, 2002c; A: William Watson (Watson, 1996g); B–E: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; Watson, 1996g; Pietsch, 2002c

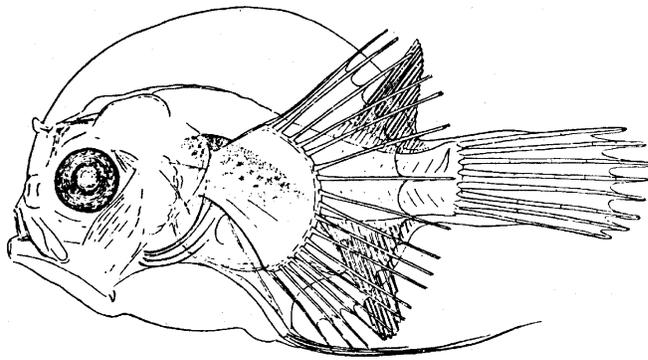
Caulophryne jordani



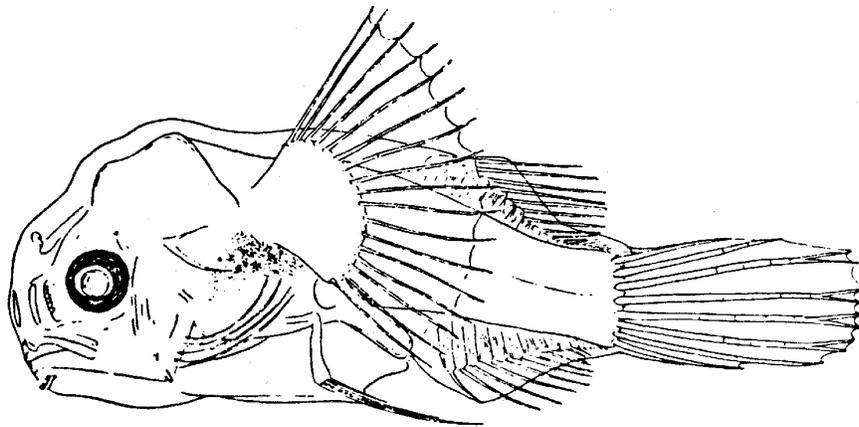
A. 2.8 mmSL
(*Caulophryne* sp.)



B. 3.7 mmTL



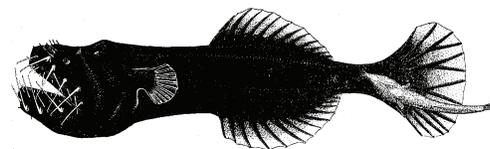
C. 9.5 mmTL



D. 10.0 mmTL
(Transforming Male)

Neoceratias spinifer* Pappenheim, 1914*Neoceratiidae**

No common name



Range: Atlantic, Pacific and Indian oceans; in the western North Atlantic occurs as far north as Welker Canyon (38°58N, 68°18W)

Habitat: Meso- and bathypelagic in depths to 1,000 m

Spawning: Obligate sexual parasites (putative); non-parasitized females never with developed ovaries; free-living males never with developed testes, gut always empty; male jaws unsuited to prey capture; season undescribed

Eggs: – Undescribed

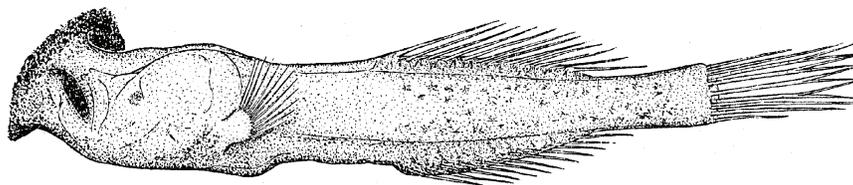
Larvae:

- Body slender, skin only slightly inflated
- Head length about equal to body depth (head shorter than in other ceratioids)
- Illicium begins to form on tip of snout (not on head profile over eye) in larvae <6.0 mm, but becomes vestigial or absent in larger specimens
- Sequence of fin ray formation: D, A, C – P₁
- Pigment very light; no peritoneal pigment; melanophores occur on myosepta on rear part of body, between posterior parts of dorsal and anal fins; scattered spots on sides of body over pectoral fin base
- Dorsal pigment absent
- Dorsal and anal fin ray counts higher than most ceratioids (except *Caulophryne jordani* where dorsal and anal fin ray counts are higher)
- High number of vertebrae

Meristic Characters

Myomeres:	about 24
Vertebrae:	24
Dorsal fin rays:	11–13
Anal fin rays:	10–12
Pectoral fin rays:	13–15
Pelvic fin rays:	none
Caudal fin rays:	9–10

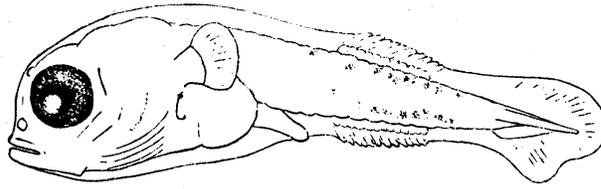
Note: 1. Eyes and olfactory organs undeveloped in adult males; illicium absent in both sexes; smaller male attached to caudal peduncle region in adult figure (above)

Adult Male:**D. 19.0 mmTL**

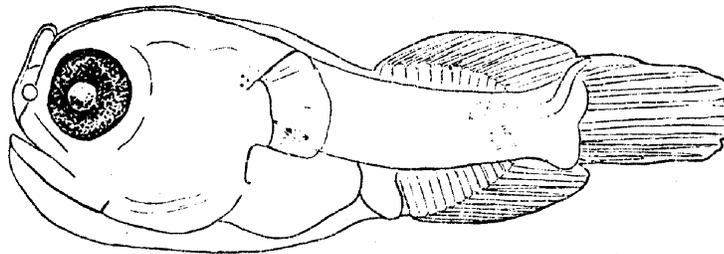
Figures: Adult: Bertelsen, 1951; A–D: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Moore *et al.*, 2003; Pietsch, 1976; 2002d

Neoceratias spinifer

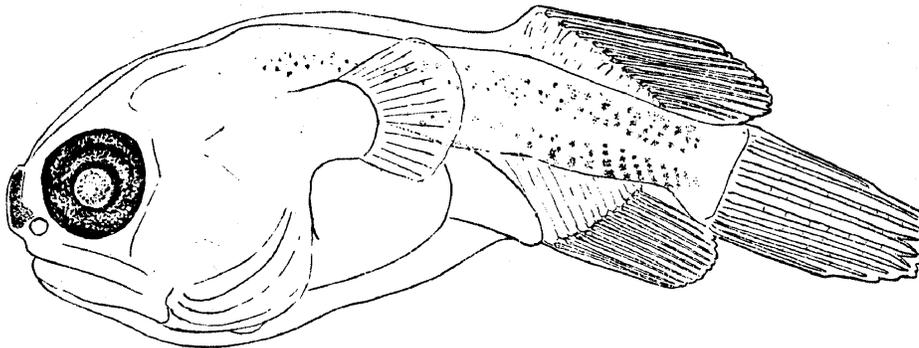


A. 4.5 mmTL



B. 6.0 mmTL

Illicium forms on tip of snout
in small larvae, then disappears
in older stages



C. 8.5 mmTL

Melanocetus johnsoni* Günther, 1864*Melanocetidae**

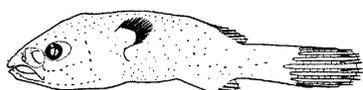
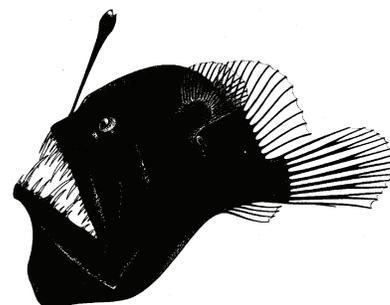
No common name

Range: Atlantic, Pacific and Indian oceans; in the western Atlantic from Greenland to Argentina

Habitat: Meso- to bathypelagic in depths to 2,700 m

Spawning: Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed



Adult female,
Anterior view



Adult male, 28 mm

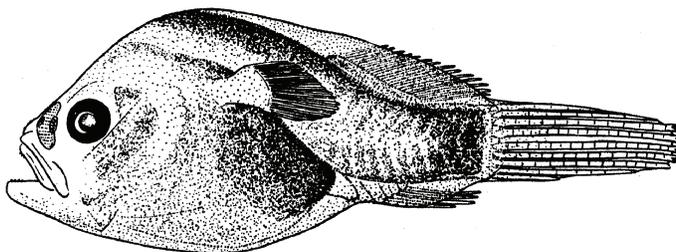
Meristic Characters

Myomeres:	about 21
Vertebrae:	21
Dorsal fin rays:	13–17
Anal fin rays:	4
Pectoral fin rays:	17–23
Pelvic fin rays:	none
Caudal fin rays:	9

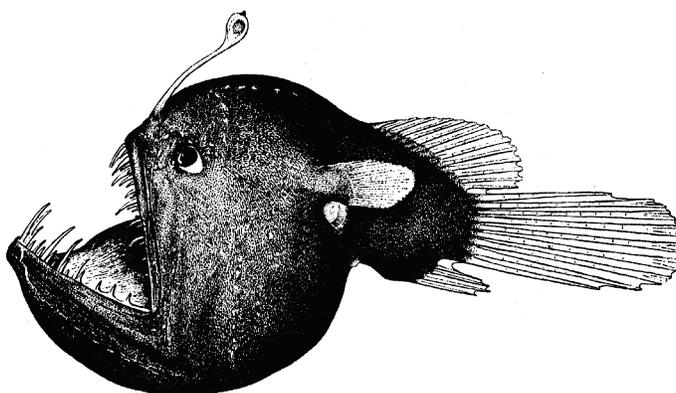
- Larvae:**
- Body ovoid, short and plump; skin moderately inflated
 - Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
 - Pelvic fins lacking
 - Sequence of fin ray formation: illicium, C – A, P₁, D
 - Pigment includes melanophores on lateral aspect of caudal peduncle, separate from dorsal pigment in small larvae, merges with dorsal pigment in larger larvae

Early Juveniles:

**I. 21 mmTL
(Male)**



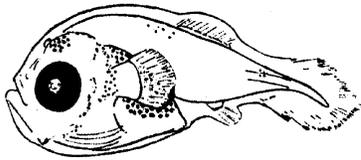
**J. 22 mmTL
(Female)**



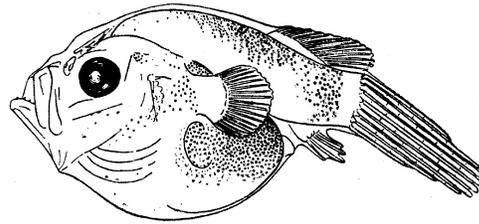
Figures: Adults: (side-view and adult male) Bertelsen, 1986; (anterior) Elizabeth Anne Hoxie (Pietsch and Van Duzer, 1980); A–J: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Pietsch, 1976; Pietsch and Van Duzer, 1980

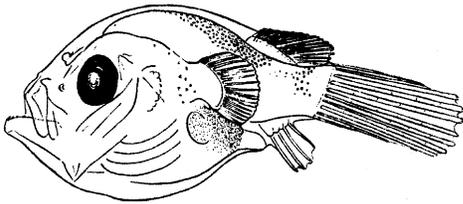
Melanocetus johnsoni



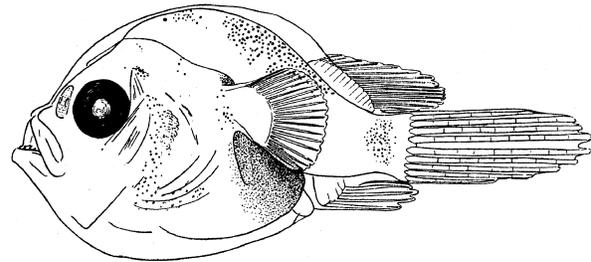
A. 3.3 mmTL (Female)



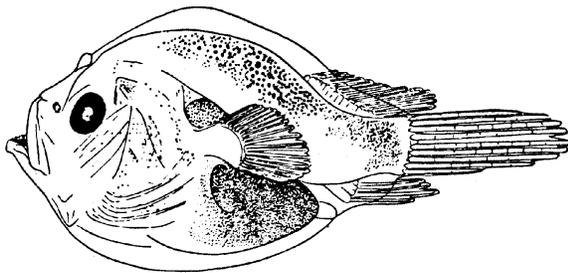
B. 8.5 mmTL (Male)



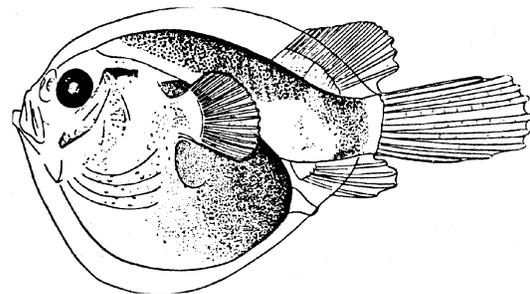
C. 6.5 mmTL (Female)



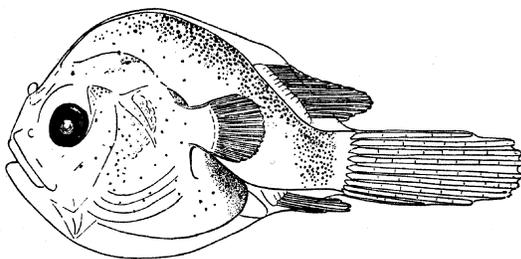
D. 13.0 mmTL (Male)



E. 17.0 mmTL (Female)

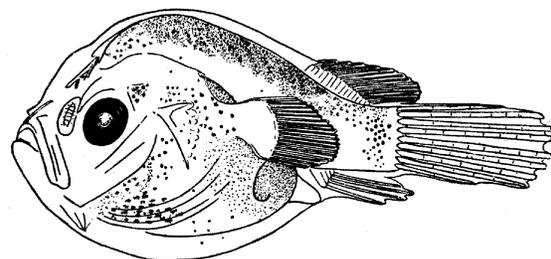


F. 15.5 mmTL (Male)



G. 11.0 mmTL (Type B, Female)

(Note scattered melanophores over skin in larvae from both coasts of Africa)

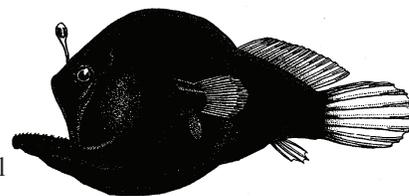


H. 12.3 mmTL (Type A, Male)

(Note 'belt' of pigment on branchiostegal rays and in front of pectoral fin base in larvae from Indian Ocean)

Melanocetus murrayi* Günther, 1887*Melanocetidae**

No common name

**Range:** Worldwide in all oceans; in the western Atlantic from Greenland to Brazil**Habitat:** Meso- and bathypelagic in depths of 600–6,370 m (mostly >1,000 m)**Spawning:** Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture**Eggs:** – Undescribed

Larvae:

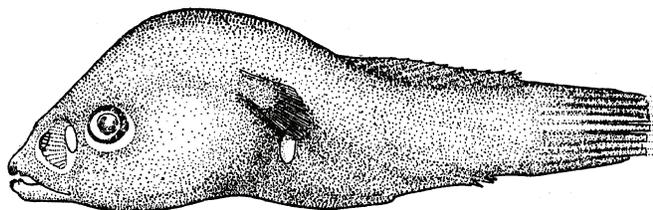
- Body ovoid, short and plump; skin moderately inflated
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Sequence of fin ray formation: illicium, C – A, P₁ – D
- Caudal peduncle unpigmented, but dorsal pigment may spread to caudal peduncle in larger larvae
- Gill cover faintly pigmented

Meristic Characters

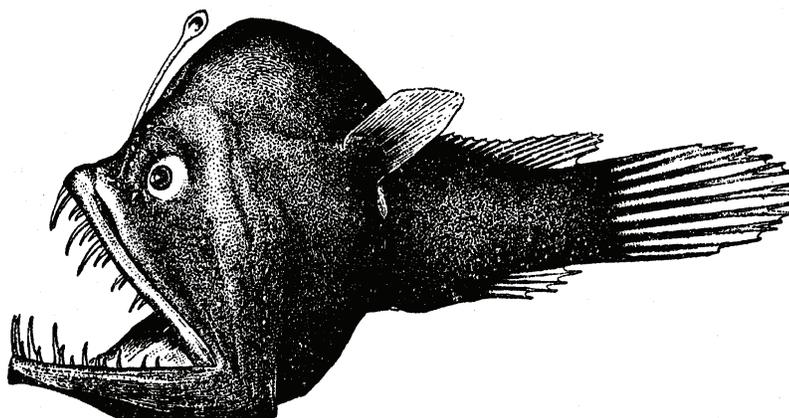
Myomeres:	about 21
Vertebrae:	21
Dorsal fin rays:	12–14
Anal fin rays:	4
Pectoral fin rays:	15–18
Pelvic fin rays:	none
Caudal fin rays:	9

Note: 1. A "dark type" larva, known only from the Indian Ocean, has darker dorsal pigment, especially below the dorsal fin**Early Juveniles:**

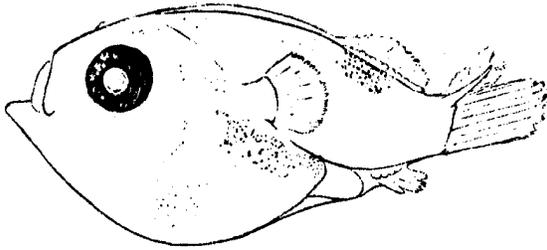
H. 14.0 mmTL
(Male)



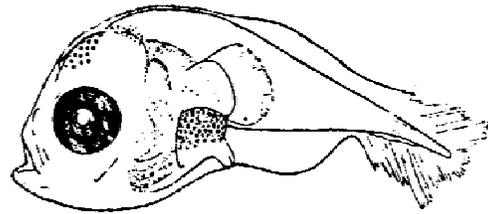
I. 20 mmTL
(Female)

**Figures:** Adult: Bertelsen, 1986; A–I: Bertelsen, 1951**References:** Regan, 1926; Bertelsen, 1951; 1984; Pietsch, 1976; Pietsch and Van Duzer, 1980

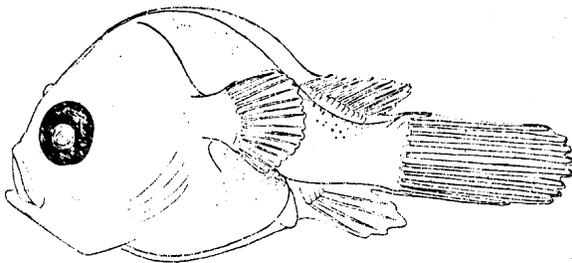
Melanocetus murrayi



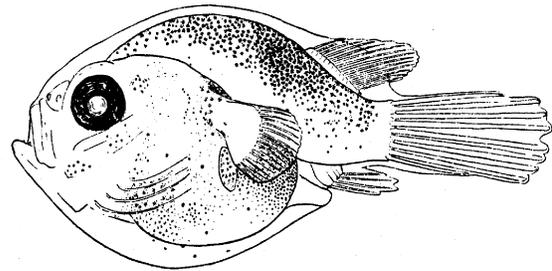
A. 4.0 mmTL (Female)



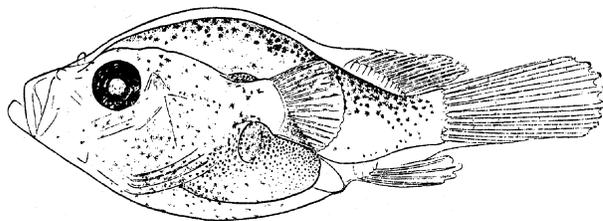
B. 3.0 mmTL (Male)



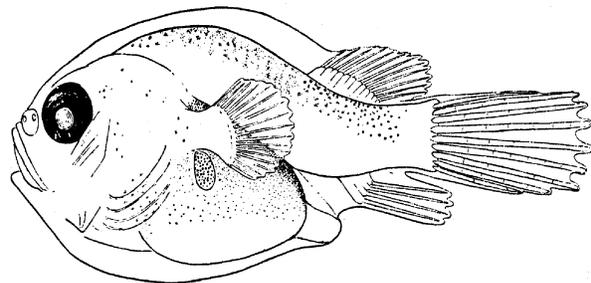
C. 6.3 mmTL (Female)



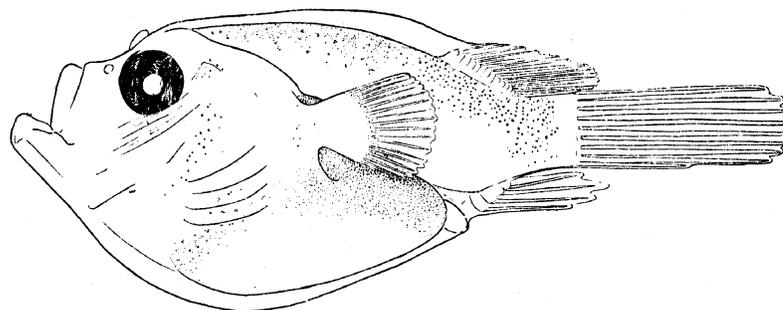
D. 8.0 mmTL (Male "Dark Type")



E. 9.0 mmTL (Female "Dark Type")



F. 8.5 mmTL (Male)



**G. 13.0 mmTL
(Female)**

Himantolophus groenlandicus* Reinhardt, 1837*Himantolophidae****Atlantic footballfish**

Range: Worldwide in all oceans; in the western North Atlantic from Greenland to Gulf of Mexico

Habitat: Meso- and bathypelagic in depths of 250–1,800 m

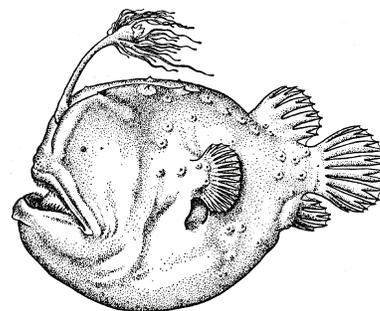
Spawning: Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

Larvae:

- Body nearly globoid
- Skin on head and body anterior to dorsal and anal fins very inflated, except in small larvae (<4 mm) when features of skin are similar to other genera
- No hyoid barbel
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Pigmentation includes melanophores in distinct groups; dorsal pigment present; caudal peduncle pigmented in 5–6 mm larvae and merges with dorsal pigment under dorsal fin by 8–10 mm; lower jaw rarely pigmented

Note: 1. Larvae in Figs. F–J are a less common type with dorsal accumulation of pigment on skin

Early Juveniles:**Meristic Characters**

Myomeres: about 19

Vertebrae: about 19

Dorsal fin rays: 5–6

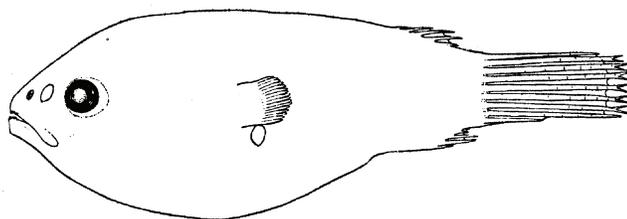
Anal fin rays: 4–5

Pectoral fin rays: 15–18

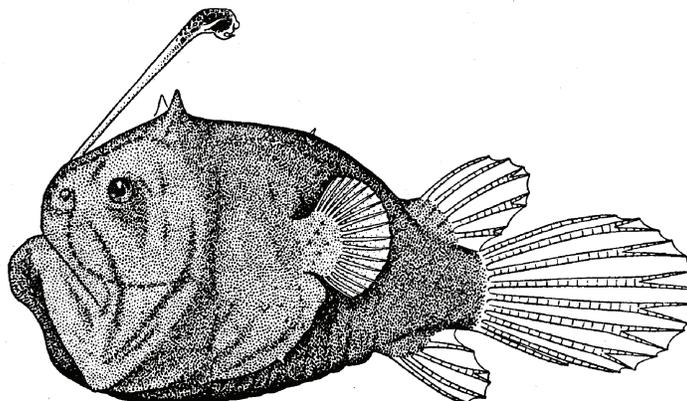
Pelvic fin rays: none

Caudal fin rays: 9

K. 40.0 mmTL
(Male)



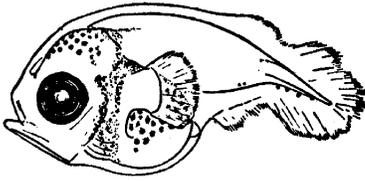
L. 53.0 mmTL
(Female)



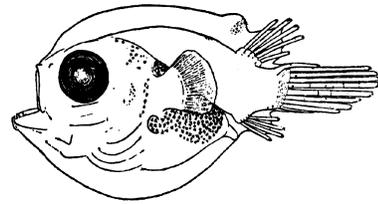
Figures: Adult: Lütken, 1878; A–L: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; 1986; Pietsch, 1976; 2002e

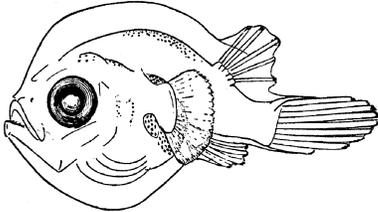
Himantolophus groenlandicus



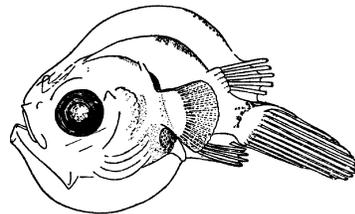
A. 2.4 mmTL (Male)



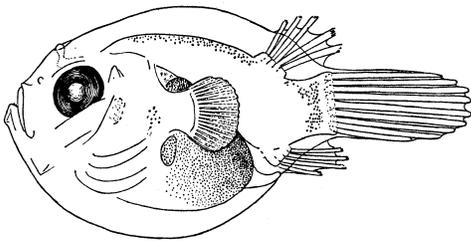
F. 5.6 mmTL (Male)



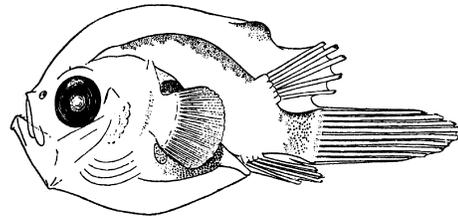
B. 5.7 mmTL (Male)



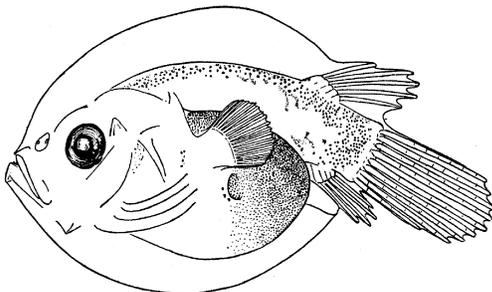
G. 5.0 mmTL (Female)



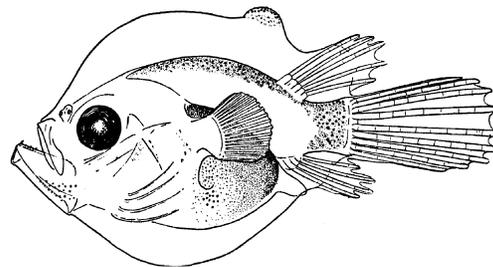
C. 9.0 mmTL (Female)



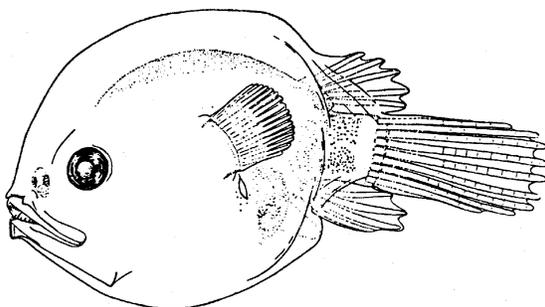
H. 8.2 mmTL (Male)



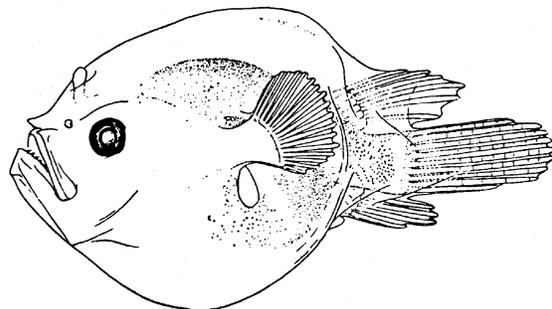
D. 13.0 mmTL (Male)



I. 10.7 mmTL (Male)



E. 24.0 mmTL (Male)



J. 22.0 mmTL (Female)

Chaenophryne draco* Beebe, 1932*Oneirodidae**

No common name

Range: Worldwide in all oceans; in the western North Atlantic from Bermuda and several larvae from as far north as 37°10.5'N, 35°01.9'W and 37°07.5'N, 73°08.7'W (MCZ 67986; MCZ 61034)

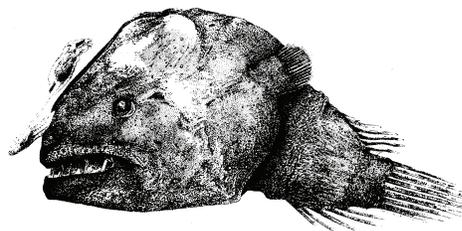
Habitat: Meso- and bathypelagic in depths of 700–1,500 m

Spawning: Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

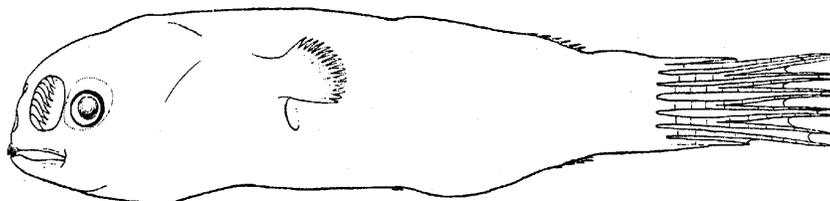
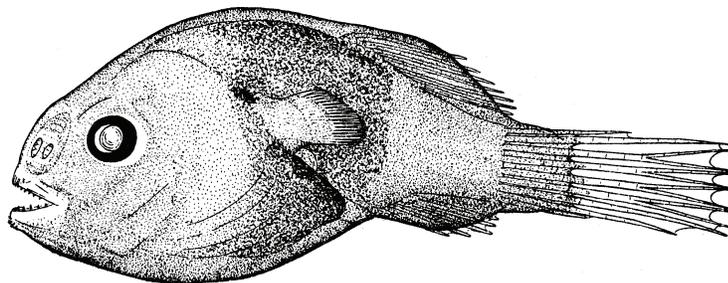
Eggs: – Undescribed

Larvae:

- Body moderately globe shaped; body depth 50–60% SL
- Head length about 45% SL
- Sequence of fin ray formation: illicium, D, A, C – P₁
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Pigmentation includes light pigment over opercle, almost none over branchiostegal region, very little pigment on pectoral fin base; dorsal pigment spreads from mid-back anteriorly, posteriorly and laterally, but no farther than end of dorsal fin; caudal peduncle unpigmented

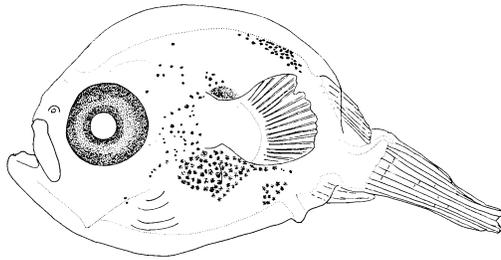
**Meristic Characters**

Myomeres:	about 19
Vertebrae:	19
Dorsal fin rays:	6–8
Anal fin rays:	4–6
Pectoral fin rays:	15–19
Pelvic fin rays:	none
Caudal fin rays:	9

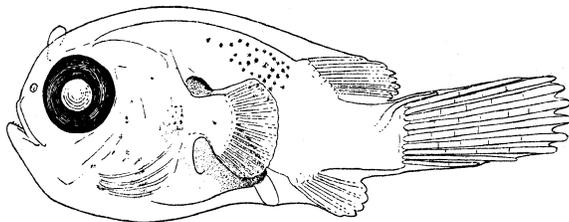
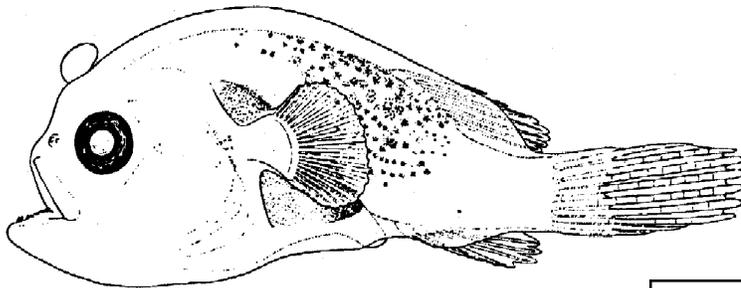
Adult Male:**E. 20.5 mmTL****Early Juvenile:****F. 12.3 mmTL (Male)**

Figures: Adult: Bertelsen, 1986; A: M. Nishiya (Amaoka *et al.*, 1992); B–F: Bertelsen, 1951

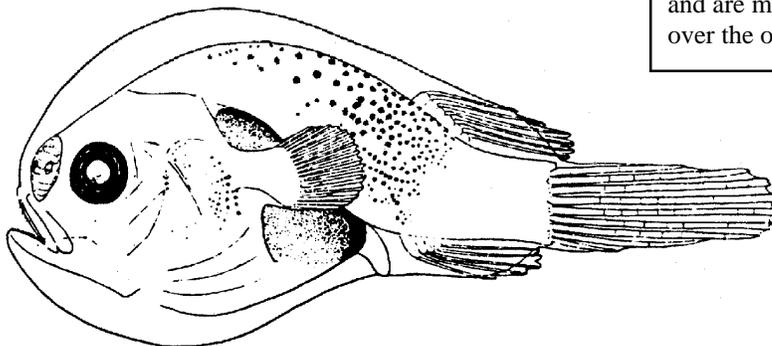
References: Bertelsen, 1951; 1984; 1986; Bertelsen and Pietsch, 1977; Pietsch, 1975; 1976; 2004; Amaoka *et al.*, 1992

Chaenophryne draco
(Group)**A. 3.4 mmSL**

Larvae in this “group” may refer to *Chaenophryne draco*, *C. parviconus* or *C. ramifera*. *Chaenophryne parviconus* has been relegated to the synonymy of *C. draco* (Pietsch, 1975). *Chaenophryne ramifera* is known from the eastern Atlantic as far west as 35°N, 33°W.

**B. 5.7 mmTL (Female)****C. 13.0 mmTL (Female)**

Similar larvae of the “*Chaenophryne longiceps* group” (Bertelsen, 1951) have pigment on the caudal peduncle and are more heavily pigmented over the opercles.

**D. 12.4 mmTL (Male)**

Chaenophryne longiceps* Regan, 1925*Oneirodidae**

No common name

Range: Worldwide in all oceans; in the western North Atlantic from Iceland to the Bahamas

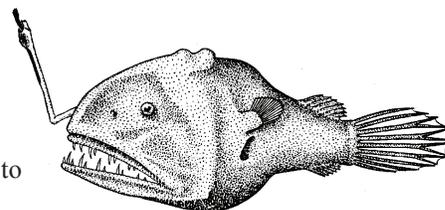
Habitat: Meso- and bathypelagic in depths to 2,500 m

Spawning: Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

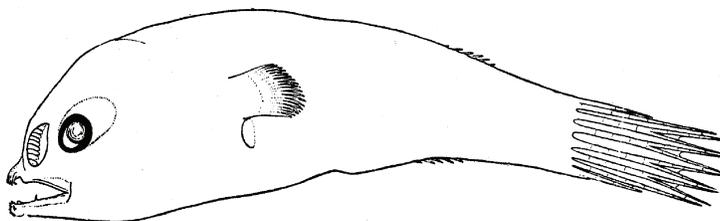
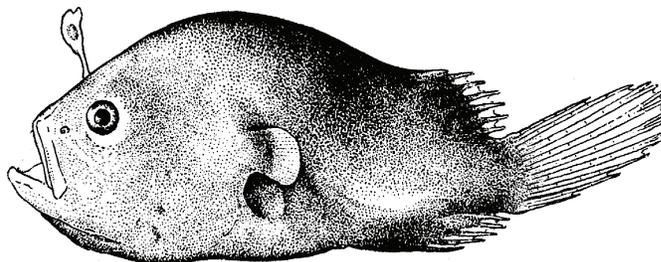
Eggs: – Undescribed

Larvae:

- Body moderately globe shaped; body depth 50–65% SL
- Head length about 45% of SL
- Sequence of fin ray formation: illicium, D, A, C – P₁
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Pigmentation includes moderately dense covering of melanophores over opercle, branchiostegal region, pectoral fin base; dorsal pigment spreads from mid-back anteriorly, posteriorly and laterally; spots on side of caudal peduncle increase in number

**Meristic Characters**

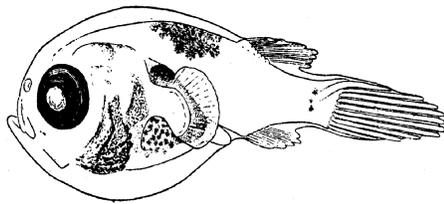
Myomeres:	about 19
Vertebrae:	19
Dorsal fin rays:	6–8
Anal fin rays:	5–6
Pectoral fin rays:	16–19
Pelvic fin rays:	none
Caudal fin rays:	9

Adult Male:**E. 21.0 mmTL****Early Juvenile:****F. 18.0 mmTL (Female)**

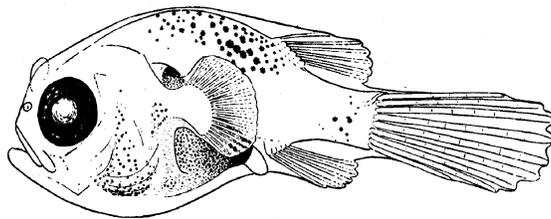
Figures: Adult: Bertelsen, 1951; A–F: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1977; Pietsch, 1975; 1976; 2004

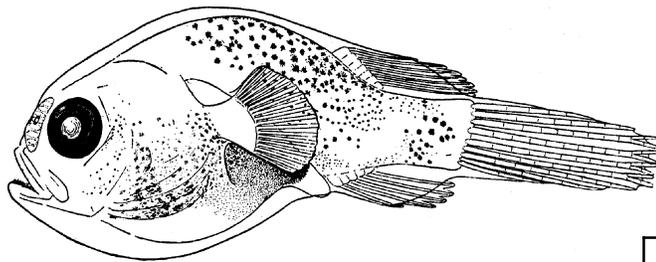
Chaenophryne longiceps
(Group)



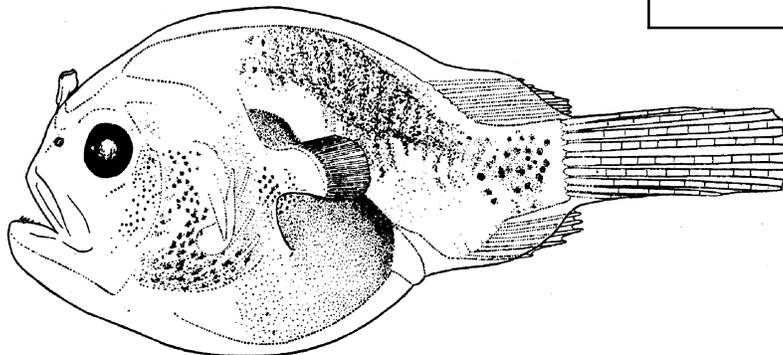
A. 4.3 mmTL (Male)



B. 8.1 mmTL (Female)



C. 13.8 mmTL (Male)



D. 19.0 mmTL (Female)

Larvae in this "group" may refer to *Chaenophryne longiceps*, *C. bicornis*, *C. quadrifilis*, *C. crenata* or *C. crossota*. Females of these nominal species were distinguished by characters of the illicium and esca (see Bertelsen, 1951). Four of these species have since been relegated to the synonymy of *Chaenophryne longiceps* (Pietsch, 1975).

Similar larvae of the "*Chaenophryne draco* group" (Bertelsen, 1951) lack pigment on the caudal peduncle and are more lightly pigmented over the opercles.

Dolopichthys allector* Garman, 1899*Oneirodidae**

No common name



Range: South Atlantic and southeastern Pacific oceans; in the western North Atlantic known from a single specimen collected northwest of Flemish Cap

Habitat: Meso- and bathypelagic in depths to 1,050 m (NW Atlantic)

Spawning: Probably not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

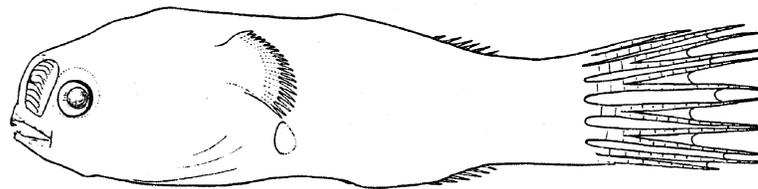
Larvae:

- Body ovoid, especially anteriorly; skin slightly inflated
- Head fairly large, head length 30–40% SL
- Sequence of fin ray formation: illicium, D, A, P₁, C
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Pigment fairly heavy on opercle and over gut; trunk and peritoneal pigment not contiguous; most dorsal pigment anterior to dorsal fin origin; bar on caudal peduncle comprised of 3 sections; head unpigmented

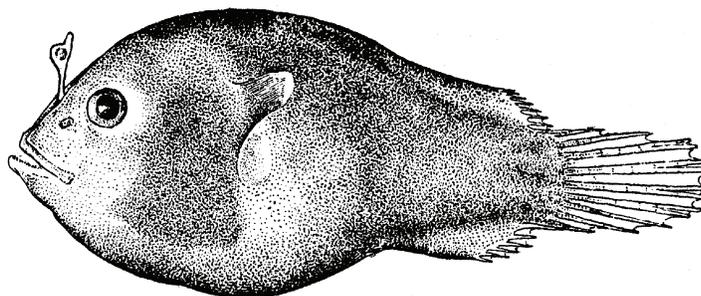
Meristic Characters

Myomeres:	about 19
Vertebrae:	19?
Dorsal fin rays:	6
Anal fin rays:	6
Pectoral fin rays:	20
Pelvic fin rays:	none
Caudal fin rays:	9

Note: The illustrated larvae may belong to a *Dolopichthys* species other than *D. allector* (Bertelsen, 1951)

Adult Male:**F. 17.3 mmTL**

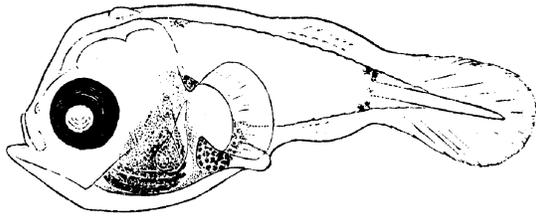
Early Juvenile: Sphenotic spine forms in adults

**G. 14.3 mmTL
(Female)**

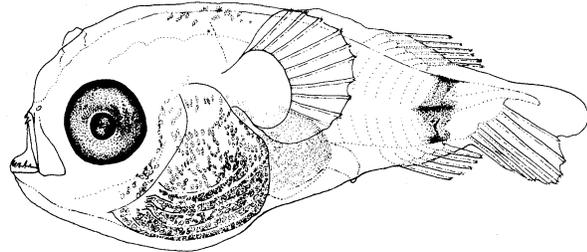
Figures: Adult: Bertelsen, 1986; **A, C–G:** Bertelsen, 1951; **B:** Mary Vona (Watson, 1996g)

References: Regan, 1926; Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1977; Scott and Scott, 1988; Watson, 1996g; Pietsch, 1976; 2004

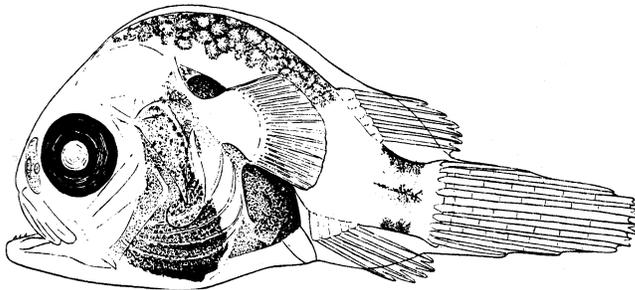
Dolopichthys allector



A. 2.6 mmTL (Female)

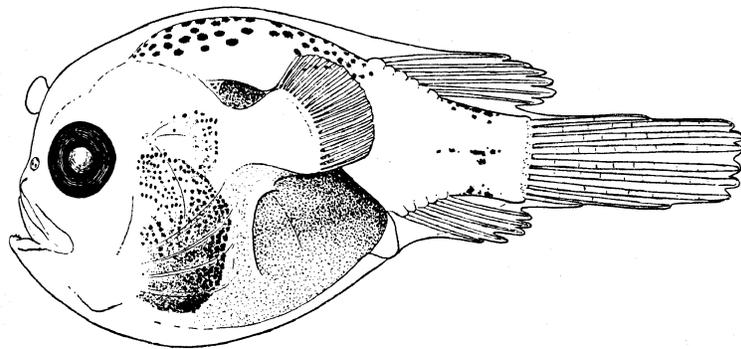


B. 4.5 mmSL (Female)

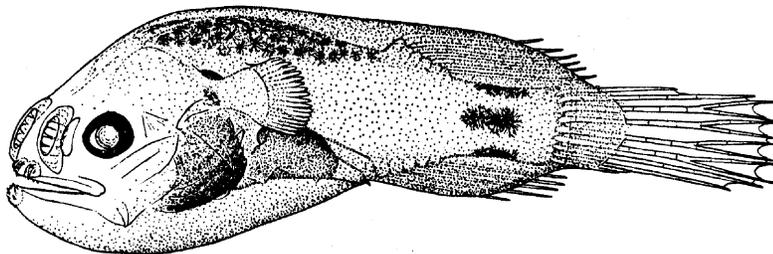


C. 8.0 mmTL (Male)

In Pacific specimens (Fig. B) pigment occurs between the dorsal, lateral and ventral groups in the caudal peduncle bar; in Atlantic larvae, these 3 groups are more clearly separated.



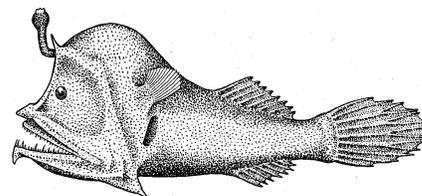
D. 10.4 mmTL (Female)



E. 11.0 mmTL (Transforming Male)

Lophodolus acanthognathus* Regan, 1925*Oneirodidae**

No common name



Range: Worldwide in all oceans; in the western North Atlantic from Greenland to the Bahamas

Habitat: Meso- to bathypelagic in depths of 650–2,830 m

Spawning: Probably not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

Larvae:

- Body fairly short, depth about 60% SL; slender caudal peduncle
- Head length >40% SL
- Sequence of fin ray formation undescribed
- Pectoral fins not greatly enlarged, barely reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Dense peritoneal pigment dorsally, pigment absent on ventral portion of peritoneum; dense pigment on gill cover "V" shaped (2 patches meeting at base of lower branchiostegals); dorsal patch of pigment (composed of large, distinct melanophores) reaching posteriorly just past the dorsal fin origin; caudal peduncle unpigmented;

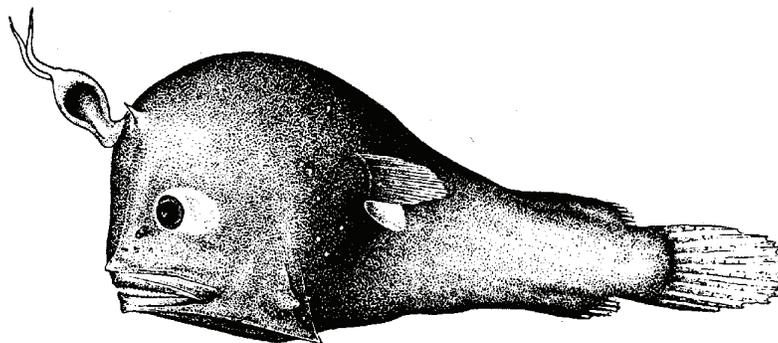
Meristic Characters

Myomeres:	about 19
Vertebrae:	about 19
Dorsal fin rays:	5–7
Anal fin rays:	4–6
Pectoral fin rays:	17–20
Pelvic fin rays:	none
Caudal fin rays:	9

Note: 1. Transforming females and adults have well-developed sphenotic spines

Early Juvenile:

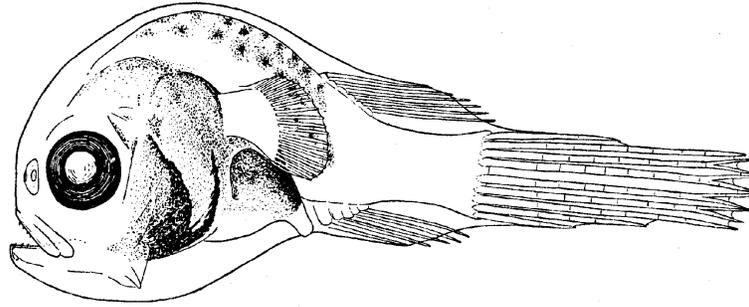
**B. 12.0 mmTL
(Female)**



Figures: Adult: Regan, 1926; A–B: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1977; Pietsch, 1974a; 1976; 2004

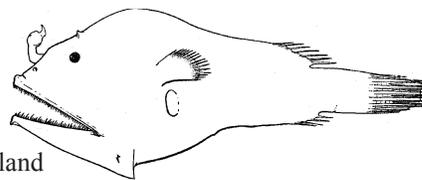
Lophodolus acanthognathus



A. 8.0 mmTL (Male)

Microlophichthys microlophus* (Regan, 1925)*Oneirodidae**

No common name



Range: Worldwide in all oceans; in the western North Atlantic from Newfoundland to Bermuda and Caribbean Sea

Habitat: Meso- to bathypelagic in depths to >2,000 m

Spawning: Probably not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

Larvae:

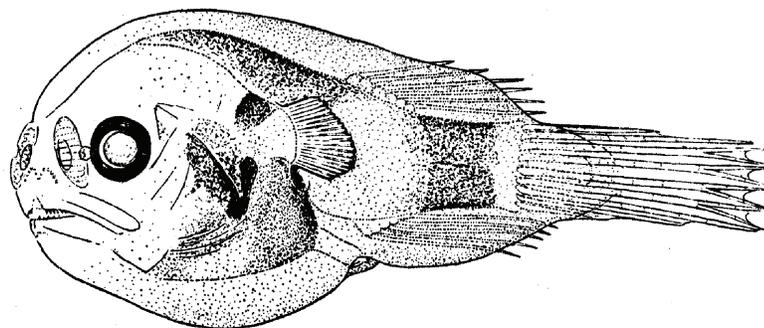
- Body relatively elongate (compared to other ceratioids)
- Body depth and head length both about 45–50% SL
- Sequence of fin ray formation: illicium, C, D, A – P₁
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Pigment concentrated on opercle, dorsum of body, caudal peduncle, peritoneum; dorsal pigment initially confined to area anterior to dorsal fin origin, then spreads to join caudal peduncle pigment patch; pigment on opercle dense; peritoneum heavily pigmented; an unpigmented area typically above and anterior to anal fin origin

Meristic Characters

Myomeres:	about 19
Vertebrae:	19?
Dorsal fin rays:	5–7
Anal fin rays:	4–6
Pectoral fin rays:	17–23
Pelvic fin rays:	none
Caudal fin rays:	9

Note: 1. Sphenotic and articular spines present in adults and might form in transforming females (undescribed)

Early Juvenile:

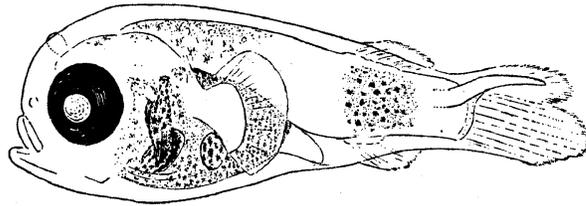


**D. 10.3 mmTL
(Transforming Male)**

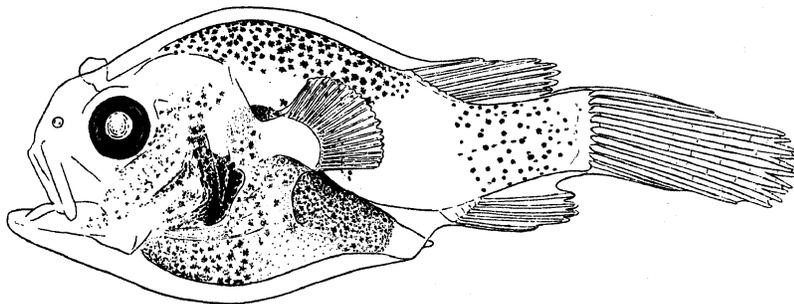
Figures: Adult: Regan and Trewavas, 1932; A–D: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1977; Pietsch, 1976; 2004

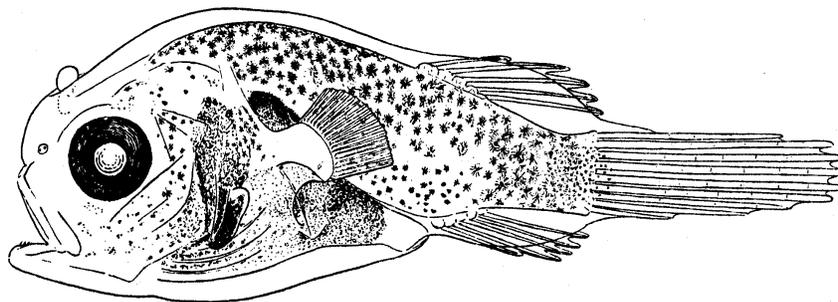
Microlophichthys microlophus



A. 4.0 mmTL (Female)



B. 12.1 mmTL (Female)



C. 12.5 mmTL (Female)

Oneirodes eschrichtii* Lütken, 1871*Oneirodidae**

No common name

Range: Worldwide in all oceans; in the western North Atlantic from Greenland to Bermuda

Habitat: Meso- and bathypelagic in depths >2,000 m (possibly to 3,500 m)

Spawning: Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

Larvae:

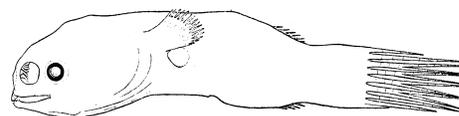
- Body moderately ovoid with moderately long caudal peduncle
- Body depth about 65% of SL; head length about 55% of SL
- Sequence of fin ray formation: illicium, D, C, A – P₁
- Pectoral fins not greatly enlarged, barely reaching dorsal and anal fin origins
- Pelvic fins lacking
- Pigment evenly dark over opercle; dorsal pigment covers wide swath, initially not reaching dorsal fin origin, eventually spreading to level of anal fin insertion; caudal peduncle unpigmented; most peritoneal pigment on dorsal aspect of gut
- Most pigment sections merge in larger larvae, resulting in dark anterior appearance with unpigmented caudal peduncle

Note: 1. Transforming and adult females have sphenotic and articular spines

Early Juvenile:

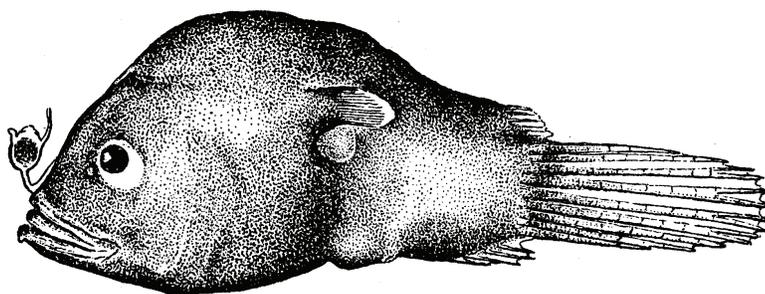
**Meristic Characters**

Myomeres:	about 19
Vertebrae:	19?
Dorsal fin rays:	6
Anal fin rays:	4
Pectoral fin rays:	13–19
Pelvic fin rays:	none
Caudal fin rays:	9



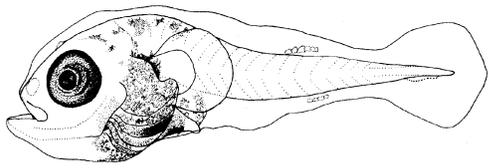
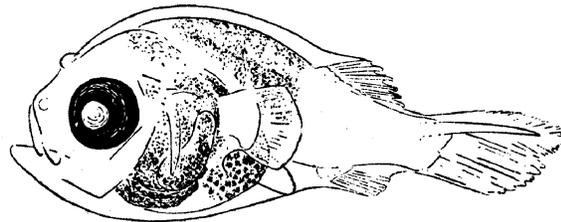
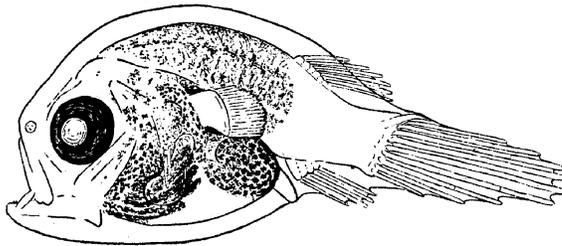
Adult male, 18.0 mmTL

**F. 12.5 mmTL
(Female)**

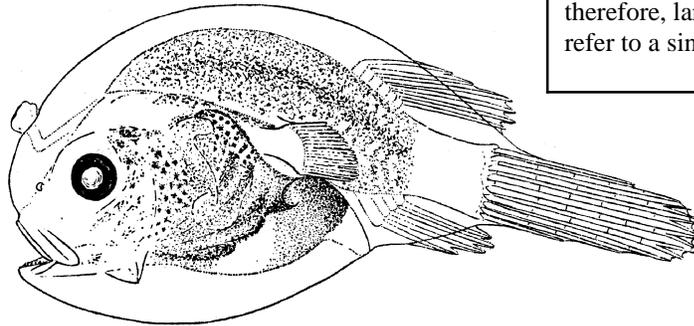
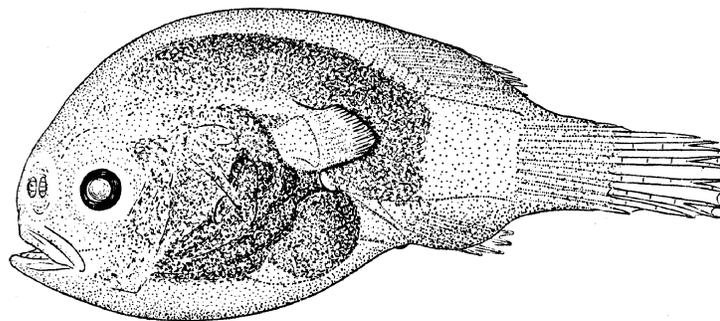


Figures: Adult female: Pietsch, 1974; Adult male: Bertelsen, 1951; **A:** Mary Vona (Watson, 1996g); **B–F:** Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1977; Pietsch, 1974b; 1976; 2004

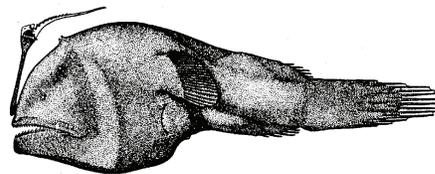
Oneirodes eschrichtii**A. 2.4 mmSL (Female)****B. 3.0 mmTL (Female)****C. 4.5 mmTL (Male)**

The larvae illustrated in Figs. B-F were identified as the "*Oneirodes eschrichtii* group" (Bertelsen, 1951) and are presumably composed of the larvae of several species, including *O. eschrichtii*. Most of the other species in this group have been relegated to the synonymy of *O. eschrichtii* (Pietsch, 1974, Table 9), therefore, larvae in this series may refer to a single species.

**D. 12.0 mmTL (Female)****E. 11.5 mmTL (Transforming Male)**

Pentherichthys atratus* (Regan and Trewavas, 1932)*Oneirodidae**

No common name



Range: Eastern Pacific and South Atlantic oceans; also a single specimen from 40°15'N, 67°10'W (southern slope of Georges Bank)

Habitat: Meso- and bathypelagic (rarely collected)

Spawning: Probably not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

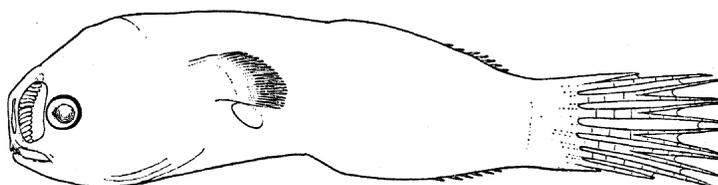
Larvae:

- Body quite deep anterior to pectoral fins, more slender posteriorly with long caudal peduncle
- Skin moderately inflated
- Head moderate in size; head length <40% SL
- Sequence of fin ray formation: illicium, D, C, A – P₁
- Pectoral fins not greatly enlarged, not reaching beyond dorsal and anal fin origins
- Pelvic fins lacking
- Scattered pigment on opercle; dorsal pigment confined to relatively tight group, not extending to dorsal fin origin; few spots on rear limit of caudal peduncle and on caudal fin rays; dorsal peritoneum densely pigmented but ventral peritoneum and skin totally unpigmented

Meristic Characters

Myomeres:	about 19
Vertebrae:	19?
Dorsal fin rays:	6–7
Anal fin rays:	5–6
Pectoral fin rays:	21–24
Pelvic fin rays:	none
Caudal fin rays:	9

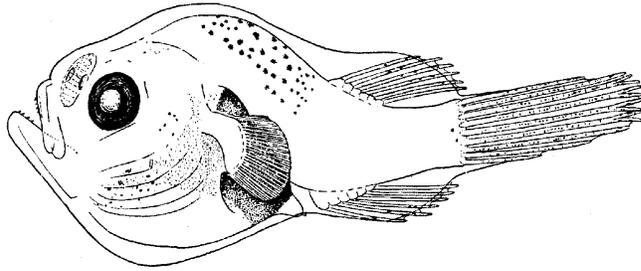
- Note:**
1. The illustrated *Pentherichthys* larvae were collected from various locations in the NE Atlantic, South China Sea and Gulf of Panama and may not refer to *P. atratus*. The 19-mm adult male was collected in the NW Atlantic and presumably does refer to *P. atratus*.
 2. Sphenotic spine forms in adult females.

Adult Male:**D. 19.0 mmTL**

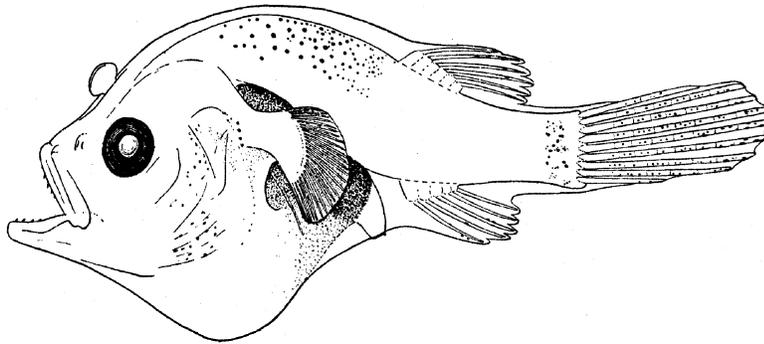
Figures: Adult: Regan and Trewavas, 1932; A–D: Bertelsen, 1951

References: Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1977; Pietsch, 1976; 2004; Moore *et al.*, 2003

Pentherichthys sp.

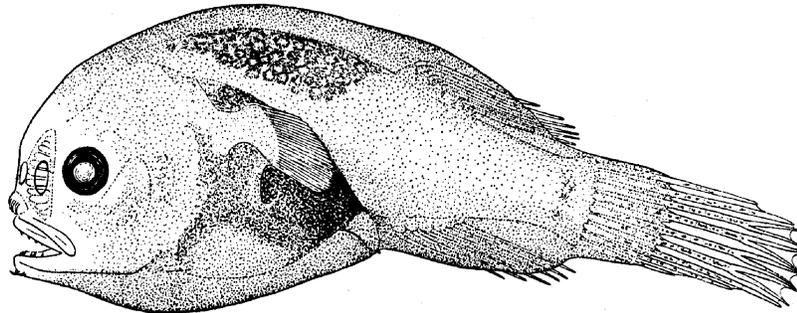


A. 11.0 mmTL (Male)



B. 15.0 mmTL (Female)

Note pigment inside
caudal fin rays (not
found in other ceratioids)



C. 15.0 mmTL (Transforming Male)

Lasiognathus intermedius* Bertelsen and Pietsch, 1996*Thaumatichthyidae**

No common name



Range: Atlantic and northeast Pacific oceans; in the western North Atlantic from east of Newfoundland to Cape Hatteras

Habitat: Bathypelagic in depths of 1,000–2,500 m

Spawning: Biology, degree of sexual parasitism, and seasonality undescribed

Eggs: – Undescribed

Larvae: – Undescribed

– Characters of *Thaumatichthys* sp. larvae:

– Body moderately globoid, with short caudal peduncle, becoming elongate in larger larvae

– Body depth <70% SL

– Head length 45% SL in small larvae, somewhat less in larger larvae

– Pectoral fins slightly enlarged, reaching to ends of dorsal and anal fin bases

– Pelvic fins lacking

– Characteristic subdermal pigment includes a dense covering of melanophores with concentrations along the margin of opercle, on the peritoneum and on the dorsum of the body; early stages have less pigment on pectoral fin base and at the caudal fin base; the outer, inflated skin has scattering of small melanophores

Note: 1. Adult females have long sphenotic and articular spines

Meristic Characters

Myomeres: about 20

Vertebrae: 20–22

Dorsal fin rays: 5

Anal fin rays: 5

Pectoral fin rays: 17

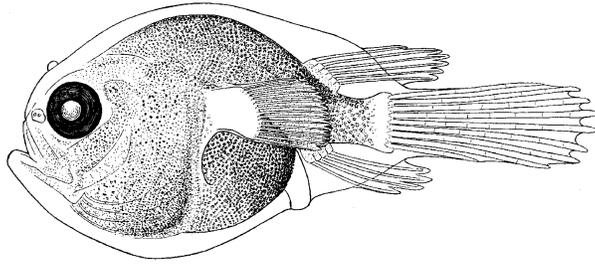
Pelvic fin rays: none

Caudal fin rays: 9

Figures: Adult *Lasiognathus saccostoma*: Bertelsen, 1951; **A, C**: Bertelsen, 1951; **B**: Bertelsen and Struhsaker, 1977

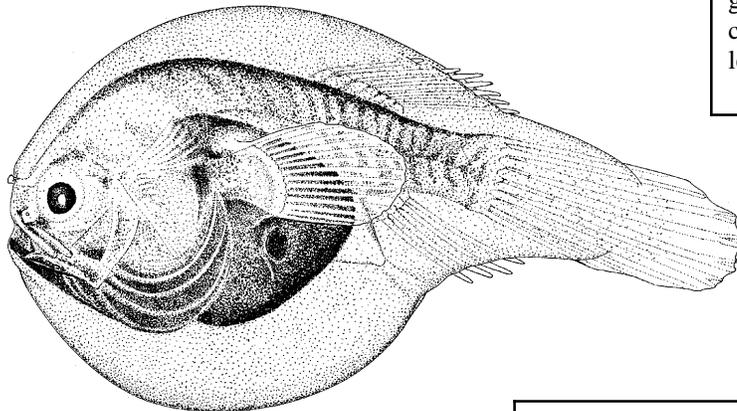
References: Bertelsen, 1951; 1984; Bertelsen and Pietsch, 1996; Pietsch, 1976; 2002f; Scott and Scott, 1988

Thaumatichthys sp.



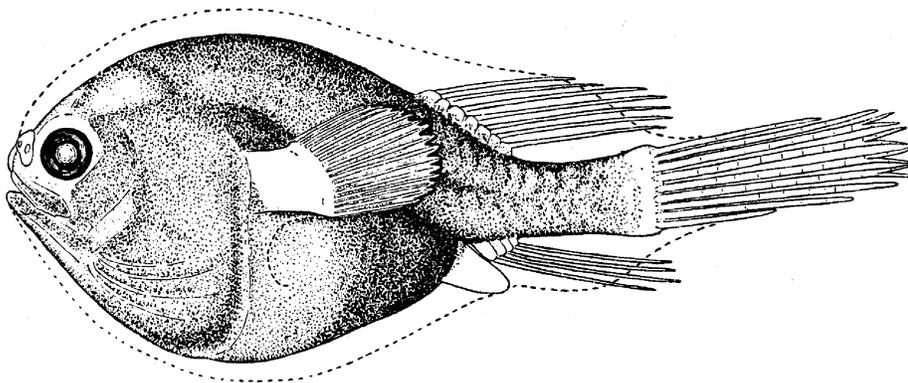
A. 6.5 mmTL (Female)

Thaumatichthys has not been reported from the study area. 2 species of *Lasiognathus* do occur here, but their larvae are undescribed. Larvae of the former are included here based on the assumption that the 2 genera share larval characters on the family level.

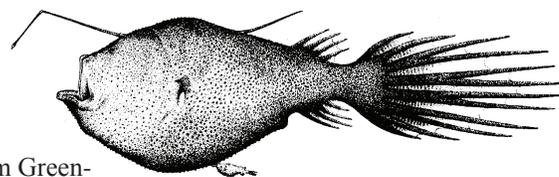


B. 22.6 mmTL (Female)

Species of *Thaumatichthys* have 6 dorsal and 4 anal fin rays (cf: 5 and 5 in *Lasiognathus*)



C. 24.0 mmTL (Male)

Ceratias holboelli* Kröyer, 1845*Ceratiidae****Deepsea angler**

Range: Worldwide in all oceans; in the western North Atlantic from Greenland to Bermuda

Habitat: Meso- to bathypelagic in depths of 150–3,400 m (mostly 400–2,000 m)

Spawning: Obligate sexual parasites; non-parasitized females never with developed ovaries; free-living males never with developed testes, gut always empty; male jaws unsuited to prey capture; season undescribed

Eggs: – Undescribed

Larvae:

- Body appears "humpbacked"; skin moderately inflated
- Mouth nearly vertical
- Low number of dorsal fin rays
- Pectoral fins not greatly enlarged, barely reaching dorsal and anal fin origins
- Pelvic fins lacking
- Female larvae develop 2 caruncles on back, anterior to dorsal fin
- Pigment lacking

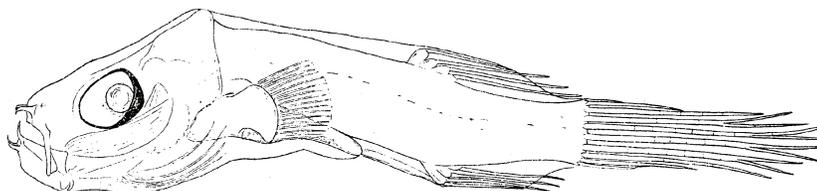
Meristic Characters

Myomeres:	–
Vertebrae:	–
Dorsal fin rays:	(3) 4 (5)
Anal fin rays:	4
Pectoral fin rays:	17–18
Pelvic fin rays:	none
Caudal fin rays:	9

Note: 1. The very similar *Ceratias uranoscopus* occurs in the western North Atlantic as far north as Nova Scotia, in depths between 95 and 4,000 m. Adults differ from those of *C. holboelli* in lacking appendages on the simple esca, and in lacking vomerine teeth (Pietsch, 1986b). Larvae of *C. uranoscopus* are undescribed.

Early Juvenile:

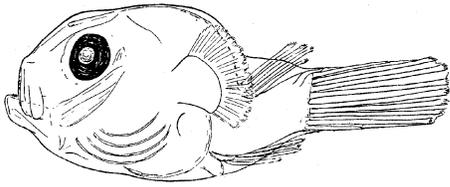
I. 15.6 mmTL
Free-living Male



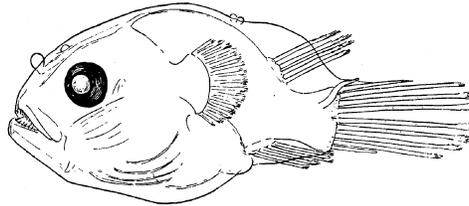
Figures: Adult female with parasitic male attached (Bertelsen 1986); **A–I:** Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; Bertelsen and Pietsch, 1984; Pietsch, 1976; 1986a; 1986b; 2002g; Scott and Scott, 1988

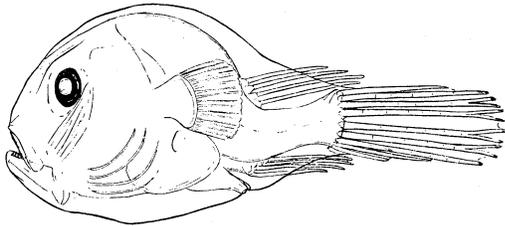
Ceratias holboelli



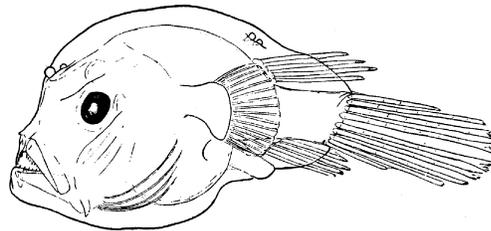
A. 4.3 mmTL (Male)



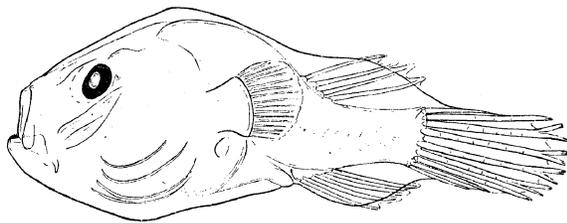
F. 4.5 mmTL (Female)



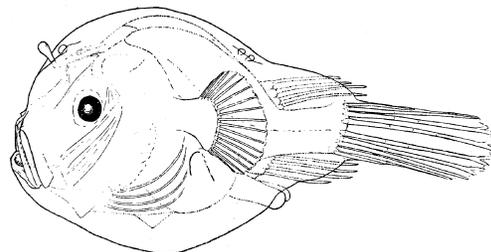
B. 8.5 mmTL (Male)



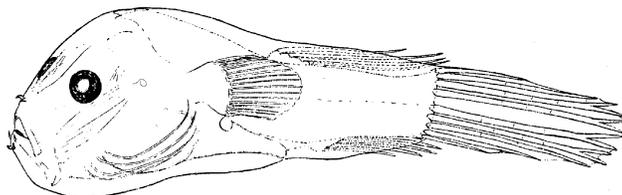
G. 8.1 mmTL (Female)



C. 9.4 mmTL (Male)

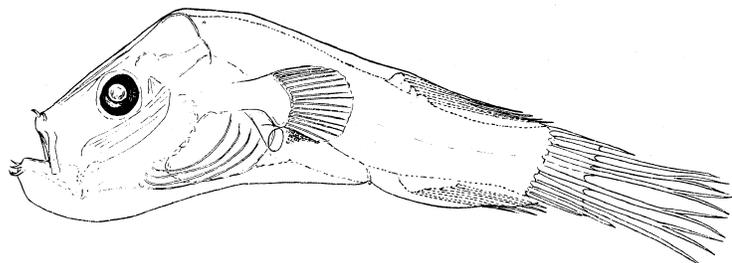


H. 11.9 mmTL (Female)



**D. 10.4 mmTL
(Transforming Male)**

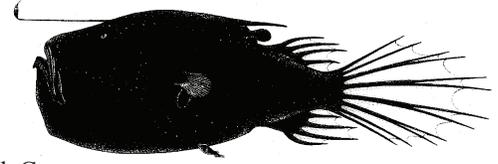
**E. 13.4 mmTL
(Transforming Male)**



Cryptopsaras couesi Gill, 1883

Ceratiidae

Triplewart seadevil



Range: Worldwide in all oceans; in the western North Atlantic from Flemish Cap to northern South America

Habitat: Meso- to bathypelagic in depths of 75–4,000 m (most commonly between 500 and 1,250 m). Common in slope water

Spawning: Obligate sexual parasites; non-parasitized females never with developed ovaries; free-living males never with developed testes, gut always empty; male jaws unsuited to prey capture; season undescribed

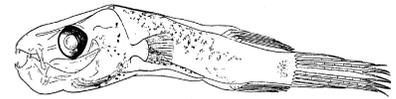
Eggs: – Undescribed

Larvae:

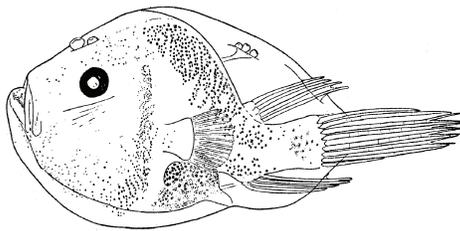
- Body appears "humpbacked"; skin moderately inflated
- Mouth nearly vertical
- Low number of dorsal fin rays
- Pectoral fins not greatly enlarged, barely reaching dorsal and anal fin origins
- Pelvic fins lacking
- Female larvae develop 3 caruncles on back, anterior to dorsal fin (1 median, 2 slightly lateral)
- Band of pigment extends from posterior head, along opercle edge, meets anteriorly on isthmus; dorsal pigment spreads and meets pigment over anal fin in larger larvae; caudal peduncle and dorsal portion of peritoneum pigmented

Meristic Characters

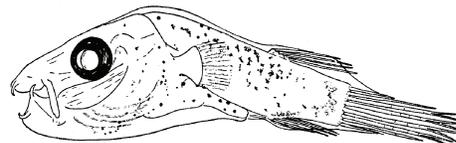
Myomeres:	about 20
Vertebrae:	20
Dorsal fin rays:	4
Anal fin rays:	4
Pectoral fin rays:	15–18
Pelvic fin rays:	none
Caudal fin rays:	8



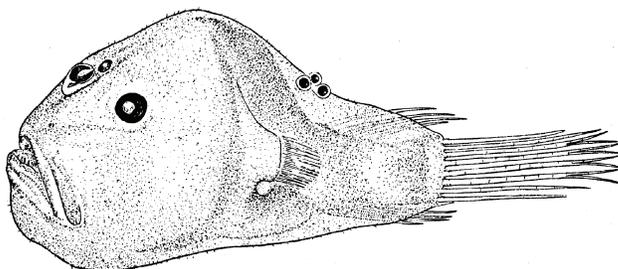
Adult male, free-living stage
14.3 mmTL

Late Larva and Early Juveniles:

I. 11.8 mmTL (Late Larval Female)



K. 11.3 mmTL (Transforming Male)

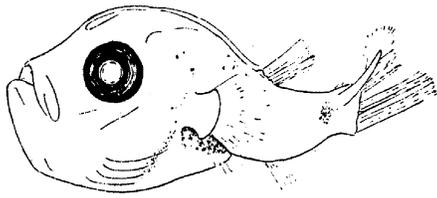


J. 15.0 mmTL (Transforming Female)

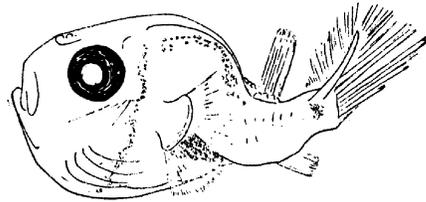
Figures: Adult female with parasitic male attached (Pietsch, 1986b); Adult male and A–E, G–K: Bertelsen, 1951; F: W. Watson (Watson, 1996g)

References: Regan, 1926; Bertelsen, 1951; 1986; Bertelsen and Pietsch, 1983; Pietsch, 1976; 1986b; 2002g; Scott and Scott, 1988

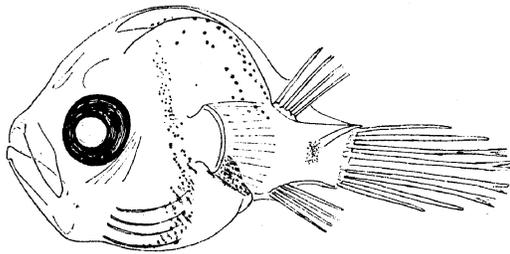
Cryptopsaras couesi



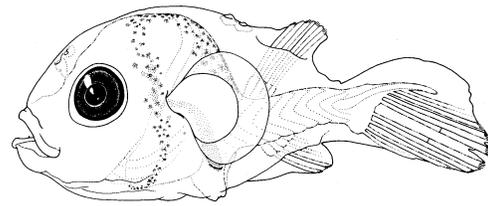
A. 3.1 mmTL (Male)



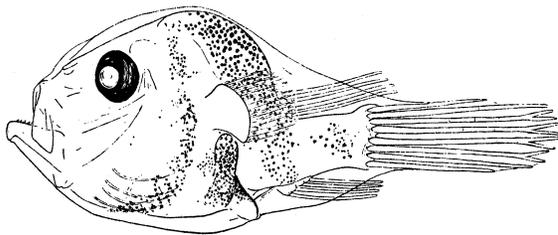
E. 3.2 mmTL (Female)



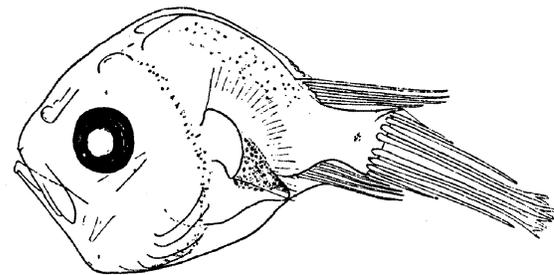
B. 4.5 mmTL (Male)



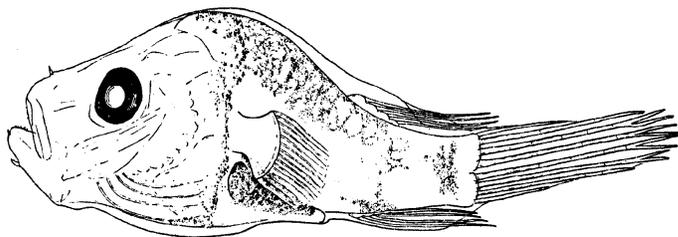
F. 3.3 mmSL (Female)



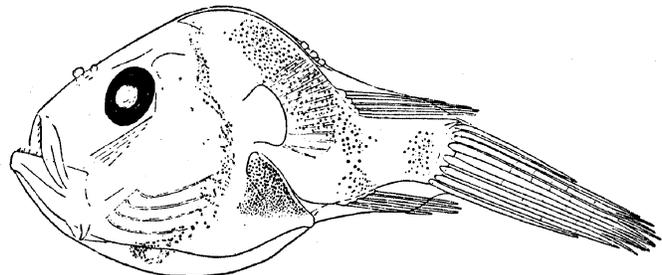
C. 7.7 mmTL (Male)



G. 4.1 mmTL (Female)

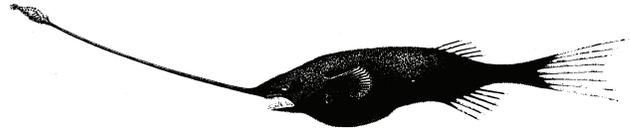


**D. 9.8 mmTL
(Transforming Male)**



H. 7.5 mmTL (Female)

***Gigantactis vanhoeffeni* Brauer, 1902**
Gigantactinidae
 No common name



Range: Worldwide in all oceans; in the western North Atlantic from Greenland to Caribbean Sea

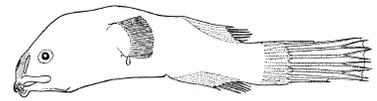
Habitat: Meso- to bathypelagic in depths of 300–1,700 m

Spawning: Not sexually parasitic; non-parasitized females may have developed ovaries; free-living males have well-developed testes and actively consume food; male jaws suited for prey capture

Eggs: – Undescribed

Larvae: – Body short, very round; skin very inflated
 – Body depth increases to 80% of SL in postflexion stage
 – Sequence of fin ray formation: illicium, P₁ – C, D – A
 – Pectoral fins very large, reaching beyond dorsal and anal fin insertions
 – Pelvic fins lacking
 – Dorsal pigment may be absent, weak or well-developed; if present, not contiguous with peritoneal pigment; no pigment at base of pectoral fin

Meristic Characters	
Myomeres:	about 22
Vertebrae:	22
Dorsal fin rays:	5–7
Anal fin rays:	5–7
Pectoral fin rays:	17–19
Pelvic fin rays:	none
Caudal fin rays:	9



Adult male, 29 mmTL

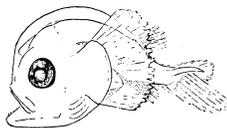
Note: Larval Types A, B, C, and D differ in pigmentation and meristic characters:

Larval Type	Dorsal and Peritoneal Pigment	Caudal Peduncle Pigment	Dorsal Fin Rays	Anal Fin Rays
A	Well developed	No large spots	5–7	3–7
B	Weak or absent	No large spots	5–7	5–7
C ¹	Weak or absent	No large spots	8–10	5–8
D ²	Well developed	3–4 large spots on dorsal and ventral edges	5–7	5–7

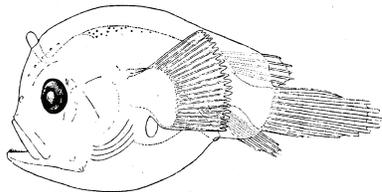
¹ Refers to *G. longicirra* Waterman, 1939 (see Bertelsen *et al.* (1981) for larva and adult male

² Not illustrated

Type B Larvae:

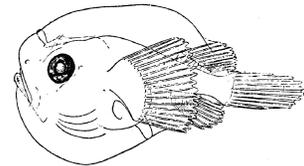


G. 4.0 mm

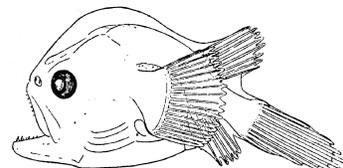


I. 12.0 mm

Type C Larvae:



H. 6.3 mm

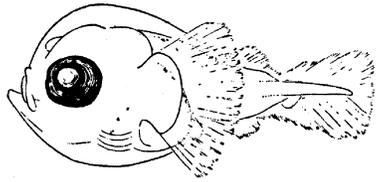


J. 7.3 mm

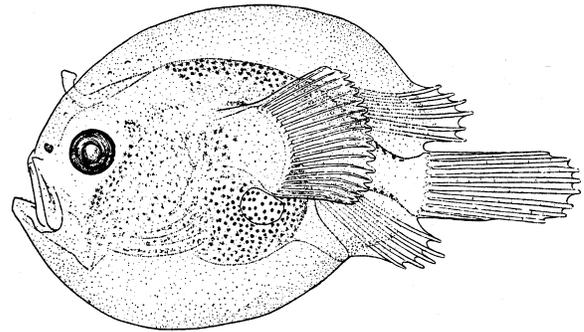
Figures: Adult: Bertelsen, 1986; Adult male and A–J: Bertelsen, 1951

References: Regan, 1926; Bertelsen, 1951; 1984; Bertelsen *et al.*, 1981; Pietsch, 1976; 1986a; 2002h; Amaoka *et al.*, 1992

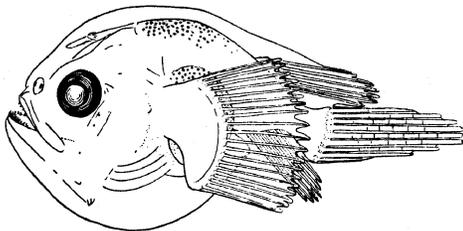
Gigantactis sp. (Type A)



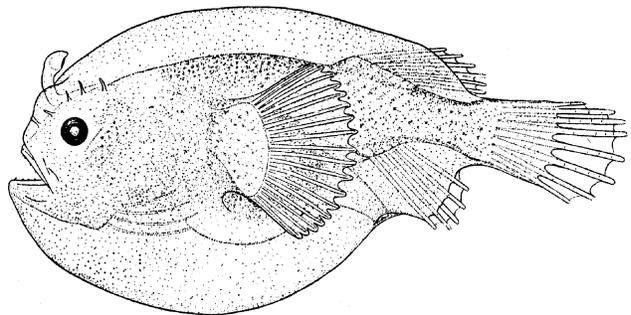
A. 2.8 mmTL (Male)



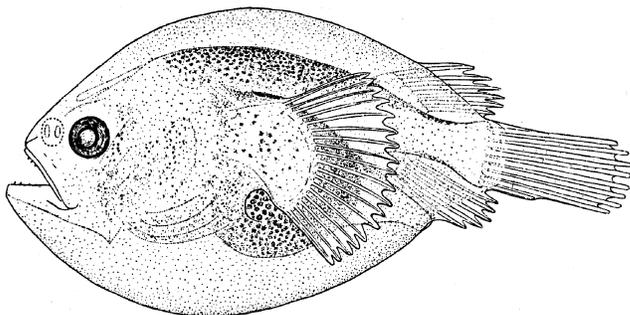
E. 12.5 mmTL (Female)



B. 8.0 mmTL (Male)

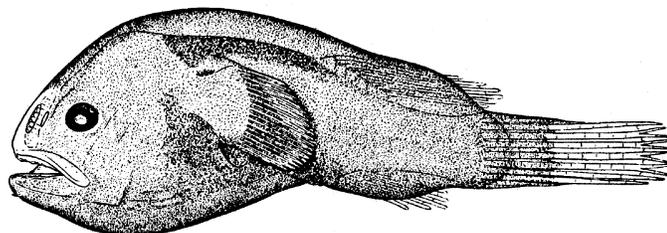


F. 25.0 mmTL (Transforming Female)



C. 17.0 mmTL (Transforming Male)

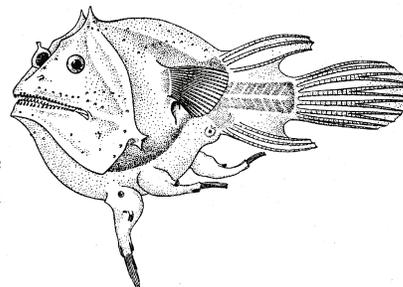
It is uncertain which of the larval "types" refer to *Gigantactis vanhoeffeni* or to the other species occurring in the study area. See Bertelsen (1951) and Bertelsen *et al.* (1981) for more information.



D. 16.0 mmTL (Transforming Male)

Haplophryne mollis* (Brauer, 1902)*Linophrynidae**

No common name



Range: Eastern and SW Pacific, Indian, North and South Atlantic oceans; in the western North Atlantic occurs as far north as LaHave Bank, Toms Canyon and Bear Seamount

Habitat: Meso- and bathypelagic in depths of 1,000–4,000 m

Spawning: Obligate sexual parasites; non-parasitized females never with developed ovaries; free-living males never with developed testes gut always empty; male jaws unsuited to prey capture; season undescribed

Eggs: – Undescribed

Larvae:

- Based on "*Hyaloceratias*" larvae (see note below)
- Body fairly elongate, with greatly inflated skin
- Pectoral fins very short, not reaching level of anus
- Pelvic fins lacking
- Pigment typically in 2 parallel, linear bands on body from opercle to caudal peduncle
- Widely scattered melanophores on peritoneum; head unpigmented
- Transforming specimens:
 - Body appears moderately globose, with strongly inflated skin
 - Sphenotic spines prominent
 - Transforming female has "wart-like" protuberance behind developing esca
 - Male pigment includes linear scattering of spots along lower half of body; peritoneal pigment present
 - Female pigment includes same linear scattering, plus a 'bar' of pigment crossing the end of the caudal peduncle; peritoneum strongly pigmented

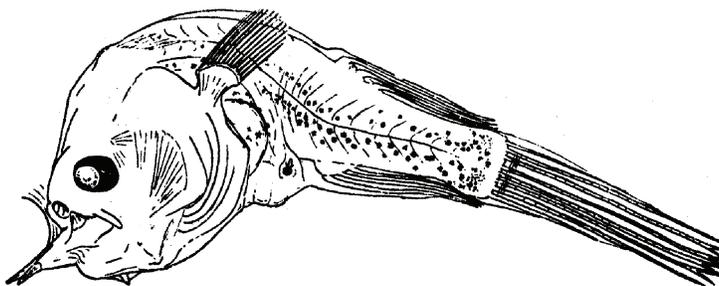
Meristic Characters

Myomeres:	about 19
Vertebrae:	19
Dorsal fin rays:	3–4
Anal fin rays:	3–4
Pectoral fin rays:	15–16
Pelvic fin rays:	none
Caudal fin rays:	9

Note: 1. Bertelsen (1951) considered "*Hyaloceratias*" larvae a blend of *Edriolychnus schmidti*, *Linophryne arborifera*, and possibly *L. corymbifera*. The name was given after a species (*Hyaloceratias parri*) described by Koefoed (1944) based on young stages, but it was not suggested that these were the larvae of that species.

Adult Male:

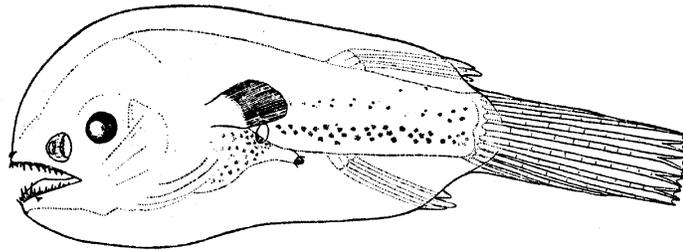
G. 17.0 mmTL



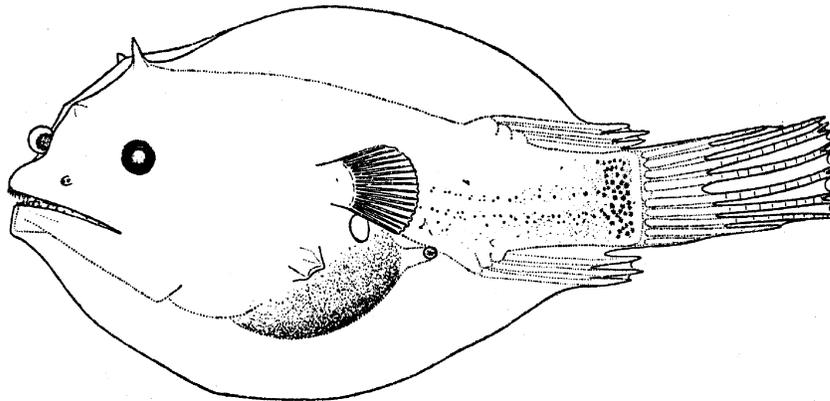
Figures: Adult female with 3 parasitic males attached: Bertelsen, 1951; **A–G:** Bertelsen, 1951 (**A, B, G** as *Edriolychnus schmidti*)

References: Regan, 1926; Bertelsen, 1951; 1984; 1986; Grey, 1956; Pietsch, 1976; 2002i

Haplophryne mollis

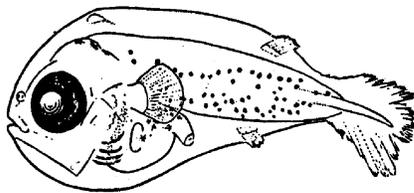


A. 19.5 mmTL (Transformed Male, Free-Living)

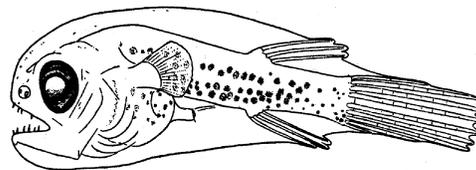


B. 38.0 mmTL (Transforming Female)

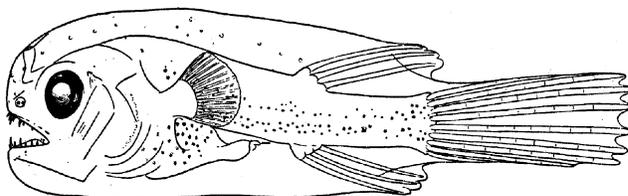
"Hyaloceratias" Larvae



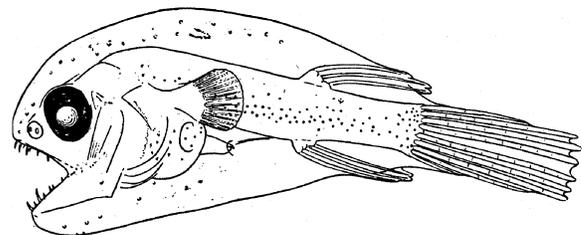
C. 2.9 mmTL (Female)



D. 8.0 mmTL (Male)



E. 13.0 mmTL (Female)



F. 12.0 mmTL (Male)

Linophryne arborifera* Regan, 1925*Linophrynidae**

No common name

Range: Atlantic Ocean between 40°N and 20°S; in the western North Atlantic from Hydrographer Canyon and Delaware to Bermuda

Habitat: Meso- to bathypelagic in depths to 2,000 m

Spawning: Obligate sexual parasites; non-parasitized females never with developed ovaries; free-living males never with developed testes, gut always empty; male jaws unsuited to prey capture; season undescribed

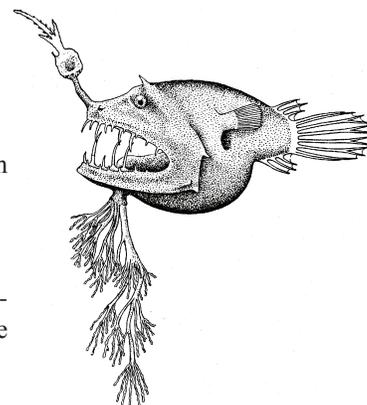
Eggs:

- A female has been collected with partially extruded egg cluster embedded in buoyant, gelatinous "raft"
- Diameter: slightly oval, 0.6 × 0.8 mm
- Oil globules: small, numerous
- Perivitelline space: irregular

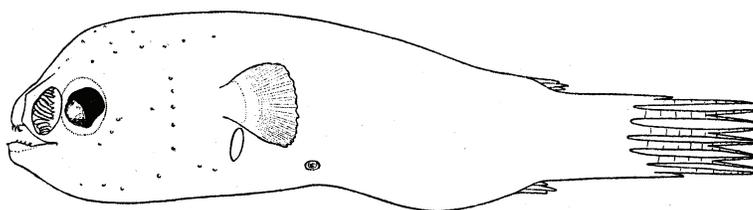
Larvae:

- Body relatively elongate in male larvae, with inflated skin
- Transforming females also have elongate bodies and inflated skin
- Preanus length long in this species, shorter in other linophrynids
- Pectoral fins not greatly enlarged, barely reaching dorsal and anal fin origins
- Pelvic fins lacking
- Sequence of fin ray development undescribed
- Sphenotic spines small or absent initially; larger spines develop in transforming females
- Pigment mostly on lateral body; light peritoneal pigment; body pigment in transforming females most dense on dorsal and ventral surface of caudal peduncle; scattered pigment over skin in transforming females

Note: 1. Transformation in males involves loss of larval teeth and degeneration of the maxillary bones (Figs. B and C). This pattern of development is similar in males of most ceratioid families (see Bertelsen, 1951).

Transformed Free-Living Male:**Meristic Characters**

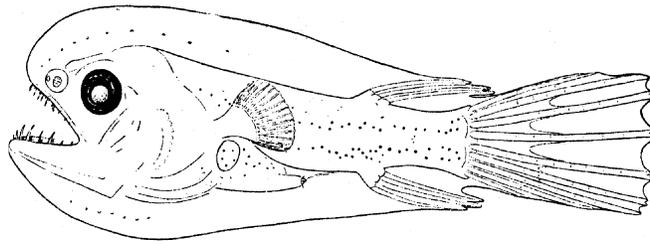
Myomeres:	about 20
Vertebrae:	19
Dorsal fin rays:	3
Anal fin rays:	3
Pectoral fin rays:	14–19
Pelvic fin rays:	none
Caudal fin rays:	9

F. 23 mmTL

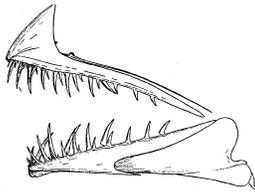
Figures: Adult: Bertelsen, 1951 after Regan, 1926; **A–F:** Bertelsen, 1951 (**B** and **C** reversed)

References: Regan, 1926; Bertelsen, 1951; 1980; 1984; 1986; Pietsch, 1976; 2002i; Watson, 1996g

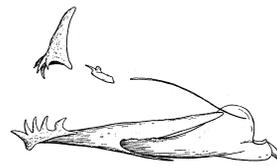
Linophryne arborifera



A. 19.0 mmTL (Male)

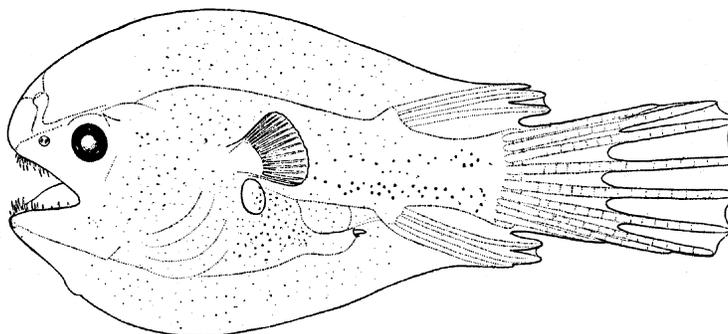


B. 19.0 mmTL (Larval Male Jaw)



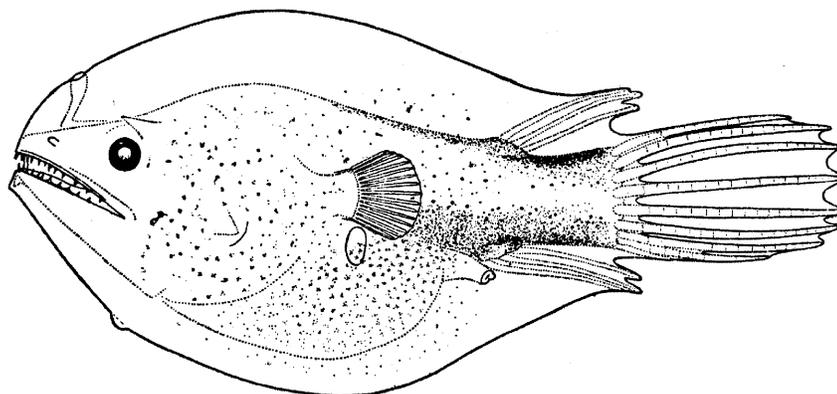
C. 23.0 mmTL (Free-Living Male Jaw)

Note reduction of maxillaries, loss of larval teeth, and development of upper and lower denticulars bearing clusters of jagged, denticles, or tooth-like structures, used for grasping females



D. 25.5 mmTL (Transforming Female)

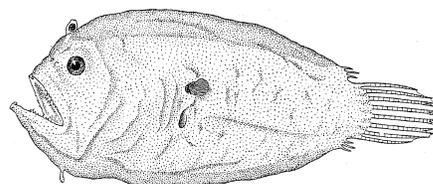
Note beginning of hyoid barbel



E. 43.0 mmTL (Transforming Female)

Linophryne macrorhinus* (Brauer, 1902) (Group)*Linophrynidae**

No common name



Range: Eastern, western and southeastern Atlantic Ocean; eastern, southern and western Pacific Ocean; northern Indian Ocean

Habitat: Meso- and bathypelagic

Spawning: Obligate sexual parasites; non-parasitized females never with developed ovaries; free-living males never with developed testes, gut always empty; male jaws unsuited to prey capture; season undescribed

Eggs: – Undescribed

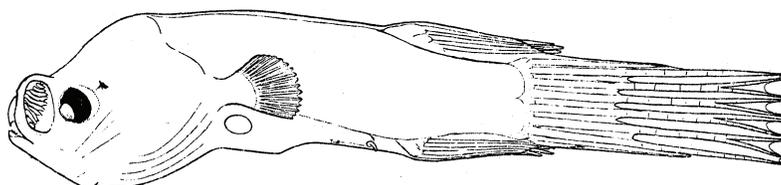
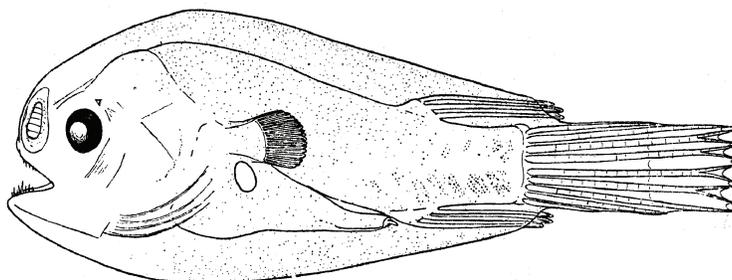
Larvae:

- Body relatively elongate (compared to other ceratioids), skin very inflated
- Body depth <60% SL (including inflated skin)
- Long and sharp sphenotic spines present
- Branchiostegal rays: 4–5
- Pectoral fins not greatly enlarged, barely reaching dorsal and anal fin origins
- Pelvic fins lacking
- Sequence of fin ray formation: illicium, C, D, A – P₁
- Pigment always absent on dorsum of body; a group of melanophores usually present on caudal peduncle (although it rarely lacks pigment)

Meristic Characters

Myomeres:	about 19
Vertebrae:	19
Dorsal fin rays:	3
Anal fin rays:	3
Pectoral fin rays:	15–18
Pelvic fin rays:	none
Caudal fin rays:	9

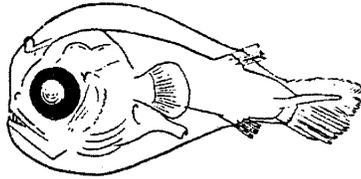
Note: 1. *Linophryne macrorhinus* is an invalid species. It is a group name referring to males and larvae of as many as 7 valid species. (See Bertelsen, 1982)

Adult Male (Free-Living):**G. 27.0 mmTL****Early Juvenile:****H. 22.5 mmTL
(Male)**

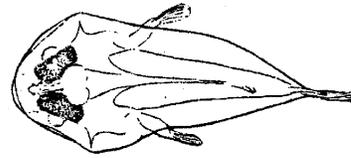
Figures: Adult (recently transformed female): Regan and Trewavas, 1932; **A–H:** Bertelsen, 1951

References: Grey, 1956; Bertelsen, 1951; 1982; 1984; 1986; Pietsch, 1976; 2002i

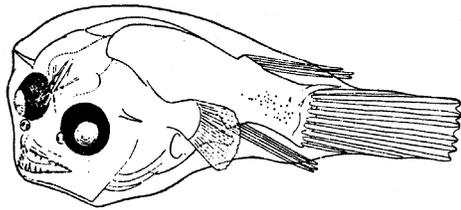
Linophryne macrorhinus
(Group)



A. 3.5 mmTL (Female)

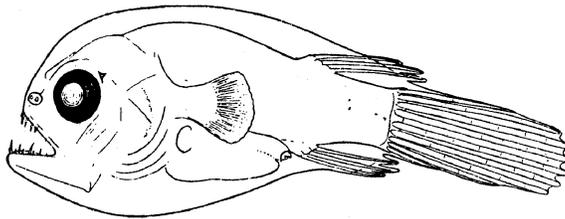


B. 3.5 mmTL (Female, Dorsal View)

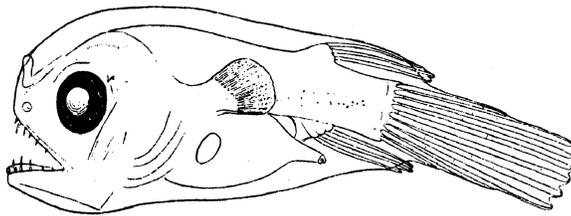


C. 5.5 mmTL (Male)

This "group" is based on the free-living males of 7 nominal species, and larvae not referred to adult females of other species (Bertelsen, 1951; 1982). In contrast to other linophrynids, larvae have long and sharp sphenotic spines. The group is included here based on the collection of a single larva at 39°03'N, 67°18'W (MCZ 76572).

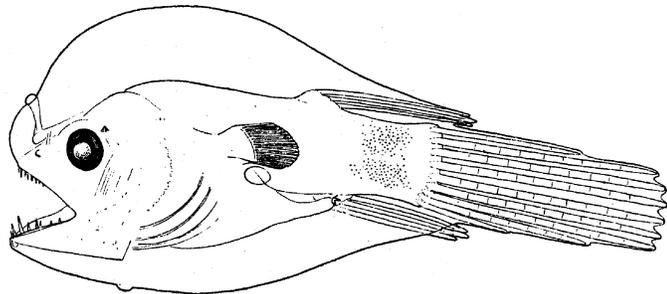


D. 9.0 mmTL (Male)



E. 9.0 mmTL (Female)

F. 17.0 mmTL (Female)



Note initial formation of small hyoid barbel