Stomiiformes and Ateleopodiformes

Selected meristic characters in species belonging to the order Stomiiformes whose adults or larvae have been collected in the study area. Classification sequence and family composition follow Eschmeyer (1990), subfamilies not considered. Transformation groups "A" through "D" defined at bottom of page (after Ahlstrom, 1974). Ateleopodiformes is placed adjacent to the Stomiiformes based on its removal from the Lampridiformes (Olney *et al*., 1993) and its placement (with Stomiiformes) in a superorder Sternopterygii (Nelson, 1994). Sources: Grey, 1964; Schultz, 1964; Morrow, 1964a, 1964b, 1964c; Gibbs, 1964a, 1964b; Morrow and Gibbs, 1964; Badcock and Merrett, 1972; Badcock, 1984a, 1984b, 1984c; Gibbs, 1986a, 1986b, 1986c, 1986d; Goodyear and Gibbs, 1986; Schaefer *et al*., 1986; Weitzman, 1986; Parin and Kobyliansky, 1996; Amaoka, 2003.

Family *Species*	Transformation Group	Vertebrae	Dorsal Fin Rays	Anal Fin Rays	Pectoral Fin Rays	Pelvic Fin Rays	Branchiostegal Rays
Gonostomatidae							
Bonapartia pedaliota	**B**	36–38	17–20	29–31	14–16	7–8	13–16
Cyclothone acclinidens	**A**	30–32	14–15	18–20	8–10	6–7	13–15
Cyclothone alba	**A**	31–32	12–15	17–20	9–10	6–7	12
Cyclothone braueri	**A**	30–32	13–14	18–20	9–10	6–7	12–14
Cyclothone microdon	**A**	31–33	13–14	17–20	9–10	5–6	12–14
Cyclothone pallida	**A**	31–33	12–15	16–19	9–11	6–7	14–15
Cyclothone pseudopallida	**A**	29–34	12–15	17–21	9–10	6–7	14
Diplophos taenia	**A**	92–98	12–13	59–72	8–10	7–8	12–14
Gonostoma atlanticum	**B**	38	16–18	28–30	10	6–7	11
Gonostoma denudatum	**B**	39	14–15	28–30	11–12	8	14
Manducus maderensis	**A**	63	10–13	34–41	10–11	8	11–13
Margrethia obtusirostre	**B**	34	15–16	21–26	13–15	8	13
Sigmops bathyphilum	**B**	37	12–14	22–24	10–11	7–8	12–13
Sigmops elongatum	**B**	39	12–14	29–32	10–11	8	12–13
Sternoptychidae							
Argyropelecus aculeatus	**D**	34–36	9	12	10–11	6	10
Argyropelecus affinis	**D**	38–41	8–9	12–14	10–11	6	10
Argyropelecus gigas	**D**	38–39	9–10	12–13	10–11	6	10
Argyropelecus hemigymnus	**D**	36–41	8–9	11–12	10–11	6	10
Argyropelecus sladeni	**D**	35–37	9	12	10–11	6	10
Argyripnus atlanticus	**D**	45–46	11–12	22–25	17–19	6–7	10
Maurolicus weitzmani	**C**	32–33	10–11?	19–23?	17–18	6–7	9–10
Polyipnus clarus	**D**	32–33	15–16	16–17	13–15	7	10
Polyipnus laternatus	**D**	32–33	12–15	15–18	12–14	6–7	10
Sternoptyx diaphana	**D**	29–30	9–11	13–16	10–11	6–7	6
Sternoptyx pseudobscura	**D**	29–30	9–12	13–15	9–11	6–7	6
Valencienellus tripunctulatus	**C**	32–33	7–8	24–25	16-17	6–7	10
Phosichthyidae							
Ichthyococcus ovatus	**A**	38–42	11–12	15–17	8	7	12
Pollichthys mauli	**A**	40–44	10–12	25–26	8	6–7	11–12
Polymetme thaeocoryla	**A**	43–45	12–13	30–34	9–10	7	12–13
Vinciguerria attenuata	**A**	40–41	13–15	14–16	9–10	7	11
Vinciguerria nimbaria	**A**	40–42	13–14	13–15	9–10	7	11
Vinciguerria poweriae	**A**	38–39	13–15	12–14	9–10	7	11
Yarella blackfordi	**A**	53–54	14–17	28–31	8–10	6–7	14–16

Transformation groups:

A = All photophores separate; most or all photophores initially laid down during pre-transformation, "white photophore" stage
B = All photophores separate; gradual, protracted transformation; initial photophores formed in OP and IV groups
C = Most photophores in clusters, common bases; gradual, protracted transformation; initial photophores formed in BR and IV groups
D = Most photophores in clusters, common bases; gradual transformation with striking change (deepening) in body form

Stomiiformes and Ateleopodiformes

Family *Species*	Vertebrae	Dorsal Fin Rays	Anal Fin Rays	Pectoral Fin Rays	Pelvic Fin Rays	Branchiostegal Rays
Chauliodontidae						
Chauliodus danae	51–58	5–6	10–12	12–14	6–7	12–16
Chauliodus sloani	54–62	5–7	10–13	11–14	6–8	14–17
Stomiidae						
Stomias affinis	66–71	17–20	18–23	6–7	5	17–18
Stomias boa ferox	77–83	17–21	19–23	6	5	17–18
Stomias brevibarbatus	64–68	16–20	19–22	7–9	5	17
Stomias longibarbatus	164	13–14	15–18	6–7	4–5	18–19
Astronesthidae						
Astronesthes gemmifer	45–55	15–17	16–19	8–9	7	20
Astronesthes leucopogon	45–55	15–18	17	8	7	16
Astronesthes macropogon	45–55	18–21	11–19	6–9	6–8	14–20
Astronesthes micropogon	45–55	17–20	11–19	6–9	6–8	14–20
Astronesthes neopogon	45–55	14–17	15	9	7	14–20
Astronesthes niger	46–51	14–17	12–15	7–9	6–8	16–21
Astronesthes similis	45–55	11–13	18–21	6–8	7	17–21
Borostomias antarcticus	56–60	10–13	14–16	7–9	7	16–23
Heterophotus ophistoma	66–68	11–13	12–17	7	7	23–25
Neonesthes capensis	51–57	9–12	22–28	7–8	7	18–21
Melanostomiidae						
Bathophilus altipinnis	38–45	15	15	24–25	15	8–14*
Bathophilus brevis	33–35	10–11	9–10	11–13	11–14	8–14*
Bathophilus digitatus	42–45	14	15	3 + 4	9	8–14*
Bathophilus longipinnis	40–44	14–16	15–16	5–8	11–14	8–14*
Bathophilus pawneei	45	14–17	15–18	2	11–14	11–14
Bathophilus proximus	38–45	16	16	16–19	16	8–14*
Bathophilus vaillanti	38–45	13–17*	13–18*	2–37*	4–26*	8–14*
Chirostomias pliopterus	54–55	18–20	22–26	6	7	19–22
Echiostoma barbatum	57–59	11–14	13–19	1 + 3	8	13–15
Eustomias achirus	56–71*	20–29*	32–46*	0–13*	7–8*	–
Eustomias bibulbosus	56–71*	21–26	35–42	3	7	–
Eustomias borealis	56–71*	20–29*	32–46*	0–13*	7–8*	–
Eustomias enbarbatus	56–71*	21–23	34–36	3	7	–
Eustomias filifer	61–67	22–25	40–45	1–2	7	–
Eustomias fissibarbis	56–71*	22–26	36–41	2	7	–
Eustomias jimcraddocki	62–63	24–25	40–41	1+	7	10–11
Eustomias macrurus	56–71*	25–29	45	9	7	–
Eustomias obscurus	56–71*	23–30	34–46	3	7	–
Eustomias satterleei	56–71*	20–29*	32–46*	0–13*	7–8*	–
Eustomias schiffi	56–71*	20–29*	32–46*	0–13*	7–8*	–
Eustomias schmidti	63–66	22–26	36–44	2–3	7–8	–
Flagellostomias boureei	65	14–17	21–26	I + 8–11	7	15–17
Grammatostomias circularis	56	21	23	9	8	10
Grammatostomias dentatus	~50	19–21	23–24	4–5	7	11
Grammatostomias flagellibarba	54	18–21	20–24	9–11	7	11
Leptostomias bilobatus	75–83*	20–21	25–26	9	7	16–17
Leptostomias gladiator	75–78	19–22	26–29	5–11	7	17–18
Leptostomias longibarba	75–83*	14–22*	23–24*	5–11*	7–8*	16–19*
Melanostomias bartonbeani	50–51	13–16	16–20*	5–6	7	–

* = Range in genus

Stomiiformes and Ateleopodiformes

Family *Species*	Vertebrae	Dorsal Fin Rays	Anal Fin Rays	Pectoral Fin Rays	Pelvic Fin Rays	Branchiostegal Rays
Melanostomiidae						
Melanostomias biseriatus	50–55*	13–15	16–20*	5–6	7	—
Melanostomias melanopogon	50–55*	13	17	5–6	7	—
Melanostomias melanops	50–55*	14–15	17–18	5–6	7–8	—
Melanostomias tentaculatus	~55	16–17	19–20	5–6	7	—
Melanostomias valdiviae	51–53	13–15	16–19	4–5	7	—
Pachystomias microdon	50–53	21–24	25–29	5–6	7–9	~9
Photonectes braueri	51–53	15–18	17–21	2	7	11–15*
Photonectes dinema	50	15–18	18–21	2–3	6–7	11–15*
Photonectes margarita	62–63	15–20	19–24	0–1	7	11–15*
Photonectes mirabilis	49–64*	16–17	19–20	0	7	11–15*
Photonectes parvimanus	60–65	17–19	21–24	2	7	11–15*
Photonectes phyllopogon	49–64*	20	22	0	7	11–15*
Trigonolampa miriceps	61–62	18–20	18–19	5	7	14–15
Malacosteidae						
Aristostomias lunifer	50–53	20–24	26–29	7–8	6	~15
Aristostomias grimaldii	44–52*	21–26	26–32	7–10	6	~15
Aristostomias photodactylus	–	18	26	10	6	~15
Aristostomias polydactylus	50–53	21–26	26–29	14–17	6	~15
Aristostomias tittmanni	52	20–22	24–29	6–7	6	~15
Aristostomias xenostoma	50	21–23	26–29	6–9	6	~15
Malacosteus niger	45–51	14–20	17–23	3–5	6	~15
Photostomias guerneri	52–58	22–28	25–32	0	6	9–12
Idiacanthidae						
Idiacanthus fasciola	~78	54–65 (74)	38–49	0	6	12–18
Ateleopodiformes/Ateleopodidae						
Ijimaia antillarum	126	9	75	14	3	7

* = Range in genus

Synopses of family characters in Stomiiformes and Photophore terminology figures to follow on next two pages.

Stomiiformes

Fishes in the 9 families that follow are generally small inhabitants of epi-, meso- or bathypelagic levels of the open ocean. Some species are extremely abundant. Recent systematic work has resulted in the reallocation of some "gonostomatids" to the families Sternoptychidae and Phosichthyidae (Weitzman, 1974). The classification of Eschmeyer (1990) reflects this allocation and is followed here. Ontogeny in each of the 9 families is briefly summarized below. (See Kawaguchi and Moser (1984) and Ahlstrom *et al*. (1984c) for more details.)

Gonostomatidae: hatch with unpigmented eyes and unformed mouth; body usually long and slender with long preanus length; gut usually not trailing; eyes begin as ovals, become round at transformation; pigment usually light, often confined to venter of body, air bladder and gut; photophores develop as series during transformation

Sternoptychidae: larvae long and slim early in development; some then remain slim, some become quite deep-bodied; preanus length one third to one half of length; gut length shortens during transformation; pigment usually very light; photophores form in clusters

Phosichthyidae: larvae long and slender with fairly long preanus length; most similar to larvae of above 2 families

Chauliodontidae: eggs with very wide perivitelline space; larvae with elongate yolk-sac; body elongate, with gut nearly as long as entire body; short head, pointy snout, slightly oval eyes; fin rays develop slowly; usually no pigment; larvae transform at large sizes

Stomiidae: larvae similar to those of Chauliodontidae, but preanus length slightly shorter; small head, long snout, slightly oval eyes; fin rays develop soon after flexion; pigment generally heavier than in chauliodontids

Astronesthidae: diverse larval morphs; many have trailing guts; pigmentation variable; dorsal fin located anteriorly

Melanostomiidae: diverse larval morphs; many elongate with voluminous finfolds, trailing guts; pigment usually in series; head large with pointy snout, small eye, sometimes telescopic; dorsal and anal fins far back on body

Malacosteidae: larvae elongate and slender, with large dorsoventrally depressed head; eyes small; gut trails well beyond body, usually with pigment; body pigment in characteristic series

Idiacanthidae: larvae very slender, elongate; prominently stalked eyes in early stages; trailing gut

In the following descriptions, many taxa are only treated to the generic level. Species in these genera are often only distinguished by characters of the barbel, features not yet formed in the early life history stages.

The numbers, arrangement and sequence of development of photophores are important characters in all the stomiiforms. Photophores are coded according to the following table and illustrations on the opposite page.

Photophore terminology in stomiiform families (see explanatory figures)

Gonostomatidae, slim-bodied Sternoptychidae and Phosichthyidae (top figure)

SO Symphyseal photophores
ORB Orbital photophores, both sides of eye
BR Branchiostegal membrane photophores
OP Opercle photophores
VAV Ventral series of photophores, pelvic to anal fins
OA Lateral series of photophores, opercle to anal fin origin
AC Ventral series of photophores, anal to caudal fins
IV Ventral series of photophores, isthmus to pelvic fin (sometimes divided into IP on isthmus and PV from pectoral to pelvic fins)

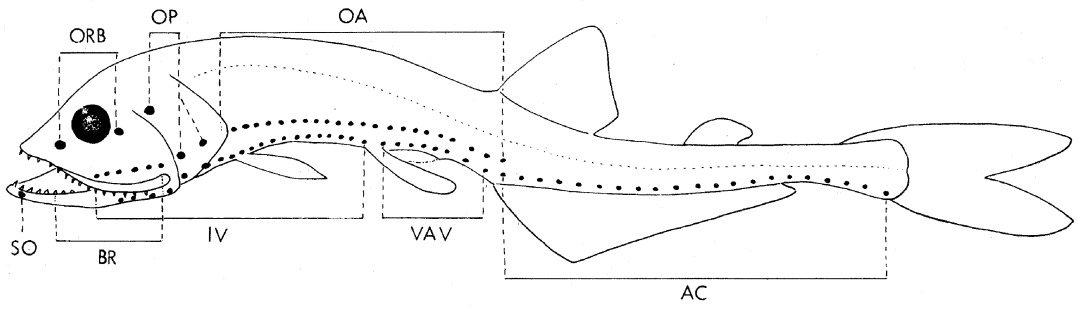
Deep-bodied Sternoptychidae (middle figure; SAB and L not shown)

BR Branchiostegal membrane photophores
IS Series of photophores on isthmus
PRO Photophores on preopercle
PO Photophore under or anterior to eye
PTO Photophore posterior to eye
SO Photophore on subopercle
SAB Photophores above AB (not in *Sternoptyx*)
SP Photophore above pectoral fin
AB Ventral series of photophores anterior to pelvic fin
PAN Photophores anterior to anal fin
SAN Photophores located above AN
AN Series of photophores anterior to anal fin
SC Series of photophores on ventral caudal peduncle
L Lateral photophores above PAN (only in *Polyipnus*)

Chauliodontidae, Stomiidae, Astronesthidae, Melanostomiidae, Malacosteidae, Idiacanthidae (lower figure)

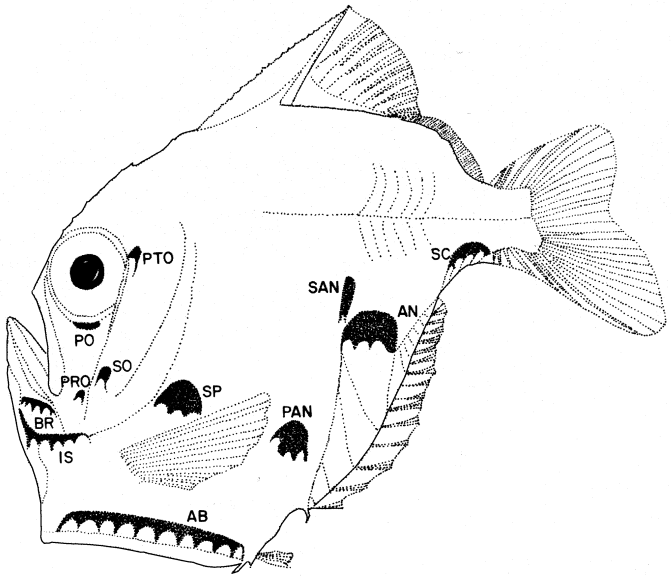
OP Opercle photophores
OA All lateral photophores, opercle to anal fin
VAL Lateral photophores, pelvic to anal fins
VAV Ventral series of photophores, pelvic to anal fins
IP Ventral series of photophores, isthmus to pectoral fin
OV Lateral photophores opercle to pelvic fin
PV Ventral series of photophores, pectoral to pelvic fins
AC Ventral series of photophores, anal to caudal fins

Stomiiformes

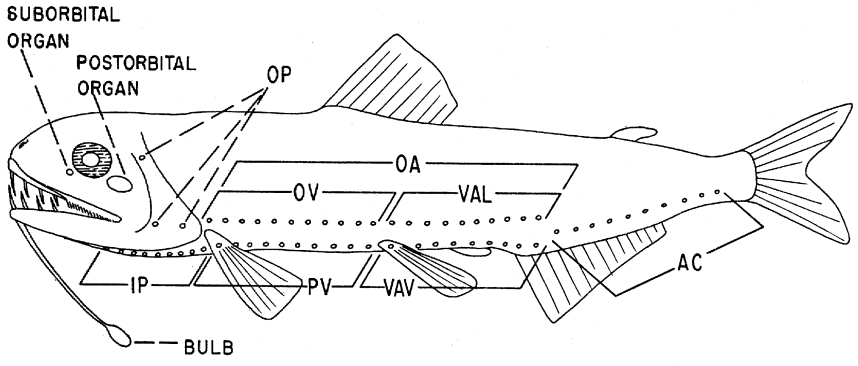


Photophore terminology in Gonostomatidae, slim-bodied Sternoptychidae and Phosichthyidae (Fahay, 1983, after Ozawa, 1976)

SAB and L photophores are not present in *Sternoptyx* sp. and are not shown in this figure.

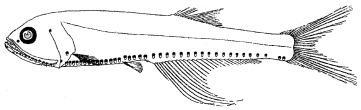


Photophore terminology in deep-bodied Sternoptychidae (Badcock and Baird, 1980, modified)



Photophore terminology in stomiatoids (Morrow, 1964a, modified)

Bonapartia pedaliota Goode and Bean, 1896
Gonostomatidae
No common name



Range: Both sides of the North Atlantic Ocean; in the western North Atlantic from Georges Bank, rarely Flemish Cap, to Caribbean Sea

Habitat: Meso- to bathypelagic layers over continental slope, in depths of 397–2,744 m; some may undertake diel vertical migrations

Spawning: Undescribed; larvae frequently collected in study area, mostly during summer

Meristic Characters

Myomeres:	about 37
Vertebrae:	36–38
Dorsal fin rays:	17–20
Anal fin rays:	29–31
Pectoral fin rays:	14–16
Pelvic fin rays:	7–8
Caudal fin rays:	10+9 (PrC)

Eggs: – Undescribed

Larvae:
- Body moderately long, elongate
- Mouth terminal and large, extending well posterior to eye in later stages
- Oval eye, becomes round at about 25 mm
- Anal fin origin slightly more anterior than dorsal fin origin in larvae and adults
- Anterior rays longer in dorsal and anal fins; anal fin base long
- Adipose fin lacking
- Pectoral fin forms on peduncle
- **Photophores**

Sequence of development:	OP	BR	IV	VAV	ORB	AC	SO	OA
Definitive # (adult) in group:	3	11–13	14–15	5–6	1	16–18+2-3	1	None

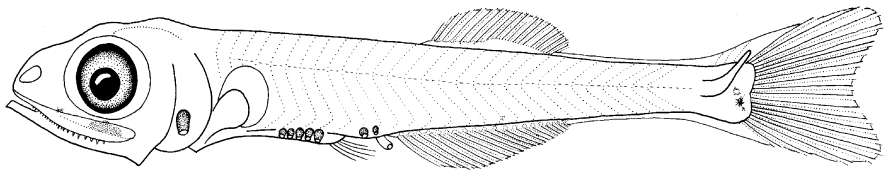
- All photophores separate; none on isthmus
- SO forms at sizes >25 mm; OA lacking in all stages
- Peritoneal pigment and spot at base of caudal fin present in smallest larvae

Note: 1. Similar to larvae of *Gonostoma*, but lack deep pigment behind eye, and have pigment on middle of caudal fin base

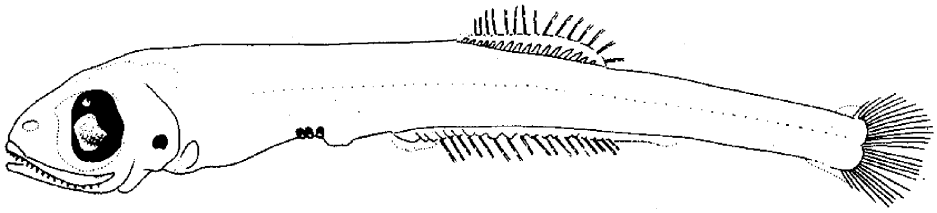
Figures: Adult: Jespersen and Tåning, 1919; **A**: Jack Javech (Ahlstrom *et al*., 1984c); **B**: Badcock, 1977 (redrawn); **C**: Jespersen and Tåning, 1919

References: Grey, 1964; Ahlstrom *et al*., 1984c

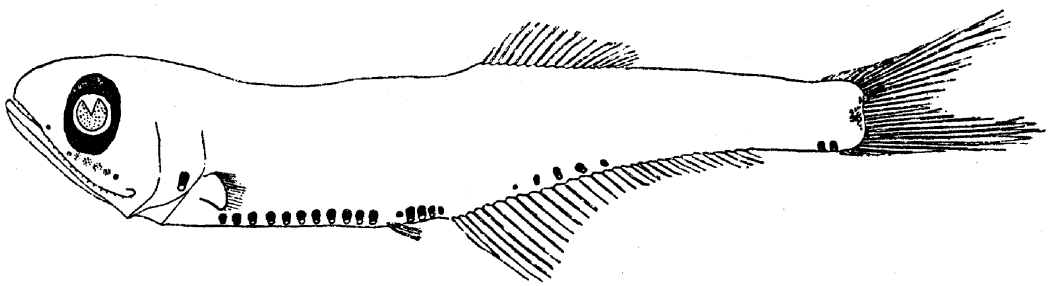
Bonapartia pedaliota



A. 11.5 mmSL Posterior IV form first, anterior added later

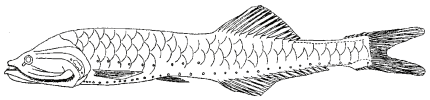


B. 12.0 mmSL Anterior AC form before posterior AC



C. 16.0 mmSL Anterior VAV forms last of VAV group

Cyclothone acclinidens Garman, 1899
Gonostomatidae
No common name



Range: Worldwide in tropical and subtropical waters; in the western North Atlantic from LaHave Bank, Nova Scotia to Caribbean Sea

Habitat: Meso- to bathypelagic in depths of 300–1,200 m

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters	
Myomeres:	30–32
Vertebrae:	30–32
Dorsal fin rays:	14–15
Anal fin rays:	18–20
Pectoral fin rays:	8–10
Pelvic fin rays:	6–7
Caudal fin rays:	6–7+10+9+5–6

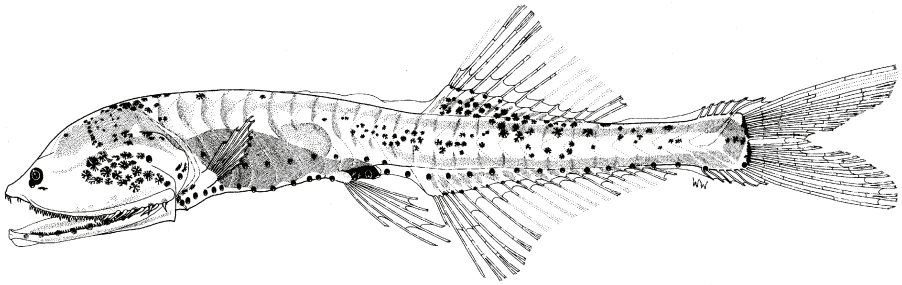
Larvae:
- Elongate body with preanus length slightly >50% SL
- Mouth terminal and large, ultimately extending well posterior to eye
- Eye slightly oval
- Air bladder conspicuous, located over posterior gut
- Sequence of fin ray development: C_1 – A – D, C_2 – P_2 – P_1
- Flexion occurs at 5–6 mm
- Dorsal and anal fin origins located at same level in larvae and adults
- **Photophores**

Sequence of development:	BR	VAV	AC	ORB	IV	OP	OA
Definitive # (adult) in group:	9–10	4–5	14–16	1	13–14	2	9

- Pigmentation includes prominent spot or streak on ventral part of caudal peduncle along edge of parahypural; melanophores occur on base of caudal fin; a pair of spots along sides of gut; air bladder pigmented on dorsal surface; 9–13 spots on body over anal fin; series of spots along dorsal edge, extending to level anterior to air bladder; few spots on head and lower jaw; spot present on dorsal caudal peduncle over tip of notochord and often at middle of hypural edge; spots occur along myosepta over gut in larger larvae
- Transformation occurs at sizes between 13 and 22 mm

Note:
1. *Cyclothone* larvae have separate photophores, most or all of which form simultaneously during late larval stage; the dorsal fin base is relatively long and the pelvic and anal fins are separated by a short gap; they lack photophores on the isthmus and have low numbers in ventral series.
2. Best characters for *C. acclinidens* include series of melanophores on myosepta over gut and series of spots along most of upper body

Early Juvenile:

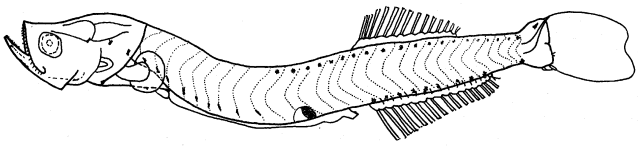


I. 21.1 mm

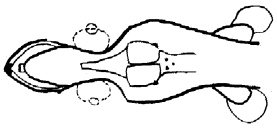
Figures: Adult: Grey, 1964; **A–B**, **E**, **G**: Ozawa and Oda, 1986a; **C–D**, **F**, **H**: Barbara Sumida M^{ac}Call (Watson, 1996b); **I**: William Watson (Watson, 1996b)

References: Grey, 1964; Ahlstrom *et al*., 1984c; Olivar and Fortuño, 1991; Watson, 1996b; Richards, 2001

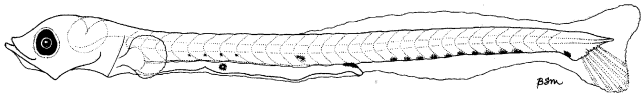
Cyclothone acclinidens



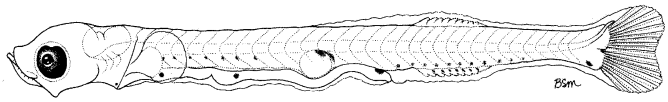
A. 5.6 mm



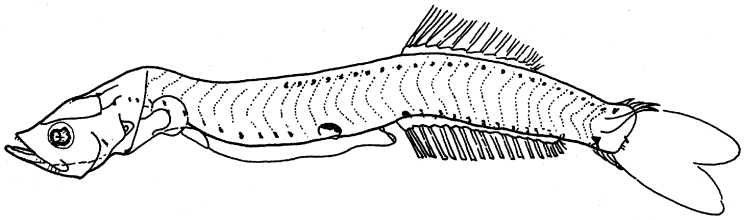
B. 5.6 mm (Dorsal View of Head)



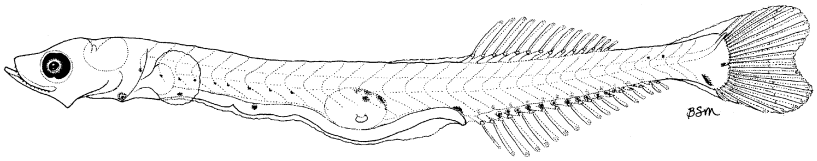
C. 5.8 mm



D. 5.8 mm

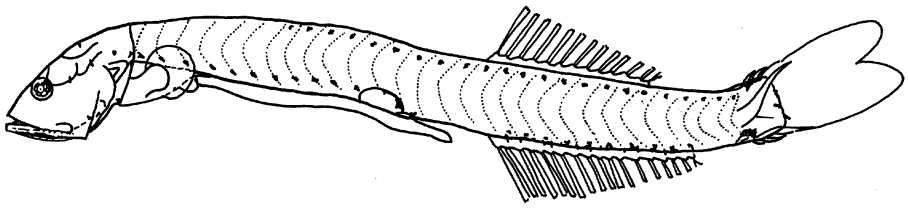


E. 7.4 mm

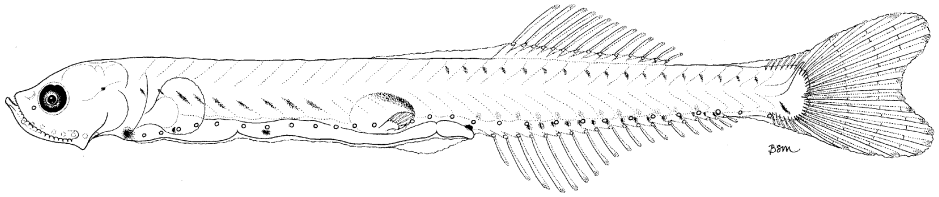


F. 10.0 mm

Note: pair of spots on either side of gut may not occur in Atlantic larvae

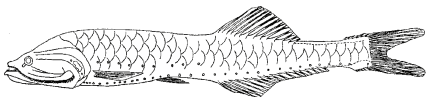


G. 12.8 mm



H. 13.7 mm

Cyclothone alba Brauer, 1906
Gonostomatidae
No common name



Range: Worldwide in tropical and subtropical waters; in the western North Atlantic from Newfoundland to the Caribbean Sea

Habitat: Meso- and bathypelgic in depths of 400–3,000 m

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

Myomeres:	about 31–32
Vertebrae:	31–32
Dorsal fin rays:	12–15
Anal fin rays:	17–20
Pectoral fin rays:	9–10
Pelvic fin rays:	6–7
Caudal fin rays:	10+9 (PrC)

Larvae:
- Elongate body with preanus length slightly >50% SL
- Eye round
- Mouth terminal and large, ultimately extending well posterior to eye
- Air bladder conspicuous; located over posterior gut
- Sequence of fin ray development: C – A, D – P_1 – P_2
- Flexion occurs at about 3.8 mm
- Dorsal and anal fin origins located at same level in larvae and adults
- **Photophores**

Sequence of development:	BR	VAV	AC	ORB	IV	OP	OA
Definitive # (adult) in group:	8	3–4	12	1	13	2	6

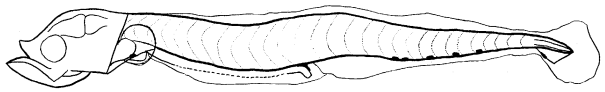
- Pigmentation includes prominent spot or streak on ventral part of caudal peduncle along edge of parahypural; no melanophores on base of caudal fin; a series of 7–8 spots on lower body over anal fin; 2 separate series of spots form dorsolaterally on caudal peduncle and under anterior dorsal fin base; dorsal surface of air bladder pigmented; few spots on lateral surface of gut; single spot at cleithral symphysis; snout without pigment; larger larvae have short series on myosepta anterior to air bladder
- Transformation occurs at sizes >12 mm

Note:
1. *Cyclothone* larvae have separate photophores, most or all of which form simultaneously during the late larval stage; the dorsal fin base is relatively long and the pelvic and anal fins are separated by a short gap; they lack photophores on the isthmus and have low numbers in ventral series.
2. Best characters for *C. alba* include lack of pigment on snout or base of caudal fin; 8 photophores in BR series

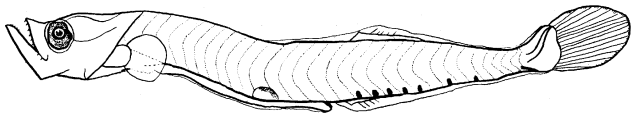
Figures: Adult: Badcock, 1984a; **A–F**: Ozawa and Oda, 1986a

References: Ahlstrom *et al*., 1984c; Ozawa and Oda, 1986a; Olivar and Fortuño, 1991

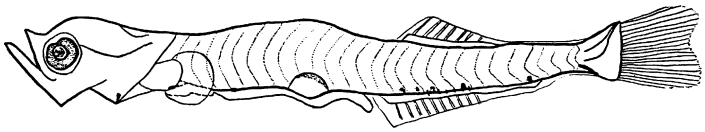
Cyclothone alba



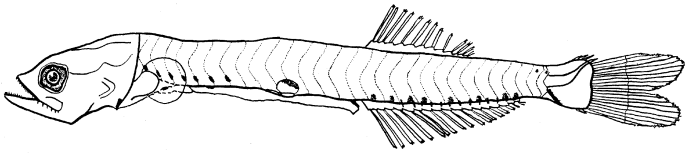
A. 2.9 mmSL



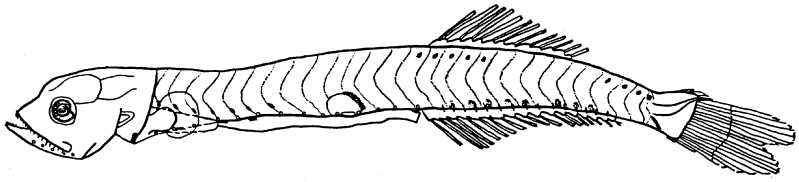
B. 3.8 mmSL



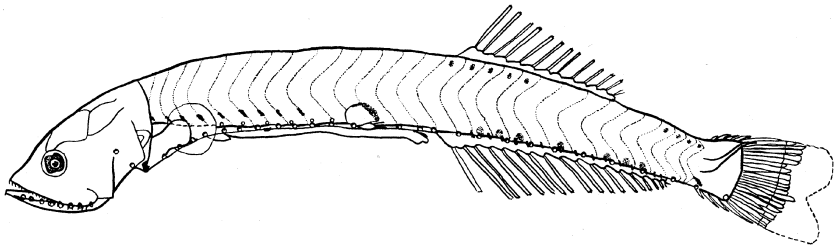
C. 4.4 mmSL 7-8 melanophores on lower body over anal fin



D. 7.1 mmSL Note 2 series of melanophores dorsolaterally

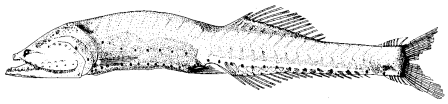


E. 8.6 mmSL



F. 9.7 mmSL

Cyclothone braueri Jespersen and Tåning, 1926
Gonostomatidae
Brauer's bristlemouth



Meristic Characters

Myomeres:	30–32
Vertebrae:	30–32
Dorsal fin rays:	13–14
Anal fin rays:	18–20
Pectoral fin rays:	9–10
Pelvic fin rays:	6–7
Caudal fin rays:	10+9 (PrC)

Range: Worldwide in tropical and subtropical waters; in the western North Atlantic from Newfoundland to Caribbean Sea

Habitat: Meso- and bathypelagic in depths from near-surface to 2,000 m; occur shallower in midwinter than in midsummer

Spawning: Apr–Oct

Eggs:
– Undescribed; ovarian eggs 0.5 mm diameter

Larvae:
– Elongate body with preanus length slightly >50% SL
– Eye round
– Mouth terminal and large, ultimately extending well posterior to eye
– Air bladder conspicuous; located over posterior gut
– Sequence of fin ray development: C – A, D – P_1 – P_2
– Flexion occurs at about 4.8 mm
– Dorsal and anal fin origins located at same level in larvae and adults

– **Photophores**

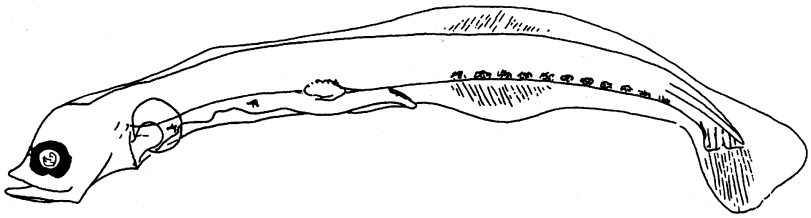
Sequence of development:	BR	VAV	AC	ORB	IV	OP	OA
Definitive # (*adult*) *in group*:	8–10	4	13–14	1	13	2	7

– Pigmentation includes prominent spot or streak on ventral part of caudal peduncle along edge of parahypural;no melanophores on base of caudal fin; pair of spots occur on either side of mid-gut; air bladder pigmented on dorsal surface; few internal spots on hindbrain; terminal end of gut with scattered pigment; series of 11–12 melanophores on lower body above anal fin, become internal; about 5–6 spots on lower body over anterior gut, aligned on myosepta; 3 internal melanophores on upper part of caudal peduncle
– Transformation occurs at sizes >12 mm (11–14 mmSL)

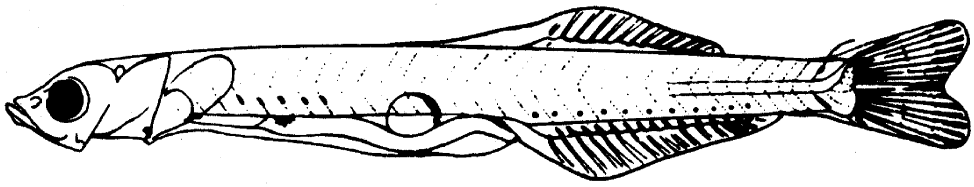
Note:
1. *Cyclothone* larvae have separate photophores, most or all of which form simultaneously during the late larval stage; the dorsal fin base is relatively long and the pelvic and anal fins are separated by a short gap; they lack photophores on the isthmus and have low numbers in ventral series.
2. Best characters for *C. braueri* include numbers of melanophores in each series
3. Meristic characters above from eastern Atlantic material

Figures: Adult: Badcock, 1984a; **A–C**: Sanzo, 1931a
References: Ahlstrom *et al*., 1984c

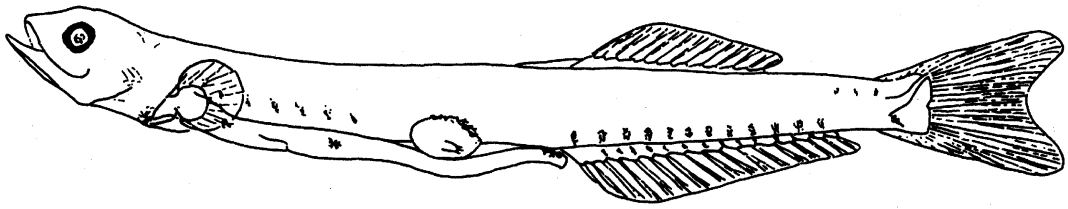
Cyclothone braueri



A. 4.8 mmSL 11-12 melanophores on lower body over anal fin

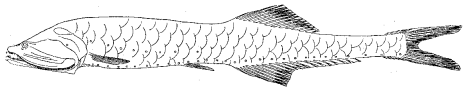


B. 10.4 mmSL



C. 13.7 mmSL Pigmentation on upper body limited to short series on upper caudal peduncle

Cyclothone microdon (Günther, 1878)
Gonostomatidae
No common name



Meristic Characters

Myomeres:	about 31–33
Vertebrae:	31–33
Dorsal fin rays:	13–14
Anal fin rays:	17–20
Pectoral fin rays:	9–10
Pelvic fin rays:	5–6
Caudal fin rays:	10+9 (PrC)

Range: Worldwide in tropical and temperate waters; abundant in Atlantic Ocean as far north as 60°N; in the western North Atlantic from Davis Strait to Bermuda

Habitat: Deep meso- to bathypelagic; juveniles and adults at depths of 500–2,700 m, early stages shallower

Spawning: Summer–autumn

Eggs:
- Undescribed, ovarian eggs 0.5 mm diameter

Larvae:
- Elongate body with preanus length slightly >50% SL
- Eye round
- Mouth terminal and large, ultimately extending well posterior to eye
- Air bladder conspicuous; located over posterior gut
- Sequence of fin ray development: C – A, D – P_1 – P_2
- Flexion occurs at about 3.8 mm
- Dorsal and anal fin origins located at same level in larvae and adults
- **Photophores**

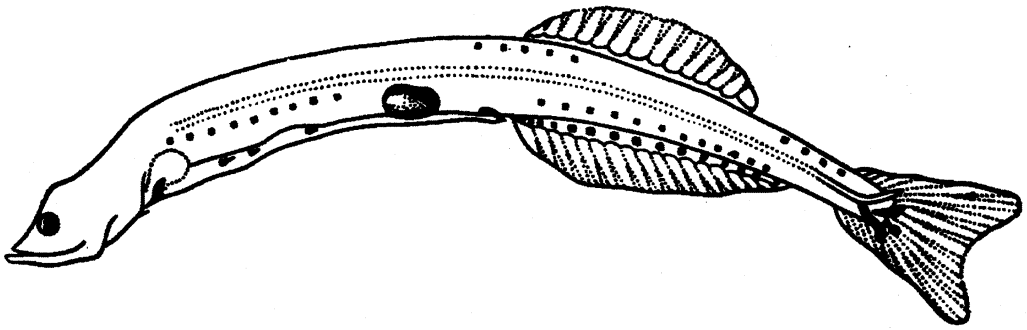
Sequence of development:	BR	VAV	AC	ORB	IV	OP	OA
Definitive # (adult) in group:	9–10	5	14–15	1	12–13	2	8–9

- Pigmentation includes prominent spot or streak on ventral part of caudal peduncle along edge of parahypural; scattered melanophores present on base of caudal fin; a series of about 12 (internal) melanophores on lower body over anal fin; previous series with a parallel series on anal fin ray bases; about 9 spots on lower body over anterior gut, aligned with myosepta; air bladder pigmented; about 5 spots on upper body under anterior dorsal fin and 4 on upper part of caudal peduncle.
- Transformation size unknown

Note:
1. *Cyclothone* larvae have separate photophores, most or all of which form simultaneously during the late larval stage; the dorsal fin base is relatively long and the pelvic and anal fins are separated by a short gap; they lack photophores on the isthmus and have low numbers in ventral series.
2. Best characters for *Cyclothone microdon* include scattered pigment on base of caudal fin and numbers of melanophores in each of 4 series
3. Larvae described as *Cyclothone microdon* by Jespersen and Tåning (1926) may pertain to larvae of another species

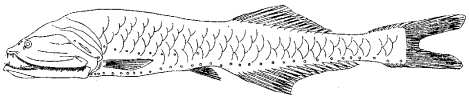
Figures: Adult: Badcock, 1984a; **A**: Mukhacheva, 1954
References: Ahlstrom *et al*., 1984c; Badcock, 1984a

Cyclothone microdon



A. 8.0 mm

Cyclothone pallida Brauer, 1902
Gonostomatidae
No common name



Meristic Characters

Myomeres:	about 31–32
Vertebrae:	31–33
Dorsal fin rays:	12–15
Anal fin rays:	16–19
Pectoral fin rays:	9–11
Pelvic fin rays:	6–7
Caudal fin rays:	6–7+10+9+6–7

Range: Worldwide in tropical to subtropical waters; in the western North Atlantic from LaHave Bank, Nova Scotia to Caribbean Sea

Habitat: Deep mesopelgic in depths of 400–1,500 m

Spawning: Undescribed

Eggs: – Undescribed

Larvae:
- Elongate body with preanus length slightly >50% SL
- Eye round
- Mouth terminal and large, ultimately extending to well posterior to eye
- Air bladder conspicuous; located over posterior gut
- Sequence of fin ray development: C – A, D – P_1 – P_2
- Flexion occurs at unknown size
- Dorsal and anal fin origins located at same level in larvae and adults

- **Photophores**

Sequence of development:	BR	VAV	AC	ORB	IV	OP	OA
Definitive # (adult) in group:	10–11	5	14–15	1	13	2	8

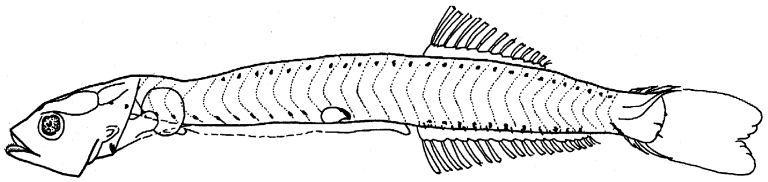
- Pigmentation includes prominent spot or streak on ventral part of caudal peduncle along edge of parahypural; few melanophores scattered on base of caudal fin; series of 15 (11 internal) melanophores on lower body over anal fin; a long series of about 25–26 spots along upper body, 9–12 of which are anterior to dorsal fin origin; 9 melanophores form in early larvae over anterior gut, following the myosepta; air bladder pigmented on posterodorsal surface; a prominent spot at cleithral symphysis
- Transformation occurs at sizes >12.5 mm

Note:
1. *Cyclothone* larvae have separate photophores, most or all of which form simultaneously during the late larval stage; the dorsal fin base is relatively long and the pelvic and anal fins are separated by a short gap; they lack photophores on the isthmus and have low numbers in ventral series.
2. Best characters for *Cyclothone pallida* include presence of pigment on base of caudal fin; about 15 melanophores in series above anal fin; 9–12 melanophores along upper body anterior to dorsal fin

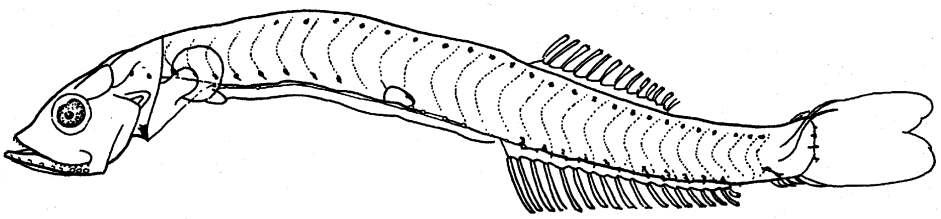
Figures: Adult: Grey, 1964; **A–C**: Ozawa and Oda, 1986a

References: Grey, 1964; Ahlstrom *et al*., 1984c; Richards, 2001

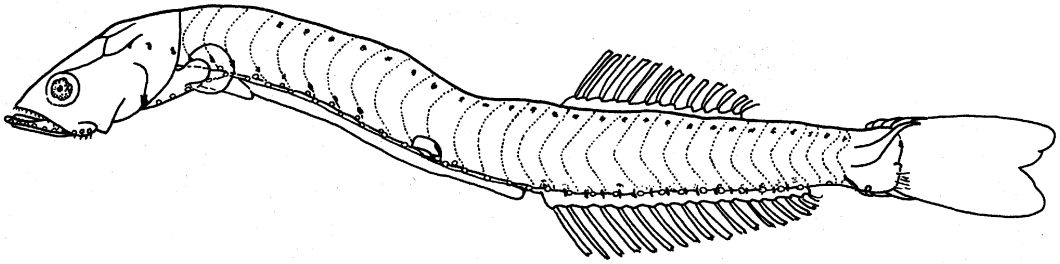
Cyclothone pallida



A. 7.8 mm About 9 melanophores form on lower body over anterior gut in early larvae

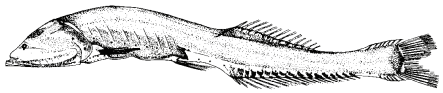


B. 10.3 mm Series of melanophores along upper body includes 9-12 anterior to dorsal fin origin



C. 12.5 mm

Cyclothone pseudopallida Mukhacheva, 1964
Gonostomatidae
No common name



Meristic Characters

Myomeres:	about 29–34
Vertebrae:	29–34
Dorsal fin rays:	12–15
Anal fin rays:	17–21
Pectoral fin rays:	9–10
Pelvic fin rays:	6–7
Caudal fin rays:	6–7+10+9+6–7

Range: Worldwide in tropical and subtropical waters; in the western North Atlantic from Grand Bank and Scotian Shelf to Caribbean Sea

Habitat: Meso- and bathypelagic in depths of 300–1,250 m

Spawning: Undescribed

Eggs:
- Undescribed

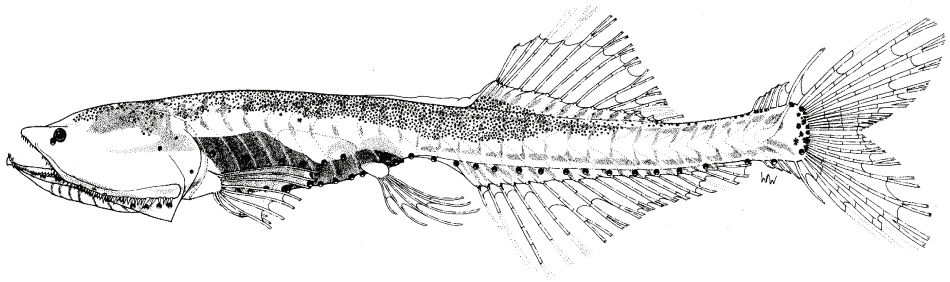
Larvae:
- Elongate body with preanus length slightly >50% SL
- Eye round
- Mouth terminal and large, ultimately extending well posterior to eye
- Air bladder conspicuous; located over posterior gut
- Sequence of fin ray development: C_1 – D, A, C_2 – P_2 – P_1
- Flexion occurs at about 5–6 mm
- Dorsal and anal fin origins located at same level in larvae and adults
- **Photophores**

Sequence of development:	BR	VAV	AC	ORB	IV	OP	OA
Definitive # (*adult*) *in group*:	10	5	14	1	13	2	8

- Pigmentation includes prominent spot or streak on ventral part of caudal peduncle along edge of parahypural; scattered pigment present on base of caudal fin; a pair of spots on sides of anterior gut; a single spot at cleithral symphysis; series of 14 external (8 internal) spots along lower body above anal fin; about 10 melanophores on myosepta above anterior gut; a series of spots along upper body including 2–4 anterior to dorsal fin
- Transformation occurs at sizes of 16.5–22.0 mm

Note:
1. *Cyclothone* larvae have separate photophores, most or all of which form simultaneously during the late larval stage; the dorsal fin base is relatively long and the pelvic and anal fins are separated by a short gap; they lack photophores on the isthmus and have low numbers in ventral series.
2. Best characters for *Cyclothone pseudopallida* include pigment scattered on base of caudal fin; a series of melanophores along upper body including 2–4 anterior to dorsal fin origin

Early Juvenile:

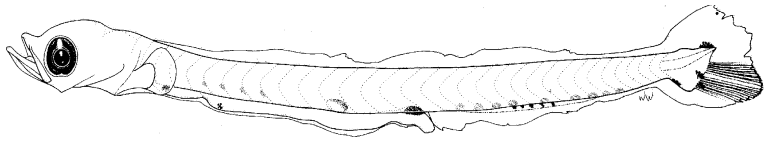


E. 21.1 mmSL

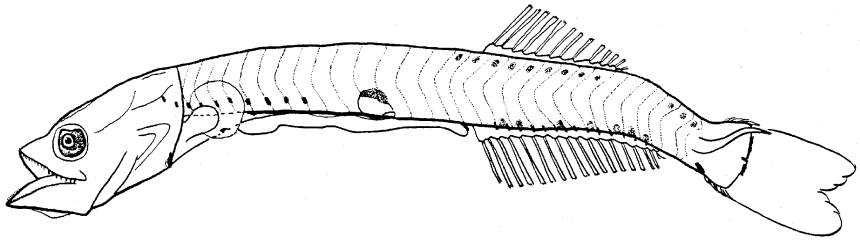
Figures: Adult: Badcock, 1984a; **A**, **C–E**: William Watson (Watson, 1996b); **B**: Ozawa and Oda, 1986a

References: Ahlstrom *et al*., 1984c;

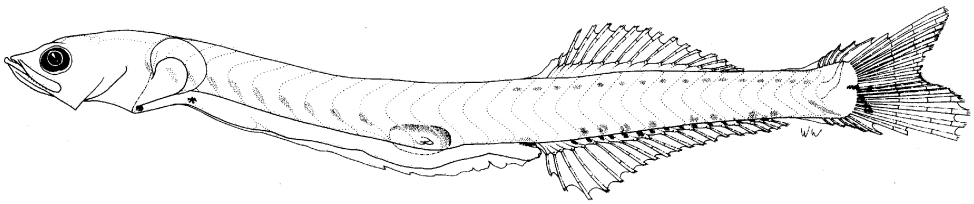
Cyclothone pseudopallida



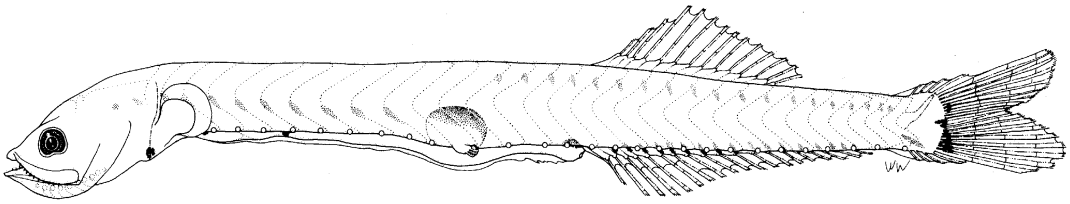
A. 5.5 mmSL



B. 7.4 mmSL

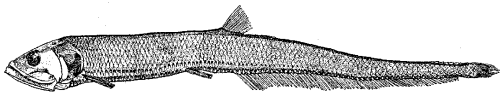


C. 10.8 mmSL



D. 14.4 mmSL

Diplophos taenia Günther, 1873
Gonostomatidae
No common name



Range: Worldwide in tropical waters; in the western North Atlantic from Georges Bank to the Caribbean Sea

Habitat: Mesopelagic, usually in depths of 300–800 m during day, vertically migrate at night to near surface; larvae usually occur near surface day and night

Spawning: Undescribed

Meristic Characters

Myomeres:	about 92–98
Vertebrae:	92–98
Dorsal fin rays:	12–13
Anal fin rays:	59–72
Pectoral fin rays:	8–10
Pelvic fin rays:	7–8
Caudal fin rays:	3–6+10+9+3–4

Eggs:
- Undescribed

Larvae:
- Hatch at about 3.5–5.0 mm with few melanophores near notochord tip
- Body very elongate and slender; 43–50 preanal myomeres; 89–99 total myomeres
- Preanus length decreases from 70% SL to 58% SL through development
- Eyes oval in early stages, become round after flexion, then decrease in relative size
- Head length decreases from 15% SL to 11% SL; head flat in small larvae; snout pointed
- Mouth small, terminal on long snout; maxilla does not extend to level of eye until after transformation
- Body depth decreases from 5% SL to 3.5% SL
- Air bladder forms at about 20 mm, about equal to eye diameter
- Flexion occurs at 19–28 mm
- Sequence of fin ray formation: $C_1 - A - D - C_2 - P_2 - P_1$
- **Photophores**

Sequence of development	OP	AC	BR	IV	Orb	OP	VAV	OA	SO
Definitive # (*adult*) *in group*:	3	45–51	10–13	44–51	1	3	14–16	66–71	1

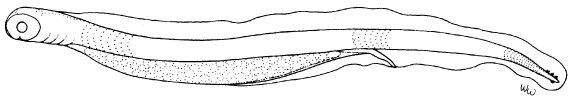
- Pigmentation includes prominent series of 25–35 dorsal melanophores and 9–22 ventral melanophores on tail; 11–20 pairs of spots along dorsal surface of gut; few spots on isthmus, hindbrain, lower jaw; pigment increases along entire dorsal surface and lateral midline at transformation
- Transformation gradual, occurs at 43–52 mm; larvae shrink to about 30 mm before growth resumes

Note:
1. Photophores form singly as white buds in large larvae, usually near transformation; most ventral photophores form simultaneously, others added gradually; photophores become pigmented after transformation
2. Dorsal and anal fins migrate anteriorly at transformation

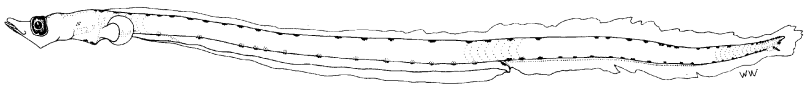
Figures: Adult: Ozawa *et al*., 1990; **A–C**, **E**: William Watson (Watson, 1996b); **D**: Jack Javech (Ahlstrom *et al*., 1984c)

References: Jespersen and Tåning, 1919; Ahlstrom *et al.*, 1984c; Badcock, 1984a; Ozawa and Oda, 1986b

Diplophos taenia



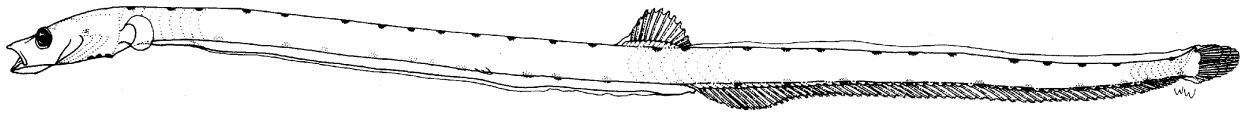
A. 5.1 mmSL



B. 17.2 mmSL

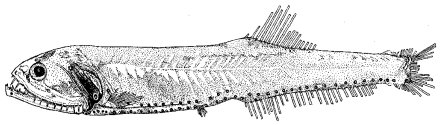
C. 21.5 mmSL

D. 22.0 mmSL



E. 43.0 mmSL

Gonostoma atlanticum Norman, 1930
Gonostomatidae
No common name



Range: Worldwide in tropical waters; in the western North Atlantic from Grand Bank to Brazil

Habitat: Mesopelagic, in depths of 50–1,000 m, deeper during day, closer to surface at night

Spawning: Undescribed, but larvae collected throughout the year in tropical waters, Aug–Sep in study area

Meristic Characters

Myomeres:	37–40
Vertebrae:	38
Dorsal fin rays:	16–18
Anal fin rays:	28–30
Pectoral fin rays:	10
Pelvic fin rays:	6–7
Caudal fin rays:	7–8+10+9+6–7

Eggs: – Undescribed

Larvae:
- Slender body with anus located just >50% SL
- Eye oval
- Teeth visible on maxilla in larvae >12.0 mm
- Mouth large, reaching middle of eye in larvae, well posterior to eye at transformation
- Loop forms in hindgut, under prominent air bladder
- Preanus myomeres: 17–19
- Sequence of fin ray formation: C – A – D – P_1 – P_2
- Anal fin origin slightly anterior to dorsal fin origin
- Pectoral fin forms on peduncle
- Flexion occurs at 4.5–6.0 mm
- **Photophores**

Sequence of development:	OP	IV	ORB	BR	VAV	AC	OA	SO
Definitive # (*adult*) *in group*:	2	15–16	1	9	5	19	13	1

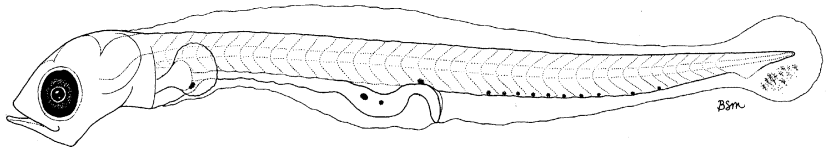
- Posterior IV photophores form first; OA and SP form after transformation
- AC photophores develop together
- Pigmentation includes series of 5–18 melanophores along ventral margin of tail; usually a deep pigment spot behind eye; early larvae have pair of spots on gut near pectoral fin, and 0–2 pairs on gut loop; later larvae have series of spots along lower body from pectoral fin to air bladder, and add another series along anal fin base; air bladder pigmented; a cluster of spots forms over hypural in later larvae
- Transformation occurs at about 15–21 mm

Note:
1. Photophores form separately, none on isthmus
2. Note lack of pigment streak parallel to parahypural as in *Cyclothone* larvae

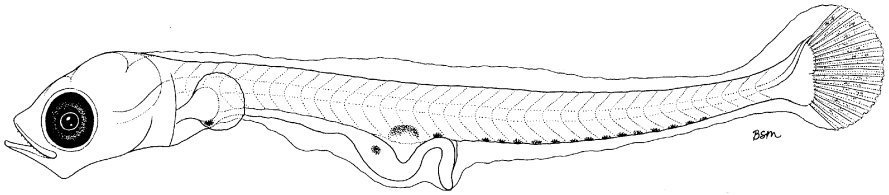
Figures: Adult: Janet Wright (Grey, 1964); **A–B**: Barbara Sumida M^{ac}Call (Watson, 1996b); **C**: Henry Orr (Ahlstrom, 1974); **D**: William Watson (Watson, 1996b)

References: Grey, 1964; Ahlstrom, 1974; Ahlstrom *et al.*, 1984c

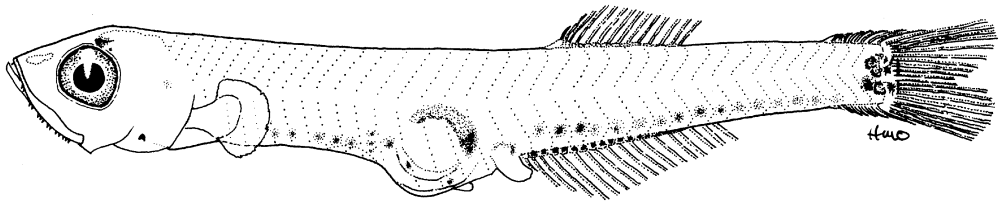
Gonostoma atlanticum



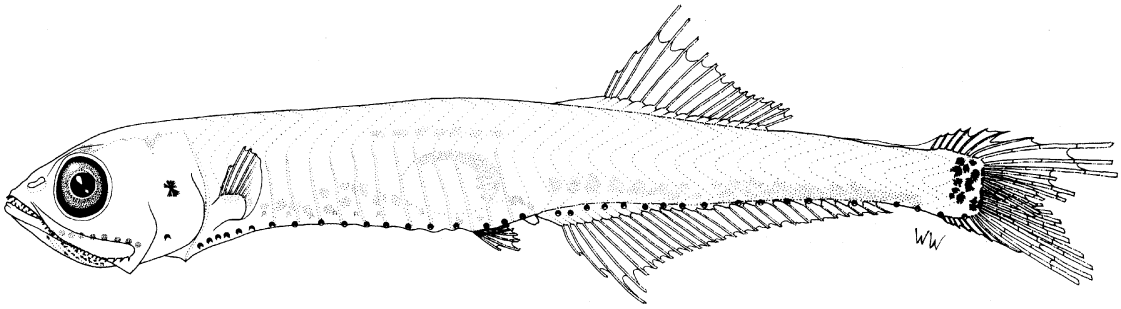
A. 5.4 mmSL



B. 6.0 mmSL

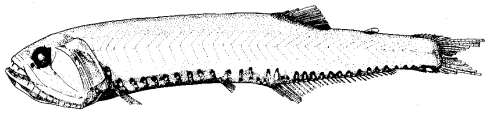


C. 12.0 mmSL



D. 19.8 mmSL

Gonostoma denudatum Rafinesque, 1810
Gonostomatidae
No common name



Range: Temperate and subtropical eastern Atlantic Ocean and Mediterranean Sea; included here based on 2 larval lots in MCZ collected within present study area (MCZ 80115; 39°24'N, 43°59'W and MCZ 80073; 41°07'N, 46°03.5'W)

Habitat: Mesopelagic, usually associated with island or continental slopes; occur at depths of 400–700 m during day, shallower at night

Spawning: Undescribed, larvae collected in study area Apr–Sep

Meristic Characters

Myomeres:	38–39
Vertebrae:	39
Dorsal fin rays:	14–15
Anal fin rays:	28–30
Pectoral fin rays:	11–12
Pelvic fin rays:	8
Caudal fin rays:	10+9 (PrC)

Eggs:
- Undescribed

Larvae:
- Slender body with anus located just >50% SL
- Eye oval
- Mouth large, extending to posterior eye at transformation, well posterior to eye in adults
- Loop forms in hindgut, under prominent air bladder
- Preanus myomeres: 18–20
- Flexion begins at about 7.0 mm
- Sequence of fin ray formation: C – A – D – P_1 – P_2
- Anal fin origin about level with dorsal fin origin
- Late-forming adipose fin present
- **Photophores**

Sequence of development:	OP	IV	AC	BR	VAV	ORB	OA	SO
Definitive # (adult) in group:	3	15–16	17–20	9	5	1	13–15	1

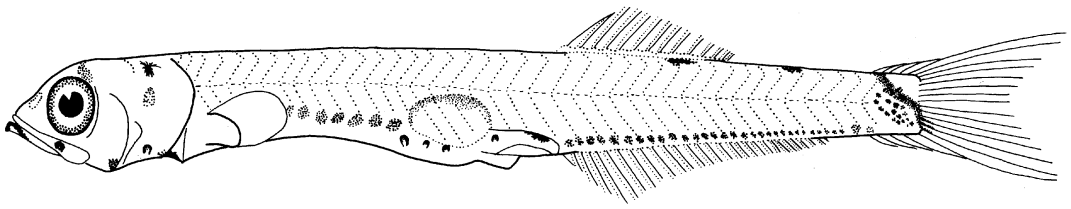
- Posterior IV photophores form first; OA and SP form after transformation
- Pigmentation includes series of melanophores along ventral margin of tail; usually a deep pigment spot behind eye; early larvae have 0–2 pairs of spots on gut loop; later larvae have series of spots along lower body from pectoral fin to air bladder; air bladder pigmented; a dark, diagonal streak of pigment forms over hypural in early larvae and later stages have melanophores added to the lower caudal peduncle; at about 20 mm, 2 spots form on dorsum, 1 under dorsal fin base, 1 on upper caudal peduncle; a melanophore also occurs on top of the posterior head

Note:
1. Best characters for distinguishing larvae of *G. denudatum* from congeners include diagonal streak of hypural pigment, 2 melanophores on dorsum under and posterior to dorsal fin, and prominent spot on top of posterior head; late-forming adipose fin present
2. Note lack of pigment streak parallel to parahypural as in *Cyclothone* larvae
3. Photophores form separately, none on isthmus

Figures: Adult: Badcock, 1984a; **A**: Henry Orr (Ahlstrom *et al*., 1984c)

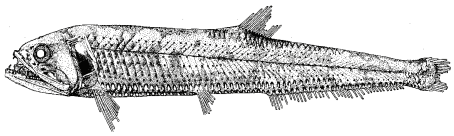
References: Sanzo, 1931a; Ahlstrom *et al*., 1984c

Gonostoma denudatum



A. 20.7 mmSL

Manducus maderensis (Johnson, 1890)
Gonostomatidae
No common name



Range: Endemic to tropical and subtropical Atlantic Ocean; in the western North Atlantic known from as far north as 37°39′N

Habitat: Mesopelagic, occurring at depths of 450–600 m, migrating vertically to shallower levels (<100 m) at night; usually associated with edges of continental or island shelves

Spawning: Undescribed; larvae rarely collected in study area in Aug

Meristic Characters

Myomeres:	about 63
Vertebrae:	63
Dorsal fin rays:	10–13
Anal fin rays:	34–41
Pectoral fin rays:	10–11
Pelvic fin rays:	8
Caudal fin rays:	10+9 (PrC)

Eggs: – Undescribed

Larvae:
- Body moderately elongate; body depth about 9% SL
- Preanus length 70% SL
- Prominent annular, mucosal folds along length of intestine
- Mouth large, extending to middle of eye in larvae, well posterior to eye at transformation
- Length at flexion unknown
- Sequence of fin ray formation: C – D – A – P_1, P_2
- Dorsal fin origin posterior to mid-point of body, well anterior to anal fin origin
- Pelvic fins are late-forming, well anterior to dorsal fin origin
- **Photophores**

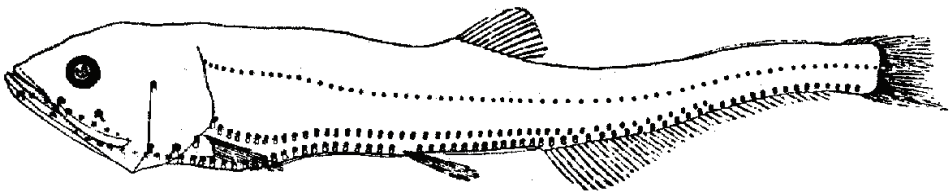
Sequence of development:	IV	VAV	AC	OA	BR	SO	ORB	OP
Definitive # (adult) in group:	30–33	12–14	28–30	45–48	8–9	1	1	3

- Pigmentation includes a series of 22 melanophores on dorsolateral body, from level of pectoral fin to caudal peduncle; a scattering of small spots on top of posterior part of head; an internal streak of pigment anterior and posterior to eye; a mid-ventral line of spots on isthmus and along edge of lower jaw; a series of spots occurs over anal fin base; a scattering of spots occurs over the hypural
- Transformation occurs at 15–18 mm

Note:
1. Larvae are best distinguished from other gonostomatids by presence of mucosal folds along intestine and by the long, dorsolateral row of melanophores (also present in *Cyclothone acclinidens* and *C. pallida*)
2. Note lack of pigment streak parallel to parahypural as in *Cyclothone* larvae

Early Juvenile:

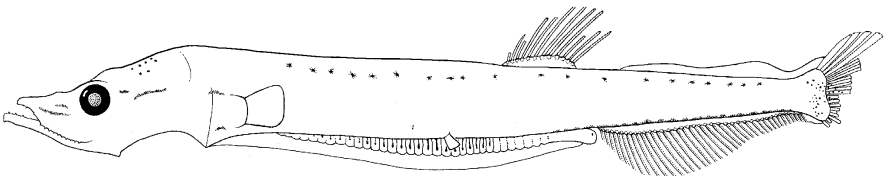
C. 17.0 mm



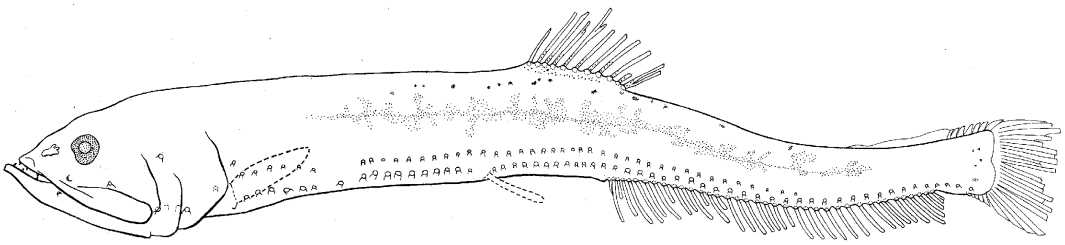
– Note formation of lateral photophores along midline

Figures: Adult: Janet Wright (Grey, 1964); **A–B**: L. Meszoly (Smith *et al*., 1991); **C**: Jespersen and Tåning, 1919
References: Ahlstrom *et al*., 1984c; Smith *et al*., 1991

Manducus maderensis

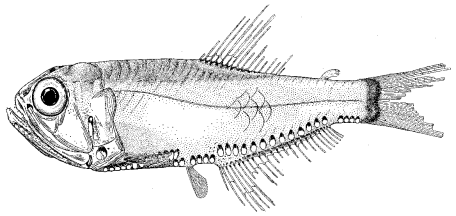


A. 10.0 mmSL



B. 18.0 mmSL

Margrethia obtusirostre Jespersen & Tåning, 1919
Gonostomatidae
No common name



Range: Atlantic Ocean in tropical and subtropical waters; in the western North Atlantic from Scotian Shelf to northern South America

Habitat: Mesopelagic, at depths of 100–600 m; usually associated with slopes of islands or continents

Spawning: Spring, summer and fall; larvae collected in study area Apr–Sep

Meristic Characters

Myomeres:	about 34
Vertebrae:	34
Dorsal fin rays:	15–16
Anal fin rays:	21–26
Pectoral fin rays:	13–15
Pelvic fin rays:	8
Caudal fin rays:	10+9 (PrC)

Eggs: – Undescribed

Larvae:
- Moderately deep-bodied with large head
- Oval eye in early larvae, becomes round later
- Mouth large, extending well posterior to eye
- Sequence of fin ray development: C – A – D – P_1 – P_2
- Dorsal and anal fin origins at about equal levels, or dorsal slightly anterior
- Anterior rays in dorsal and anal fins longest
- Pelvic fin located slightly anterior to dorsal fin origin
- Adipose fin present (forms early)
- Pectoral fin forms on peduncle
- **Photophores**

Sequence of development:	OP	IV	VAV	AC	BR	ORB	SO	OA
Definitive # (adult) in group:	3	13–15	4	16–18	9–12	1	None	None

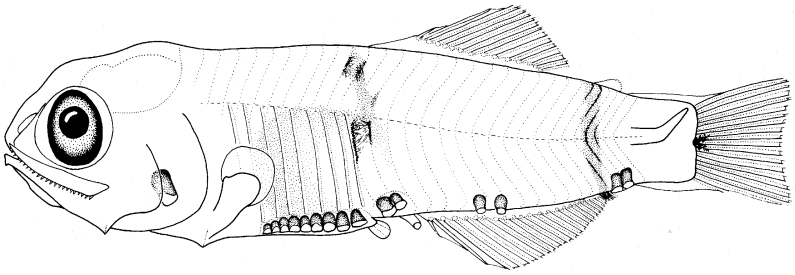
- Posterior IV photophores form before anterior
- All photophores separate, none on isthmus
- Pigmentation includes a ring around caudal peduncle under adipose fin (present in most larvae); larger larvae develop a smudge of pigment on body under dorsal fin origin; peritoneal pigment present; a single melanophore on base of central caudal fin rays

Note: 1. Best characters to distinguish larvae from other gonostomatids include deep-bodied morphology, meristic characters and pigment pattern (if present)

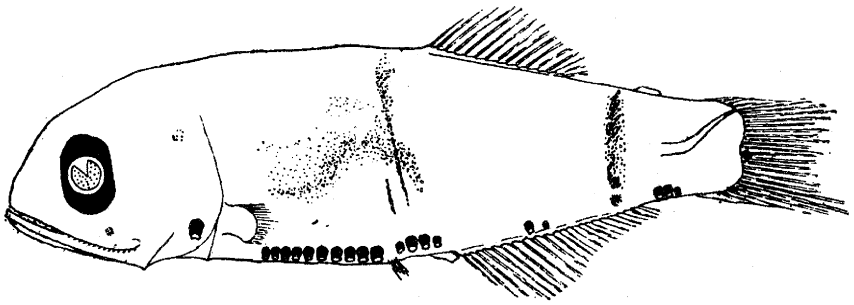
Figures: Adult: Grey, 1955; **A**: Jack Javech (Ahlstrom *et al*., 1984c); **B–C**: Jespersen and Tåning, 1919

References: Jespersen and Tåning, 1919; Badcock, 1984a; Ahlstrom *et al*., 1984c

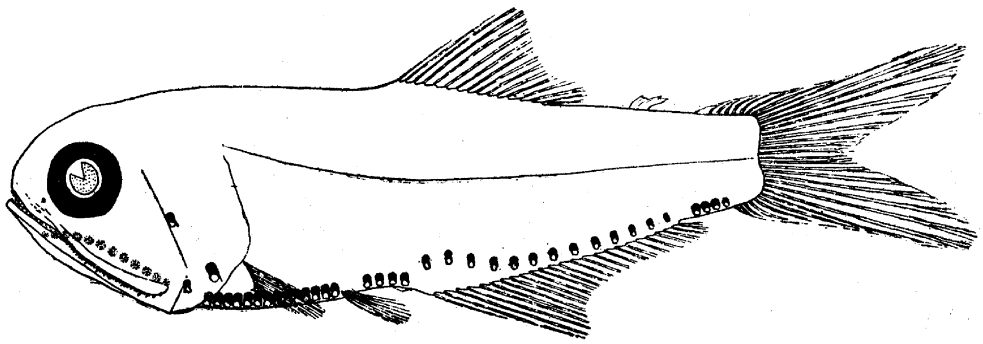
Margrethia obtusirostre



A. 6.7 mmSL

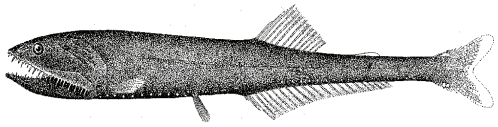


B. 7.0 mmSL Bars of pigment on body not typical



C. 19.0 mmSL

Sigmops bathyphilum (Vaillant, 1888)
Gonostomatidae
No common name



Range: Worldwide in tropical waters; in the western North Atlantic from Greenland to Caribbean Sea

Habitat: Meso- and bathypelagic in depths of 700–2,700 m; larvae in near-surface layers

Spawning: Undescribed

Meristic Characters

Myomeres:	about 37
Vertebrae:	37
Dorsal fin rays:	12–14
Anal fin rays:	22–24
Pectoral fin rays:	10–11
Pelvic fin rays:	7–8
Caudal fin rays:	10+9 (PrC)

Eggs:
- Undescribed

Larvae:
- Slender body with preanus length <50% SL
- Preanus myomeres: fewer than 20
- Eye round (described as oval in juveniles)
- Mouth large, extending to posterior edge of eye in larvae, well posterior to eye at transformation
- Prominent air bladder
- Sequence of fin ray formation: C – A – D – P_1 – P_2
- Anal fin origin slightly anterior to dorsal fin origin
- Pelvic fin origin well anterior to dorsal fin origin
- Pectoral fin forms on peduncle
- Flexion occurs at <11.0 mm
- Photophores begin formation at about 11.0 mm, as unpigmented spots
- **Photophores**

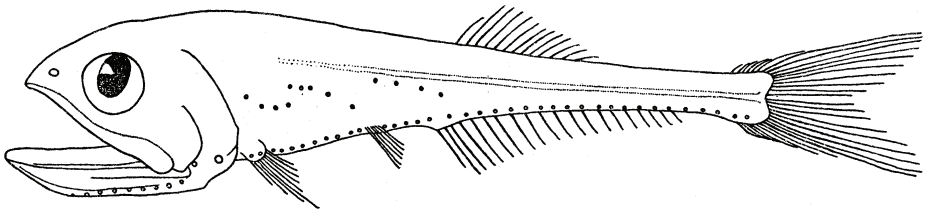
Sequence of development:	OP	IV	BR	VAV	ORB	AC	OA	SO
Definitive # (*adult*) *in group*:	3	11–13	9–10	4–5	1	18–21	14–15	1

- Pigmentation includes internal spot behind eye and on upper surface of gut and air bladder; series of 4 melanophores on upper part of caudal peduncle; spot at snout tip
- Transformation occurs at >14.8 mm

Note:
1. Best characters for distinguishing *S. bathyphilum* from other gonostomatids include series of melanophores on upper caudal peduncle, relative positions of fins and meristic characters

Early Juvenile:

B. 20.0 mm

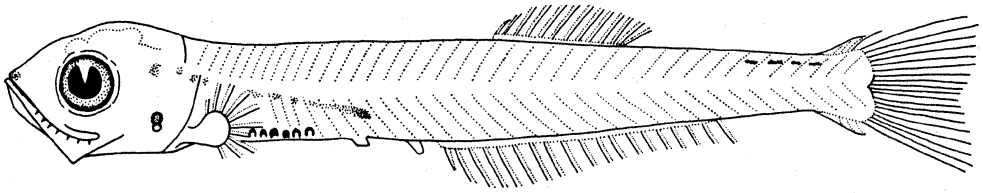


Most photophores complete, except SO and 3rd OP

Figures: Adult: Goode and Bean, 1896; **A**: Henry Orr (Ahlstrom, 1974); **B**: Koefoed, 1910

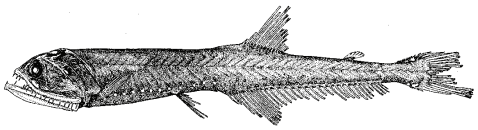
References: Grey, 1964; Ahlstrom, 1974; Badcock, 1984a; Ahlstrom *et al*., 1984c; Miya and Nishida, 2000

Sigmops bathyphilum



A. 11.0 mmSL

Sigmops elongatum (Günther, 1878)
Gonostomatidae
No common name



Range: Worldwide in tropical and subtropical waters; in the western North Atlantic from Grand Bank to northern Brazil, including Caribbean Sea

Habitat: Meso- and bathypelagic in depths of 500–1,200 m (25–600 m at night); larvae in near-surface layers

Spawning: Undescribed, but larvae collected throughout the year, mostly in tropical waters, but also in study area

Eggs: – Undescribed

Meristic Characters

Myomeres:	about 39
Vertebrae:	39
Dorsal fin rays:	12–14
Anal fin rays:	29–32
Pectoral fin rays:	10–11
Pelvic fin rays:	8
Caudal fin rays:	10+9 (PrC)

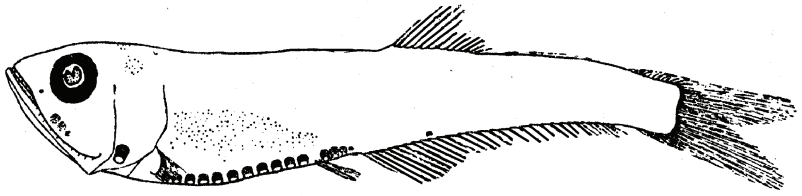
Larvae:
- Slender body with preanus length <50% SL
- Preanus myomeres: 15–18
- Eye oval
- Mouth large, extending to middle of eye in larvae, well posterior to eye at transformation
- Prominent air bladder
- Flexion occurs at 4.7–5.3 mm
- Sequence of fin ray formation: C – A – D – P_1 – P_2
- Anal fin origin slightly anterior to dorsal fin origin
- Pelvic fin origin anterior to dorsal fin origin
- Pectoral fin forms on peduncle
- Adipose fin present; forms late in development
- Photophores begin formation at about 6.0 mm, as unpigmented spots; complete by 22.0 mm
- **Photophores**

Sequence of development:	OP	IV	BR	VAV	ORB	AC	OA	SO
Definitive # (adult) in group:	3	15	8–9	4–6	1	21–23	13–14	1

- No pigment in early larvae; later stages have internal spot behind eye and on upper surface of air bladder; internal pigment on hindbrain
- Transformation occurs at 16.0–21.0 mm

Note:
1. Best characters for distinguishing *S. elongatum* from other gonostomatids include relative positions of fins and meristic characters; late-forming adipose fin present
2. Unpigmented early stages similar to *Valenciennellus tripunctulatus*; larvae of the latter have a late-forming, short-based dorsal fin with very few rays (7)

Early Juvenile:



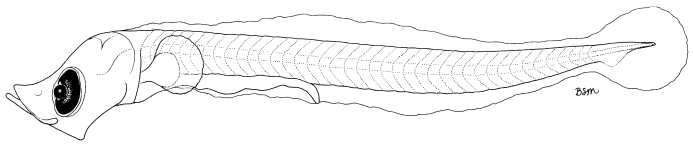
F. 16.7 mm

- Photophores formed include OP, IV, some VAV

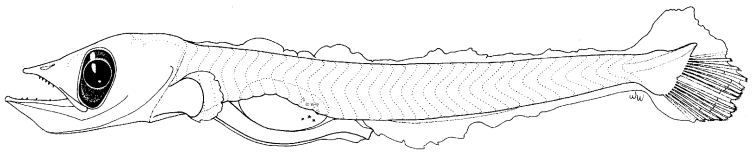
Figures: Adult: Goode and Bean, 1896; **A**: Barbara Sumida M[ac]Call (Watson, 1996b); **B**: William Watson (Watson, 1996b); **C–D**: Ozawa, 1986b (**D** reversed); **E**: Henry Orr (Ahlstrom, 1974); **F**: Jespersen and Tåning, 1919 (fin rays restored)

References: Grey, 1964; Ahlstrom, 1974; Badcock, 1984a; Ahlstrom *et al*., 1984c; Miya and Nishida, 2000

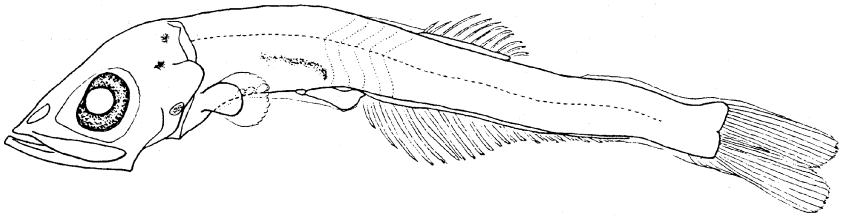
Sigmops elongatum



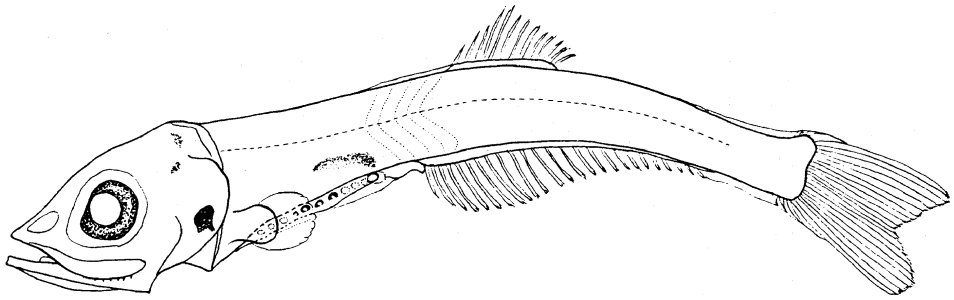
A. 4.6 mmSL No pigment in earliest stages



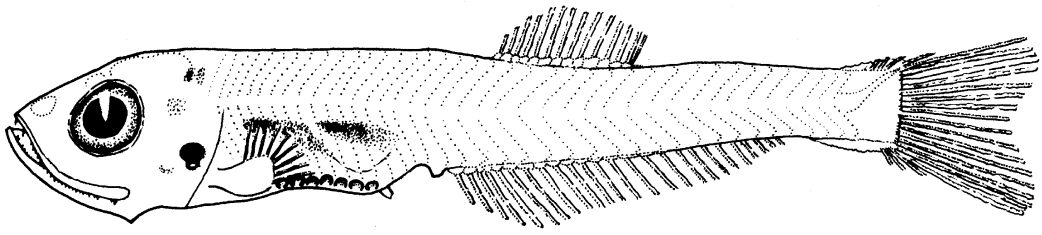
B. 4.7 mmSL Note concave head profile in early larvae



C. 6.8 mmSL

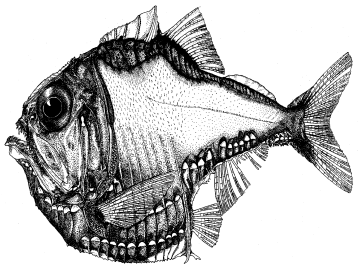


D. 8.0 mmSL



E. 9.8 mmSL

Argyropelecus aculeatus Valenciennes, 1849
Sternoptychidae
Atlantic silver hatchetfish



Range: Worldwide in tropical waters; in the western North Atlantic from Flemish Cap to Gulf of Mexico and Caribbean Sea

Habitat: Mesopelagic in depths of 200–500 m during day, as shallow as 80 m at night; occasional collections from >1,200 m

Spawning: Undescribed; larvae abundant in spring, but occur year-round, primarily in tropical waters

Meristic Characters

Myomeres:	about 34–36
Vertebrae:	34–36
Dorsal fin rays:	9
Anal fin rays:	12
Pectoral fin rays:	10–11
Pelvic fin rays:	6
Caudal fin rays:	10+9 (PrC)

Eggs: – Undescribed

Larvae: – Early larvae undescribed
– Larvae of congeners:

- Very elongate, with relatively short gut
- Gut typically 'swollen' in appearance
- Eye oval and narrow in early stages
- Fin rays form within finfold, then drawn into body margin
- Caudal fin first to form fin rays

– **Photophores**

Sequence of development:	PO	PTO	BR	IS	PRO/SO	SP	AB	PAN	AN	SC	SAB	SAN
Definitive # (adult) in group:	1	1	6	6	1+1	2	12	4	6	4	6	None

– Pigment present over air bladder, around stomach, over brain, on upper body behind cleithra, below eye; pigment spreads over much of body, primarily associated with photophore groups; pigment associated with SC group expands to form distinct blotch around caudal peduncle

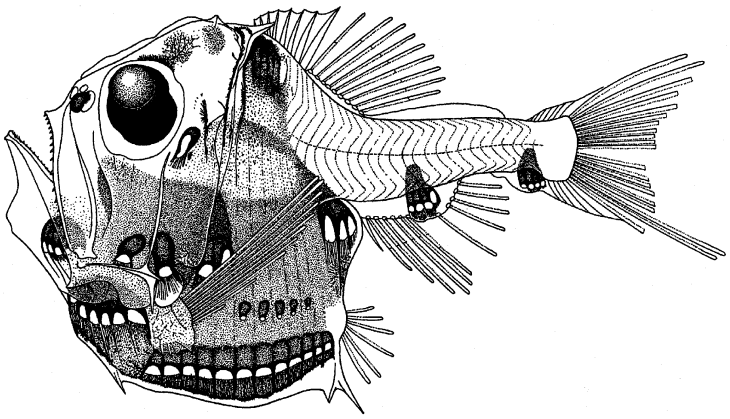
Note: 1. Photophores form in distinct groups; numbers within each group increase with development

2. Posteriorly directed postabdominal spine

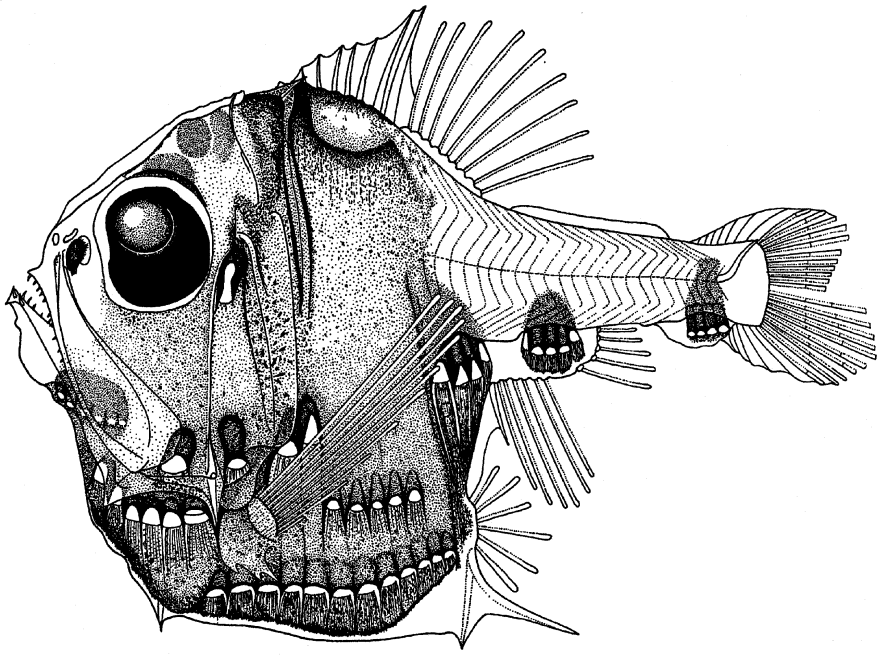
Figures: Adult: M. J. Johnson (Weitzman, 1974); **A–B**: Richards, 2001

References: Baird, 1971; Ahlstrom *et al.*, 1984c; Richards, 2001

Argyropelecus aculeatus

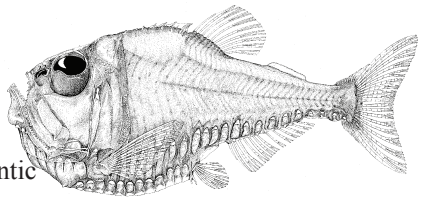


A. 9.9 mmSL



B. 12.7 mmSL

Argyropelecus affinis Garman, 1899
Sternoptychidae
Deepsea hatchetfish



Range: Worldwide in tropical and subtropical waters; in the western North Atlantic from Banquereau Bank, Nova Scotia to Caribbean Sea

Habitat: Mesopelagic, in depths of 300–600 m during day, 100–300 m at night

Spawning: Undescribed; larvae abundant in spring, but occur year-round, primarily in tropical waters

Meristic Characters

Myomeres:	38–39
Vertebrae:	38–41
Dorsal fin rays:	8–9
Anal fin rays:	12–14
Pectoral fin rays:	10–11
Pelvic fin rays:	6
Caudal fin rays:	10+9 (PrC)

Eggs:
- Undescribed

Larvae:
- Hatching occurs at lengths <3.7 mm
- Very elongate, with relatively short gut (10–15 preanus myomeres)
- Gut typically 'swollen' in appearance
- Eye oval and narrow in early stages
- Flexion occurs between 7 and 11 mm
- Fin rays form within finfold, then drawn into body margin
- Sequence of fin ray formation: $C_1 - C_2 - A, P_1 - D - P_2$
- Caudal fin first to form fin rays
- **Photophores**

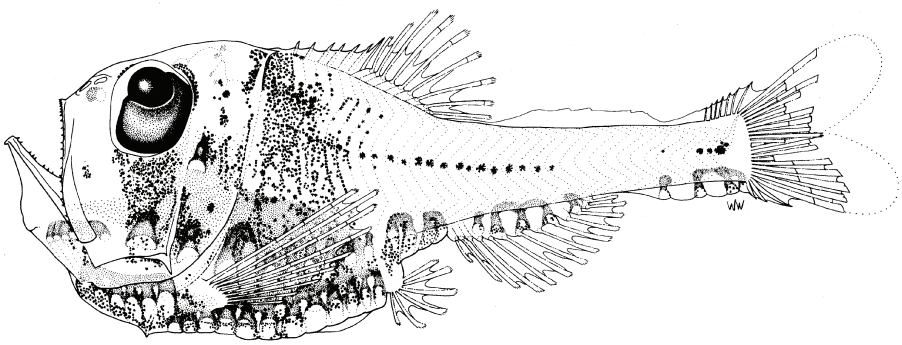
Sequence of development:	PO	BR	IS	PRO/SO	AB	SAB	PAN	AN	SC	SAN
Definitive # (*adult*) *in group*:	1	1	6	1+1	12	6	4	6	4	None

- Pigment in early stages includes internal melanophores anterior to notochord tip, condenses to single blotch in later stages; other pigmented areas include air bladder, stomach, between the eyes, over fore- and midbrain, opercle, and gut; series along lateral midline begins anteriorly at about 13–16 mm
- Transformation occurs at lengths of 10.5–15.0 mm; initial period of shrinkage during transformation

Note: 1. Photophores in AN and SC groups are widely spaced

Early Juvenile:

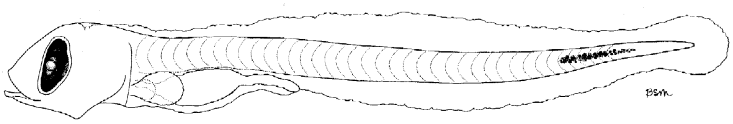
E. 16.0 mm



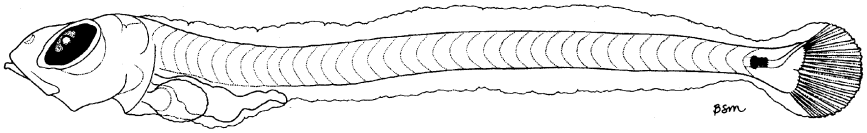
- Blade anterior to dorsal fin low in profile

Figures: Adult: Weitzman, 1974; **A–D**: Barbara Sumida M^{ac}Call (Watson, 1996b); **E**: William Watson (Watson, 1996b)
References: Baird, 1971; Ahlstrom *et al.*, 1984c; Watson, 1996b; Richards, 2001

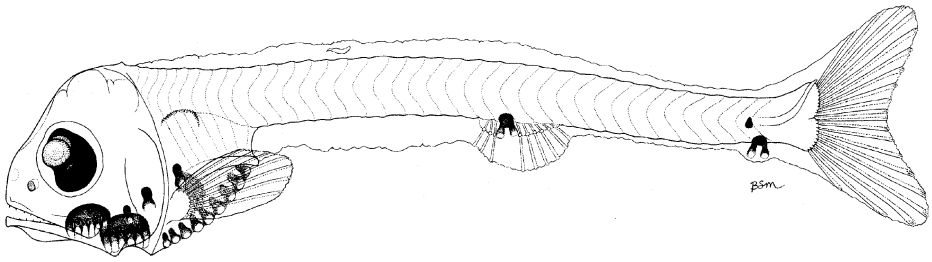
Argyropelecus affinis



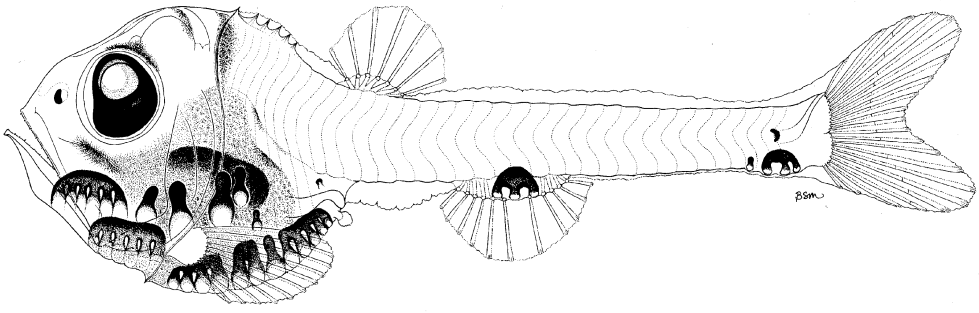
A. 5.2 mmSL Internal pigment on posterior tail becomes blotch in later stages



B. 10.4 mmSL

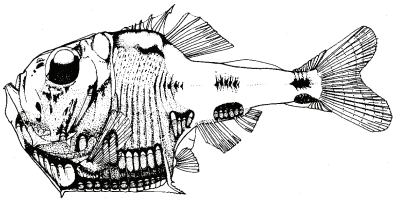


C. 11.0 mmSL



D. 11.5 mmSL Note widely spaced photophores In AN and SC groups

Argyropelecus hemigymnus Cocco, 1829
Sternoptychidae
Short silver hatchetfish



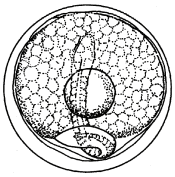
Range: Worldwide in tropical to warm temperate waters; in the western North Atlantic from Flemish Cap and Scotian Shelf to Gulf of Mexico and Caribbean Sea

Habitat: Mesopelagic, in depths of 200–800 m during day, 100–600 m at night

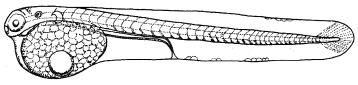
Meristic Characters

Myomeres:	38–39
Vertebrae:	36–41
Dorsal fin rays:	8–9
Anal fin rays:	11–12
Pectoral fin rays:	10–11
Pelvic fin rays:	6
Caudal fin rays:	9–10+10+9+5

Spawning: Undescribed; possibly year-round



Eggs:
- Pelagic, spherical, transparent
- Chorion: smooth (secondary membrane inside outer)
- Yolk: segmented
- Diameter: 0.92–1.04 mm
- Oil globules: single, 0.26–0.28 mm in diameter



Yolk-sac larva

Larvae:
- Hatching occurs at 2.5 mm; eyes and body unpigmented
- Very elongate, with preanus length 44–59% SL in early larvae
- 14–18 preanus myomeres initially, then 10–14
- Gut typically 'swollen' in appearance
- Eye oval and narrow in early stages
- Mouth large, extending to middle of eye in larvae
- Flexion occurs between 10 and 11 mm
- Fin rays form within finfold, then drawn into body margin
- Sequence of fin ray formation: $C_1 - P_1 - A$, $C_2 - D - P_2$
- **Photophores**

Sequence of development:	BR	IS	PRO/SO	AB	AN	SC	SP	PO	PTO	SAB	PAN	SAN
Definitive # (adult) in group:	6	6	1+1	12	6	4	2	1	1	6	4	None

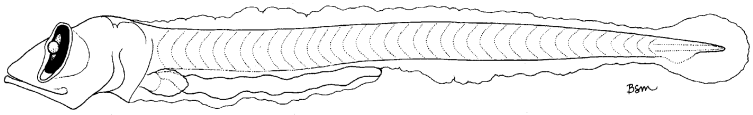
- Gap forms in anal fin at site of developing photophores
- Pigment lacking in stages before flexion; pigmented areas in later stages include air bladder, stomach, on frontal area next to eyes, opercle below eye; pigment increases on gut in later stages; early juveniles have anterior half of body heavily pigmented
- Transformation occurs at lengths of 7.8–12.0 mm; initial period of shrinkage during transformation (especially anterior part of body), gut shortens, head deepens, and eyes become telescopic

Note: 1. Juveniles may have interrupted stripe of pigment along midline

Figures: Adult: Badcock, 1984a; Egg, yolk-sac larva: Sanzo, 1931a; **A–B**: Barbara Sumida M^{ac}Call (Watson, 1996b); **C, E**: Sanzo, 1931a (reversed); **D**: Henry Orr (Ahlstrom *et al.*, 1984c)

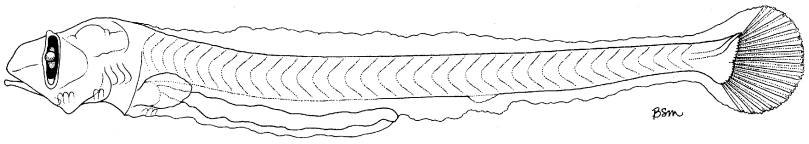
References: Jespersen and Tåning, 1926; Baird, 1971; Ahlstrom **et al**. 1984c; Watson, 1996b; Richards, 2001

Argyropelecus hemigymnus

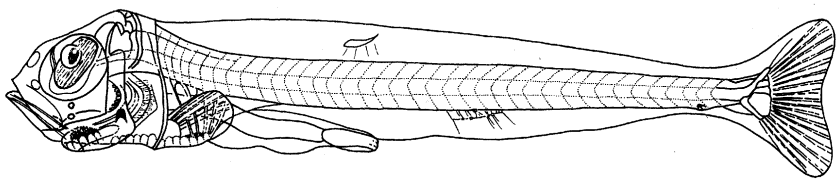


A. 6.9 mmSL

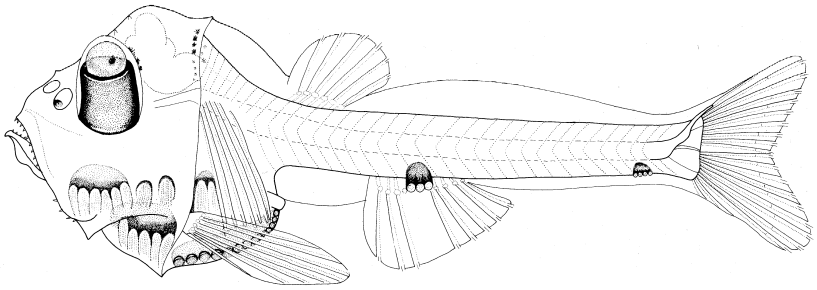
Preanus length in early larvae slightly longer than in larvae of congeners



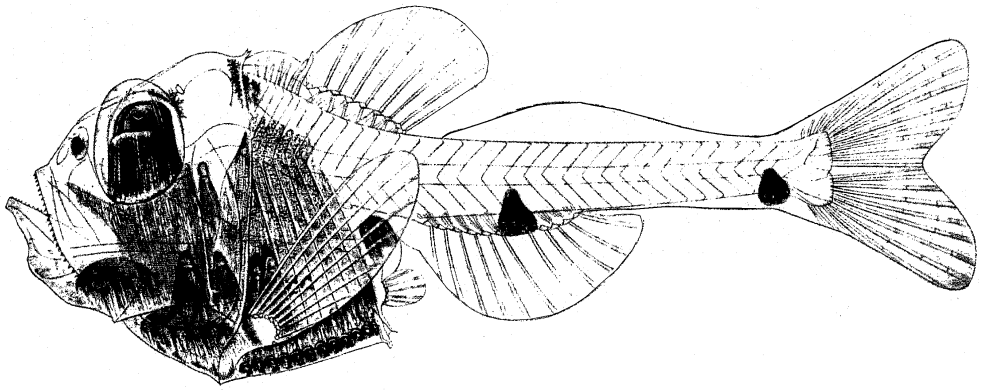
B. 10.8 mmSL



C. 10.9 mm

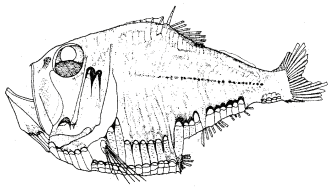


D. 7.8 mmSL



E. 11.2 mmSL

Argyropelecus sladeni Regan, 1908
Sternoptychidae
Silvery hatchetfish



Range: Worldwide in tropical to temperate waters; in the western North Atlantic from Grand Bank to southern Brazil

Habitat: Mesopelagic, in depths of 350–600 m during day, 100–375 m at night

Spawning: Undescribed; possibly year-round

Eggs: – Undescribed

Meristic Characters

Myomeres:	35–37
Vertebrae:	35–37
Dorsal fin rays:	9
Anal fin rays:	12
Pectoral fin rays:	10-11
Pelvic fin rays:	6
Caudal fin rays:	10–11+10+9+6–7

Larvae:
- Very elongate, with relatively short gut
- 11–12 preanus myomeres initially
- Gut typically 'swollen' in appearance
- Eye oval and narrow in early stages
- Mouth large, extending to middle of eye in larvae, well posterior to eye at transformation
- Fin rays form within finfold, then drawn into body margin
- Sequence of fin ray formation: $C_1 - P_1 - A, C_2 - D - P_2$
- Caudal fin first to form fin rays
- Flexion occurs between 7.5–11.4 mm
- **Photophores**

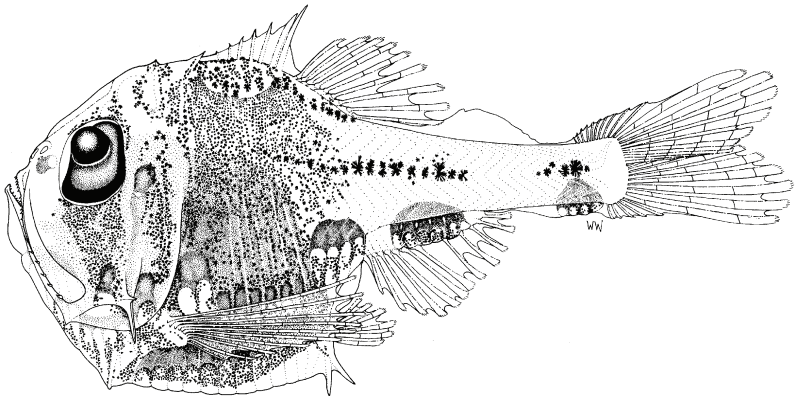
Sequence of development:	BR	IS	PRO/SO	AB	PO	SP	AN	SC	PTO	SAB	PAN	SAN
Definitive # (adult) in group:	6	6	1+1	12	1	2	6	4	1	6	4	None

- Pigment lacking in stages before flexion; pigmented areas in later stages include frontal area next to eyes, each side of midbrain, near upper cleithra, over air bladder, around stomach; later stages increase pigment over gut, on opercle and over brain; early juveniles have line of pigment anteriorly on midline and a blotch on caudal peduncle
- Transformation occurs at lengths of 8.2–13.0 mm; initial period of shrinkage during transformation

Early Juvenile: Note 2 postabdominal spines of almost equal length

E. 13.8 mmSL

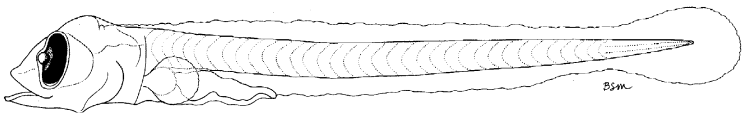
Note midline pigment anteriorly and on caudal peduncle



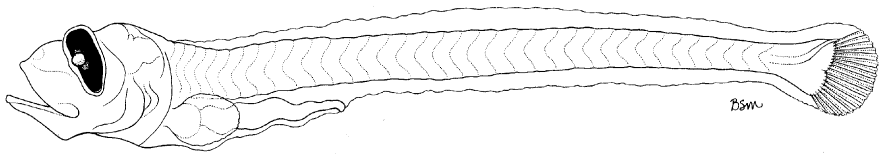
Figures: Adult: Baird, 1971; **A–D**: Barbara Sumida M^{ac}Call (Watson, 1996b); **E**: William Watson (Watson, 1996b)

References: Baird, 1971; Ahlstrom *et al*., 1984c; Watson, 1996b; Richards, 2001

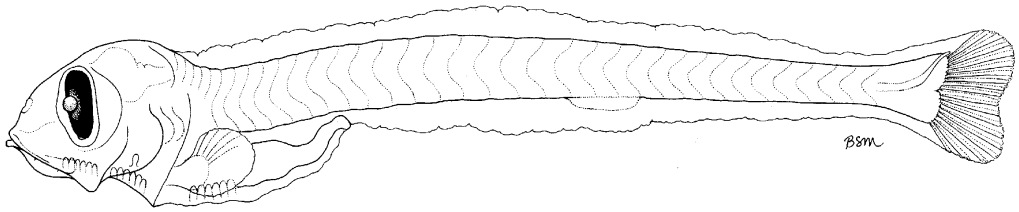
Argyropelecus sladeni



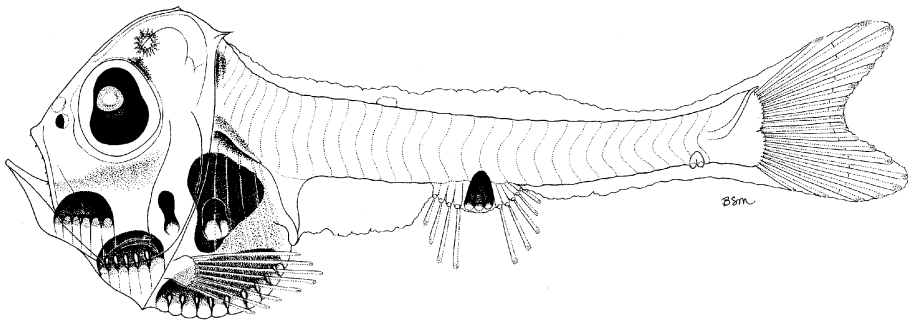
A. 5.2 mmSL



B. 9.4 mmSL

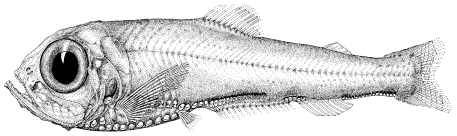


C. 10.0 mmSL



D. 8.2 mmSL

Argyripnus atlanticus Maul, 1952
Sternoptychidae
No common name



Range: Primarily tropical waters in eastern North Atlantic Ocean; rarely in the western North Atlantic north of Bahamas and in the western Caribbean Sea

Habitat: Demersal in depths of 200-475 m; found primarily off islands and over offshore banks

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

Myomeres:	45–46
Vertebrae:	45–46
Dorsal fin rays:	11–12
Anal fin rays:	13–15+9=22–25
Pectoral fin rays:	17–19
Pelvic fin rays:	6–7
Caudal fin rays:	10+9 (PrC)

Larvae:
- Slim-bodied with head length 25–28% SL; eye diameter 11–13% SL
- Preanus length about 43% SL; increases to about 50% SL in juveniles
- Maxilla extends to posterior edge of eye
- Adipose fin present
- Flexion size unknown
- Gap in anal fin rays (see Fig. A)
- Anal fin origin even with or slightly anterior to dorsal fin origin
- Photophores begin to appear at about 16 mm

– **Photophores** (terminology as in Gonostomatidae)

Sequence of development:	ORB	OP	BR	IP	IV	VAV	AC	OA	SO
Definitive # (adult) in group:	1	3	6	6	10	26	22	7	None

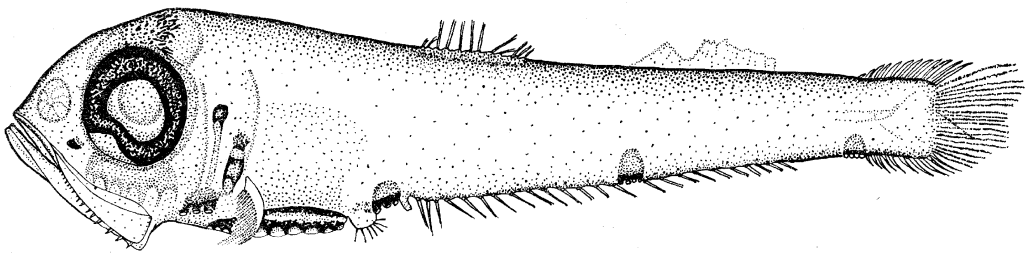
– Pigment light; melanophores only present on top of head and around photophores; some photophores without accompanying pigment (compare to larvae of *Valenciennellus tripunctulatus*)

– Transformation size unknown

Figures: Adult: Marion Johnson Dalen (Weitzman, 1974); **A**: Badcock and Merrett, 1972

References: Grey, 1964; Ahlstrom *et al*., 1984c; Richards, 2001

Argyripnus atlanticus

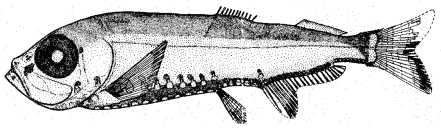


A. 18.7 mmSL

Note gap in anal fin between ray 13 and 15 (under developing middle AC photophores)

OP_3 photophore enlarged and double

Maurolicus weitzmani Parin and Kobyliansky, 1993
Sternoptychidae
Weitzman's pearlside



Range: Western North Atlantic Ocean from Grand Bank and Flemish Cap to Gulf of Mexico and Brazil; also eastern Atlantic in tropical waters

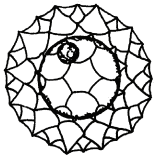
Habitat: Mesopelagic in depths of 200–400 m (maximum 549 m) during day, vertically migrating to upper 100 m at night

Spawning: Peak in summer off United States; may be more protracted in other areas

Meristic Characters

Myomeres:	32–33
Vertebrae:	32–33
Dorsal fin rays:	9–12
Anal fin rays:	22–28
Pectoral fin rays:	17–18
Pelvic fin rays:	6–7
Caudal fin rays:	10+9 (PrC)

Eggs:
- (Description pertains to Mediterranean eggs)
- Diameter: 1.32–1.58 mm (west. Atlantic to 1.65 mm)
- Chorion: sculptured with points hexagonally arranged
- Yolk: segmented
- Oil globule: single, 0.26–0.28 mm diameter
- Perivitelline space: narrow



A. 3.9 mmSL

Larvae:
- Body elongate, with preanus length 52–69% SL; gut appears 'swollen'
- Eye vertically narrowed
- Mouth moderately large, extending to middle of eye
- Body depth increases from 11% SL at 3.9 mm to 25% SL at 20 mm
- Head length increases from 22% SL at 3.9 mm to 29% SL at 20 mm
- Flexion occurs at 4–6 mmSL
- Sequence of fin ray formation (based on *M. japonicus*): $C_1 - A - D - P_2 - P_1 - C_2$
- Adipose fin present; anal fin origin posterior to dorsal fin origin
- Vertebrae fully ossified by 9.3 mm

B. 5.9 mmSL

- **Photophores** (may apply to species other than *M. weitzmani*)

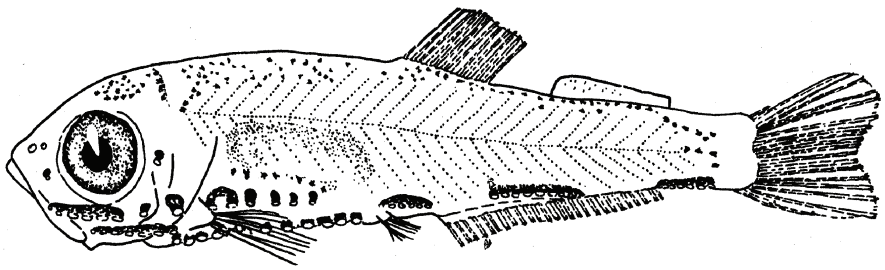
Sequence of development:	BR	IV	OP	ORB	IP	AC	VAV	OA	SO
Definitive # (*adult*) *in group*:	6	12–13	3	1	6	22–26	6	2+7	1

- (**Note**: IP = photophores from isthmus to pectoral fin origin; also referred to as anterior IV)
- Pigmentation: see figures
- Transformation gradual; general adult body form reached at 13–14 mm

Early Juvenile:

I. 14.9 mm

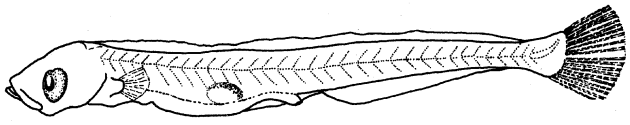
Becomes silvery over-all >15 mm



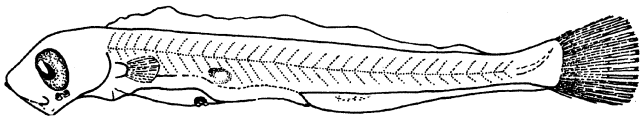
Figures: Adult: Parin and Kobyliansky, 1993; Egg, **C–D**, **F**, **I**: Robertson, 1976 (putative *M. australis*); **A–B**: Okiyama, 1971 (putative *M. japonicus*); **E**, **H**: Olivar and Fortuño, 1991 (putative *M. walvisensis*); **G**: Ahlstrom, 1974 (origin and species unknown, possibly *M. weitzmani*)

References: Ahlstrom *et al*., 1984c; Parin and Kobyliansky, 1993; Watson, 1996c; Richards, 2001

Maurolicus weitzmani

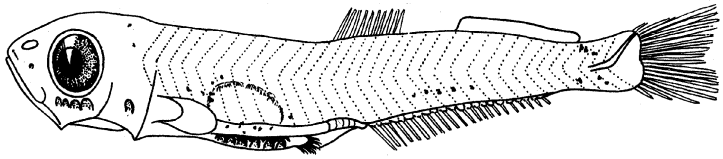


C. 7.6 mm



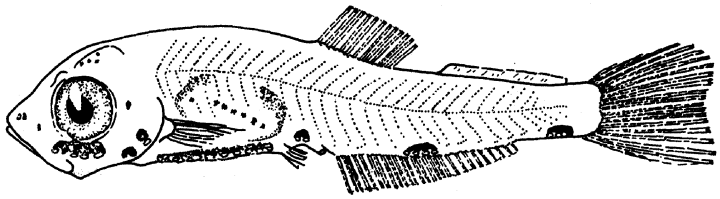
D. 7.4 mm

Atlantic specimens (6-10 mm) may have row of 7-10 melanophores along anal fin base and an accumulation on caudal peduncle



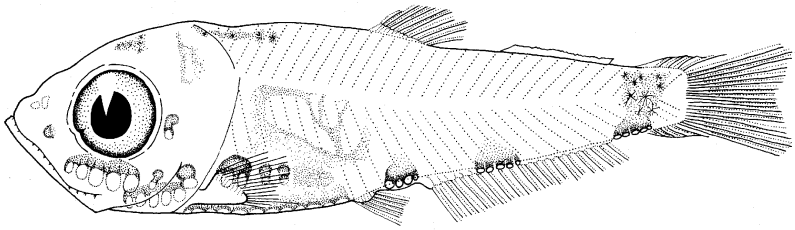
E. 9.3 mm

Pigment forms on nape and on caudal peduncle, spreads across dorsum >10 mmSL

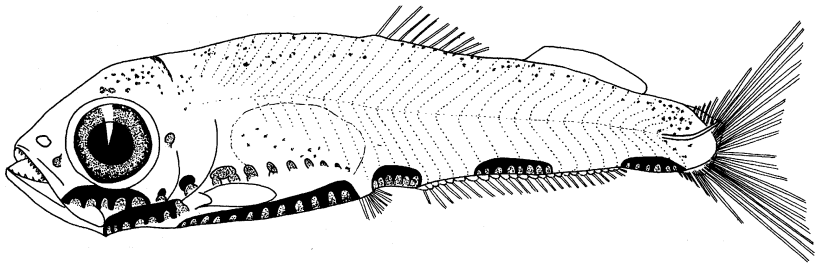


F. 11.7 mm

Note: Larvae in all illustrations (except G) are based on specimens collected in waters outside the western North Atlantic, and are therefore not *M. weitzmani*



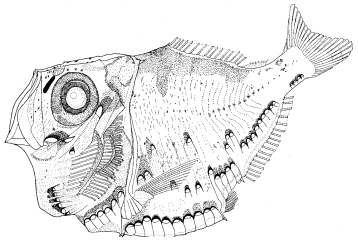
G. 10.8 mm



H. 14.2 mm

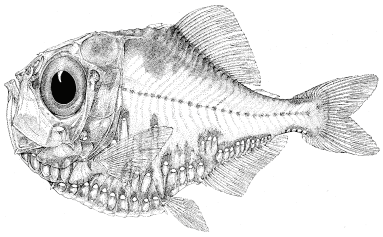
Note: The ontogeny of *M. weitzmani*, based on western North Atlantic specimens, should be described

Genus Polyipnus (Interim account)
Sternoptychidae
No common name



Polyipnus clarus

Meristic Characters
(See below)



Polyipnus laternatus

Range: *Polyipnus clarus* occurs in the western North Atlantic from Scotian Shelf to Gulf of Mexico and Caribbean Sea; *P. laternatus* occurs in the Gulf of Mexico, Caribbean Sea and the Gulf Stream as far north as Cape Hatteras

Habitat: Mesopelagic; both species occurring between 300 and 500 m

Spawning: Undescribed

Eggs: – Undescribed

Larvae:
- Undescribed. Larva of *Polyipnus polli* described as example of genus
- Body deep through cleithral-pectoral fin region
- Conspicuous spines at lower angle of preopercle and posttemporal region
- Anal fin origin under middle of dorsal fin
- Adipose fin present or absent
- Teeth visible early in development
- Caudal, anal and pectoral fin rays form before dorsal fin rays
- **Photophores** (in genus)

Name of photophore group:	ORB	OP	BR	IS	IV	VAV	AC	SO
Definitive # (adult) in group:	2	2	6	6	16	5	10–18	None

- Sequence of photophore formation in *Polyipnus clarus* and *P. laternatus* undescribed

Note:
1. Juveniles of *Polyipnus laternatus* have prominent, tapered, ventral preopercle spine and a long, needle-like posttemporal spine; 11–13 ACB* photophores, without a conspicuous step between #3 and #4
2. Juveniles of *Polyipnus clarus* have reduced preopercle spine and a short, stout posttemporal spine; 8–10 ACB* photophores with a conspicuous step between #3 and #4

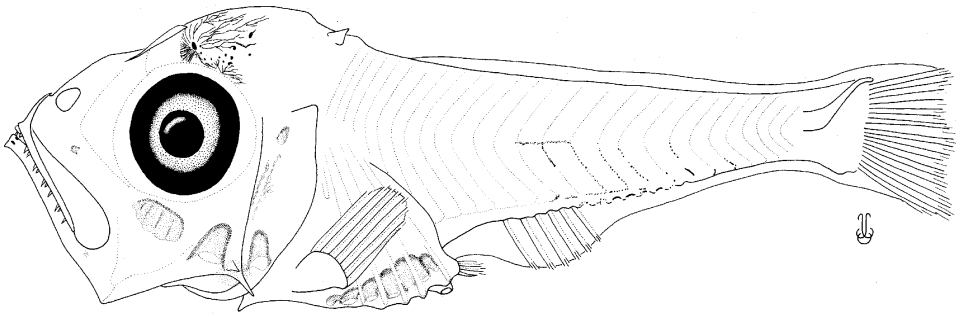
* ACB photophores equal to SAN + AN + SC photophores as defined by some authors

Meristic characters:	*Polyipnus clarus*	*Polyipnus laternatus*
Vertebrae:	32–33	32–33
Dorsal fin rays:	15–16	12–15
Anal fin rays:	16–17	15–18
Pectoral fin rays:	13–15	12–14
Pelvic fin rays:	7	6–7

Figures: Adult: *P. clarus*: Baird, 1971 (as *P. asteroides*); *P. laternatus*: Weitzman, 1974; **A**: Jack Javech (Ahlstrom *et al*., 1984c)

References: Baird, 1971; Ahlstrom *et al*., 1984c; Harold, 1994

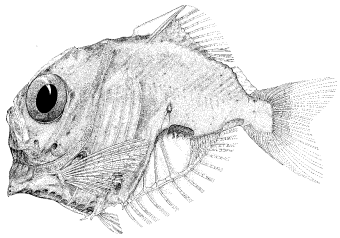
***Polyipnus* sp.**



A. 5.2 mmSL

(*Polyipnus polli*, restricted to tropical and subtropical eastern Atlantic Ocean)

Sternoptyx diaphana Hermann, 1781
Sternoptychidae
No common name



Range: Temperate to tropical Atlantic Ocean, as far north as 52°N; in the western North Atlantic from Grand Bank to Brazil

Habitat: Mesopelagic in depths of 300–1,200 m

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters	
Myomeres:	29–30
Vertebrae:	29–30
Dorsal fin rays:	9–11
Anal fin rays:	13–16
Pectoral fin rays:	10–11
Pelvic fin rays:	6–7
Caudal fin rays:	10+9 (PrC)

Larvae:
- Head and gut region deep, followed by slim tail
- Mouth smaller than in comparably sized *Sternopteryx pseudobscura*
- Spiny ridges on frontal and parietal bones
- Opercular and posttemporal spines present
- Flexion occurs at 6–7 mm
- Sequence of fin ray formation C, A, P_1 – D spine – D rays – P_2
- Adipose fin present
- Note length of posterior anal pterygiophores (longer than in *S. pseudobscura*)
- SAN forms just above anal pterygiophores (closer to midline in *S. pseudobscura*)

– **Photophores**

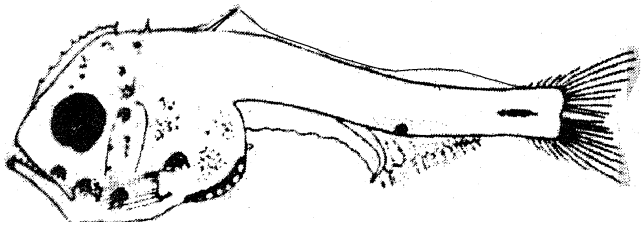
Sequence of development:	SO	BR	AB	IS	SP	PTO	AN	PAN	SC	PRO	SAN	SAB
Definitive # (*adult*) *in group*:	1	3	10	5	3	1	3	3	4	1	1	None

- Adult photophore pattern acquired at 11–13 mmSL
- Pigmentation includes spots on head and tip of lower jaw; peritoneum heavily pigmented; middle of caudal peduncle may have spot; pigment spreads over dorsum after transformation
- Transformation occurs at 6–14 mmSL when body deepens substantially; [see Badcock and Baird (1980) for description of striking change in body form during this transformation]

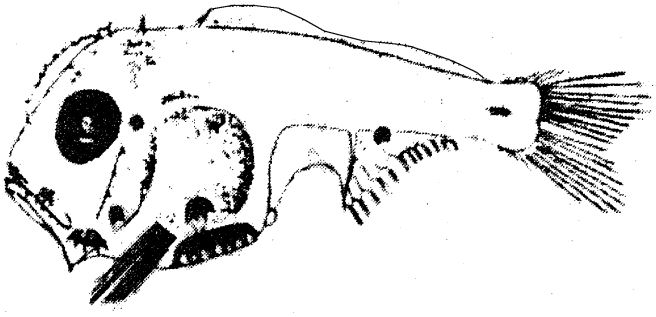
Figures: Adult: M. J. Dalen (Weitzman, 1974); **A–D**: Belyanina, 1984; **E**: Henry Orr (Watson, 1996c)

References: Badcock and Baird, 1980; Ahlstrom *et al*., 1984c; Matarese *et al*., 1989; Richards, 2001

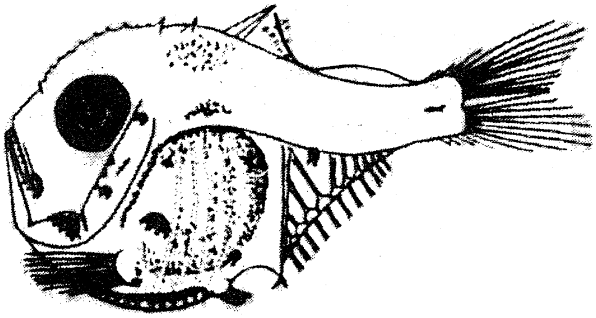
Sternoptyx diaphana



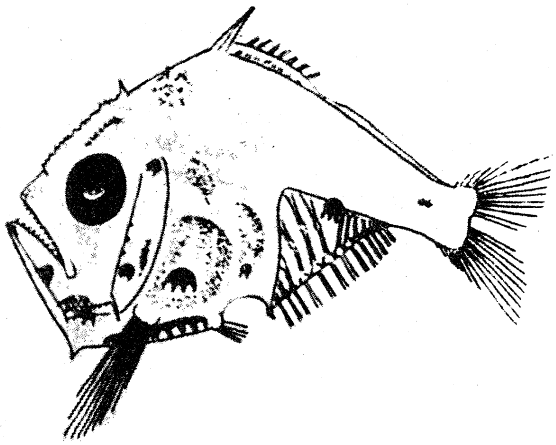
A. 8.3 mm



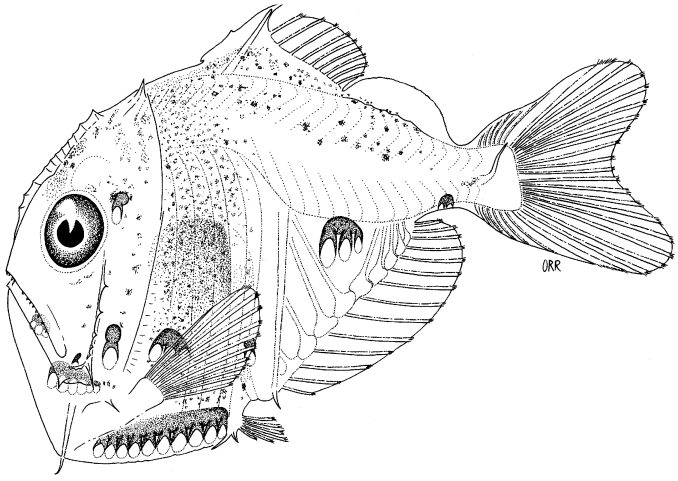
B. 7.3 mm



C. 6.9 mm

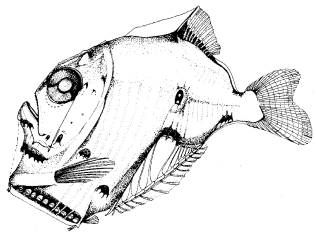


D. 8.5 mm



E. 11.2 mm

Sternoptyx pseudobscura Baird, 1971
Sternoptychidae
No common name



Range: Tropical-subtropical Atlantic Ocean, as far north as 42°N; uncommon in the western North Atlantic from Flemish Cap to Brazil

Habitat: Deep mesopelagic in depths of 800–1,500 m

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters	
Myomeres:	29–30
Vertebrae:	29–30
Dorsal fin rays:	9–12
Anal fin rays:	13–15
Pectoral fin rays:	9–11
Pelvic fin rays:	6–7
Caudal fin rays:	10+9 (PrC)

Larvae:
- Head and gut region deep, followed by slim tail
- Mouth larger than in comparably sized *Sternopteryx diaphana*
- Spiny ridges on frontal and parietal bones
- Opercular and posttemporal spines present
- Flexion size unknown
- Sequence of fin ray formation C, A, P_1 – D spine – D rays – P_2
- Adipose fin present
- Note length of posterior anal pterygiophores (shorter than in *S. diaphana*)
- SAN forms close to midline (just above anal pterygiophores in *S. diaphana*)
- **Photophores**

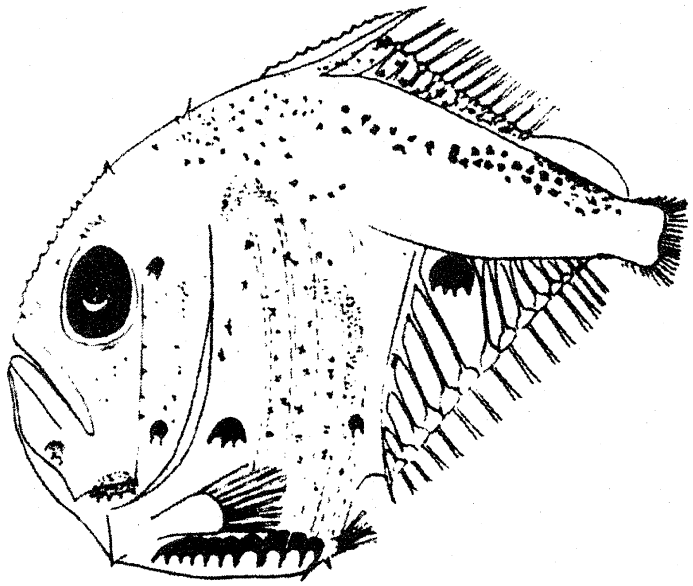
Sequence of development:	SO	BR	AB	IS	SP	PTO	AN	PAN	SC	PRO	SAN	SAB
Definitive # (adult) in group:	1	3	10	5	3	1	3	3	4	1	1	None

- Adult photophore pattern acquired at 16–18 mmSL
- Pigmentation includes spots on head and tip of lower jaw; peritoneum heavily pigmented; middle of caudal peduncle unpigmented; pigment spreads over dorsum after transformation
- Transformation occurs at 6–14 mmSL when body deepens substantially; body rounder than in *S. diaphana*

Figures: Adult: Badcock, 1984b; **A–B**: Belyanina, 1984

References: Ahlstrom *et al*., 1984c; Matarese *et al*., 1989; Richards, 2001

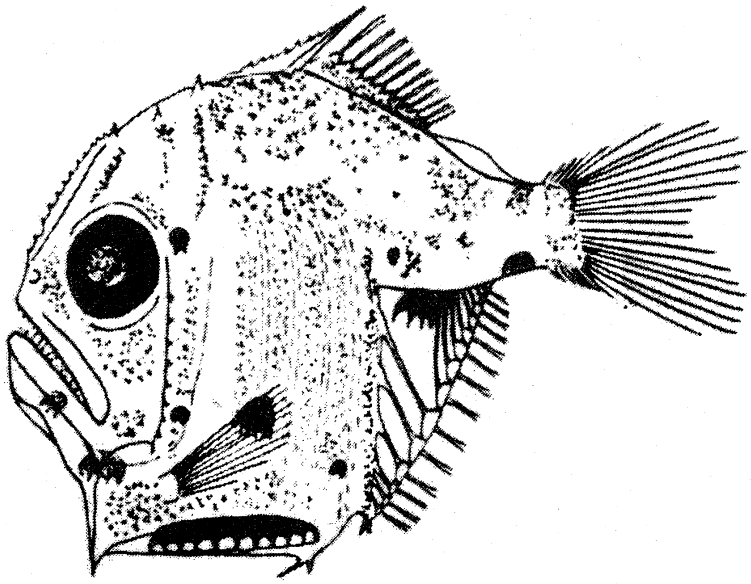
Sternoptyx pseudobscura



A. 11.0 mm

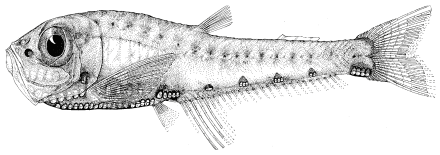
SAN forms close to midline
(Compare to *Sternoptyx diaphana*)

Posterior anal pterygiophores
shorter than in *S. diaphana*



B. 14.0 mm

Valenciennellus tripunctulatus (Esmark, 1871)
Sternoptychidae
No common name



Range: Worldwide in temperate to tropical waters; in the western North Atlantic from Banquereau Bank, Nova Scotia to Gulf of Mexico; widespread

Habitat: Mesopelagic in depths of 100–700 m

Spawning: Year-round, little or no seasonal variation

Eggs:
– Undescribed

Meristic Characters

Myomeres:	32–35
Vertebrae:	32–33
Dorsal fin rays:	7–8
Anal fin rays:	24–25
Pectoral fin rays:	16–17
Pelvic fin rays:	6–7
Caudal fin rays:	8–9+10+9+5–6

Larvae:
– Elongate, slender body; preanus length 55–60% SL
– Oval eye
– Mouth terminal on pointy snout; maxilla reaches anterior edge of eye until transformation
– 14–15 preanus myomeres decrease to 12–13 at transformation
– Air bladder located in relatively posterior position (at myomere 10–12)
– Flexion occurs at 5.0–7.3 mm
– Sequence of fin ray development: C – A – P_1 – D – P_2
– Adipose fin present
– Anal fin origin anterior to dorsal fin origin

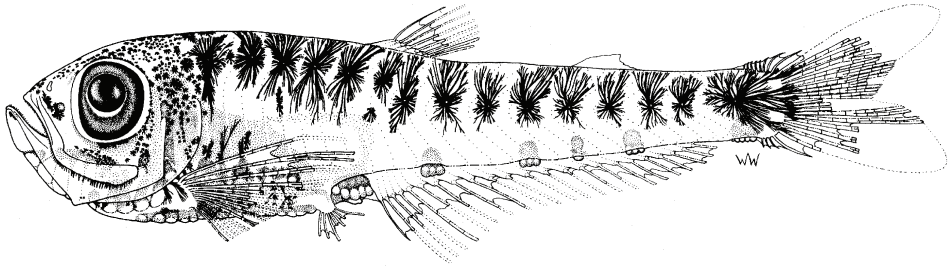
– **Photophores**

Sequence of development:	BR	IV(post)	VAV	ORB	IV(ant)	OP	AC	OA
Definitive # (adult) in group:	6	16–17	4-5	1	3+4	3	3+3+3	2+3

– Pigment aggregates over developing photophores
– No other pigment (except over air bladder) until after transformation, when a series of blotches forms along upper flank and over gut

– Transformation occurs gradually at 9.5–16.0 mm

Early Juvenile:

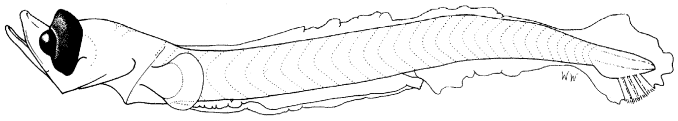


F. 26.7 mmSL

Figures: Adult: M. J. Dalen (Weitzman, 1974); **A, F**: William Watson (Watson, 1996c); **B–C**: Barbara Sumida M[ac]Call (Watson, 1996c); **D**: Badcock, 1977 (redrawn); **E**: Ahlstrom, 1974

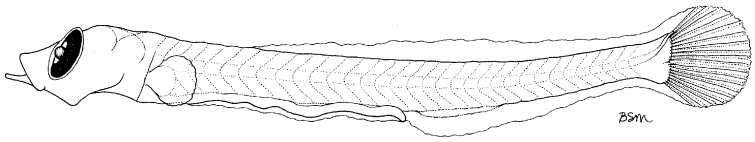
References: Badcock, 1977; Ahlstrom *et al*., 1984c; Howell and Krueger, 1987; Watson, 1996c;

Valenciennellus tripunctulatus

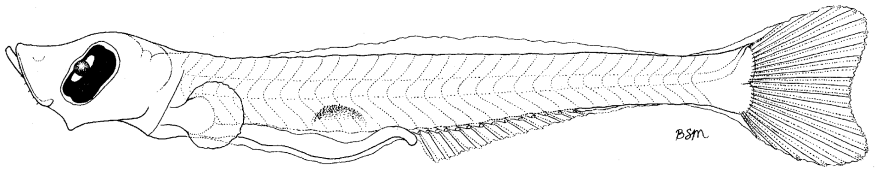


A. 4.1 mmSL

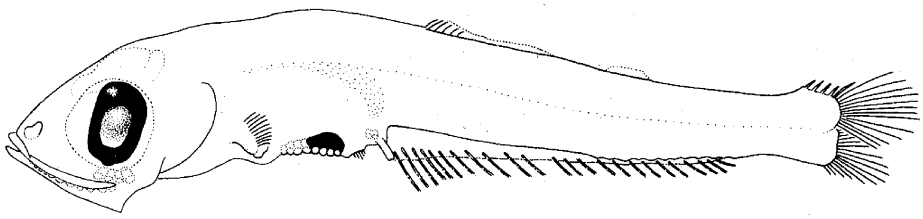
Concave head profile in early larvae



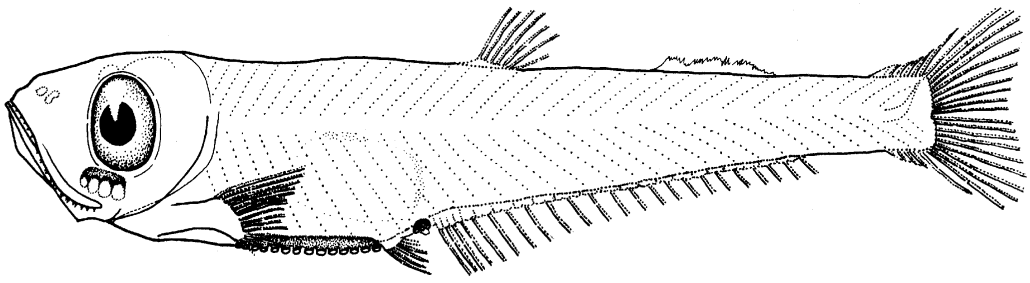
B. 7.3 mmSL



C. 8.6 mmSL



D. 10.5 mmSL Early forming BR photophores (under eye)



E. 13.6 mmSL