Stephanoberyciformes

Selected meristic characters in species belonging to the order Stephanoberyciformes whose adults or larvae have been collected in the study area. Classification sequence follows Johnson and Patterson (1993); Baldwin and Johnson (1995). "gen." = range in genus. Sources: Koefoed (1953); Ebeling (1962); Ebeling and Weed (1963; 1973); Paxton (1989); Paxton *et al.* (2001); Moore (2002b).

Family *Species*	Vertebrae	Dorsal Fin Rays	Anal Fin Rays	Pectoral Fin Rays	Pelvic Fin Rays
Stephanoberycidae					
Acanthochaenus luetkenii	30–31	0, 11	I, 10	12–13	5
Stephanoberyx monae	31–33	I–III, 11–13	I–III, 11–12	12–13	5
Melamphaeidae					
Melamphaes longivelis	28–30	III, 15–18	I, 8–9	15	I, 7
Melamphaes microps	28–30	III, 16–18	I, 7–8	14–15	I, 8
Melamphaes pumilus	27–28	III, 14–16	I, 7–9	14–16	I, 7–8
Melamphaes simus	28–30	III, 15–17	I, 8–10	14–16	I, 7
Melamphaes suborbitalis	28–29	III, 15–16	I, 7–8	15–16	I, 7
Melamphaes typhlops	25–27	III, 14–15	I, 8	14–16	I, 7
Poromitra capito	25–26	III, 11–12	I, 8–9	13–14	I, 7
Poromitra crassiceps	26–29	III, 11–14	I, 8–11	13–15	I, 7–8
Poromitra megalops	26–30	II–III, 10–12	I, 8–10	13–15	I, 7
Scopeloberyx opisthopterus	24–27	II–III, 11–12	I, 7–8	12–15	I, 7–8
Scopeloberyx robustus	23–27	II–III, 10–13	I, 7–9	12–14	I, 7–8
Scopeloberyx rubriventer	24–25	II, 11–12	I, 8	14	I, 8
Scopeloberyx sp.[1]					
Scopelogadus beanii	26–27	II, 11	I, 8	14–15	I, 7
Scopelogadus mizolepis	24–25	I–II, 11	I, 8	14–16	I, 7
Gibberichthyidae					
Gibberichthys pumilus	30–31	V–VI, 8–9	II–III, 7–8	14–15	I, 5
Rondeletiidae					
Rondeletia bicolor	27	14–15	14–15	10–11	6
Rondeletia loricata	24–26	13–14	12–13	9–11	5–6
Barbourisiidae					
Barbourisia rufa	40–43	19–22	15–18	13–14	6
Cetomimidae					
Cetomimus gilli	44–54 (gen.)	16–19	16–19	16	0
Cetostoma regani	47–53	29–37	26–34	20–21	0
Ditropichthys storeri	38–42	19–22	15–18	17–21	0
Gyrinomimus myersi	47–56	17	17	18–23 (gen.)	0
Gyrinomimus bruuni	47–59 (gen.)	14–20 (gen.)	14–20 (gen.)	18–23 (gen.)	0
Gyrinomimus sp.	47–59 (gen.)	14–20 (gen.)	14–20 (gen.)	18–23 (gen.)	0
Mirapinnidae					
Parataeniophorus gulosus	49	28–33	23–29	19–20	9–10
Megalomycteridae					
Ataxolepis apus	41–55 (gen.)	15–18	13–19	18–23	0–1

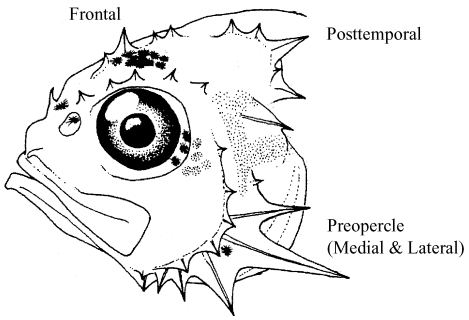
[1] Description unpublished

Stephanoberyciformes

Families included in the Stephanoberyciformes were, until recently, included within the Beryciformes. See the Beryciformes and Polymixiiformes chapter for discussion of the importance of ontogenetic evidence contributing to the classification used here, and for a table describing the distribution of head spines in larvae. Larvae are best known and described in the family Melamphaidae. They are undescribed in the families Cetomimidae and Megalomycteridae. A few descriptions of larval development have recently been published in the five other families

Head spines: Most stephanoberyciform larvae lack spination on the head (see table in Beryciformes Introduction). Exceptions are found in *Barbourisia rufa* and the melamphaid genus *Poromitra* (below):

Poromitra oscitans 7.6 mmSL (Pacific Ocean). Modified after R.C. Walker (Sandknop and Watson, 1996a)



Note that in some species of *Poromitra* (but not all), head spines, including frontal, posttemporal and preopercle are well developed. Certain other spines are also present, including nasal, supraocular, parietal and opercular.

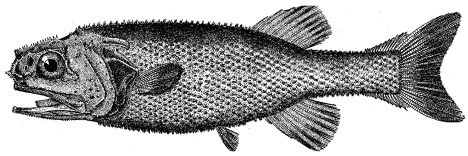
Melamphaidae: Fishes in this family are characterized by: pelvic fin formula of I, 7–8; 3–5 procurrent caudal fin rays dorsally and ventrally (typically 4); deciduous, usually large cycloid scales; well-developed sensory head canals , but no pored lateral line scales. Other diagnostic characters are observable in adults (see Ebeling, 1962).

Common larval features in melamphaeids include: principal caudal fin rays 10+9; total caudal fin ray count typically 4+10+9+4; pelvic fin develops very early (during preflexion stage) with 1 weak spine and 7 or 8 rays; pelvic fin origin anterior to, under or posterior to pectoral fin origin; pectoral fin rays also early forming; weak spines in dorsal and anal fins; dorsal fin origin anterior to anal fin origin, insertions at about the same level. Body shape and pigment patterns are important in distinguishing the larvae. Anterior dorsal fin rays can be elongate in some species.

Important larval characters in melamphaid genera:

Scopeloberyx:	Myomeres 23–27; Dorsal fin rays 10–13
	Note body shape rather thick, caudal peduncle not as elongate as in larvae of other genera
	Pigment sparse; in 3–4 mm larvae a swath of pigment extends from dorsal fin origin to anal fin insertion
Scopelogadus:	Myomeres 23–27; Dorsal fin rays 10–12
	Head Length about 50% SL
	Heavy pigment; in 3–4 mm larvae a swath of pigment extends from dorsal fin origin to anal fin insertion
	Supramaxillary bone absent (present in other genera; may be visible in larger larvae and juveniles)
Poromitra:	Myomeres 25–29; Dorsal fin rays 10–14
	Well–developed preopercle, frontal or posttemporal spines in some species
	Rostral spine present in large larvae of some species
	Caudal peduncle elongate in larvae
Melamphaes:	Myomeres 25–31; Dorsal fin rays 13–18
	Note 'hump' on head over eye
	Pigment characteristically in bands between dorsal and anal fins and on caudal peduncle

Acanthochaenus luetkenii Gill, 1884
Stephanoberycidae
No common name



Range: Western North Atlantic, South Atlantic, southwest Pacific and western Indian oceans; in the western North Atlantic from Southern New England to South Carolina; known from very few specimens

Habitat: Benthopelagic in depths of 1,655–5,400 m; most specimens from vicinity of submarine canyons; larvae strongly neustonic

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

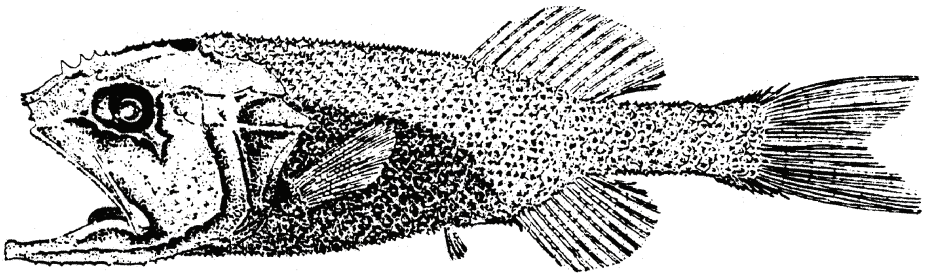
Myomeres:	30–31
Vertebrae:	30–31
Dorsal fin rays:	0, 11
Anal fin rays:	I, 10
Pectoral fin rays:	12–13
Pelvic fin rays:	5
Caudal fin rays:	11+10+9+10

Larvae:
- Hatching size undescribed
- Body initially rather massive, somewhat laterally compressed, bulging gut, wide finfold
- Body depth increases with development; body depth at 17 mm = ca 50% SL
- Large head, slightly flattened dorso–ventrally, short, blunt snout; eyes oval; mouth large
- Profile with slight concavity over eye
- Single spine (sphenotic?) on side of head, at level of upper margin of orbit
- Supramaxillary bone present, visible in larvae >8.7 mm
- Note posterior position of pelvic fins, high up on body; fin rays increase in length
- Sequence of fin ray formation: D, A, P_2 – P_1, C; all fin rays complete by 17.0 mm
- Predorsal finfold persists after fin ray formation
- Lower abdomen equipped with spiny scales between pectoral and pelvic fins in 8.7–11.2 mm larvae
- Entire body covered with round scales, each with a single spine, star–shaped in cross section, in 17.0 mm larvae
- Larvae in life are vivid violet, but this color fades after preservation
- Pigmentation is dense in all stages, except for lower gut and extreme tip of urostyle; band of pigment crosses the caudal peduncle and extends into dorsal and anal fins; pelvic fins are intensely pigmented, pectoral fins are unpigmented

Note: 1. *Stephanoberyx monae* (larvae undescribed) also occurs in study area. Adults are similar to *A. luetkenii* except 1 to 3 spines are present in dorsal fin (none in *A. luetkeni*) and pelvic fin origin is closer to level of pectoral fin than to anal fin origin (closer to anal fin origin in *A. luetkeni*).

Early Juvenile:

E. 37.5 mmSL

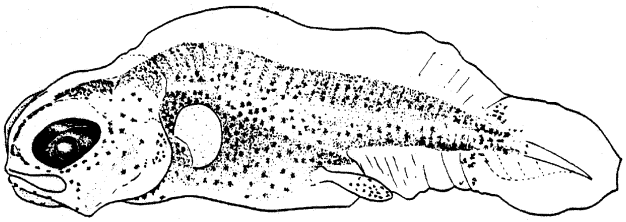


Body proportions similar to those of adult, except snout is longer, eye is smaller, and head is deeper. Pelvic fins have moved to ventral edge of body and have shrunk in size. Anal fin spine is very short.

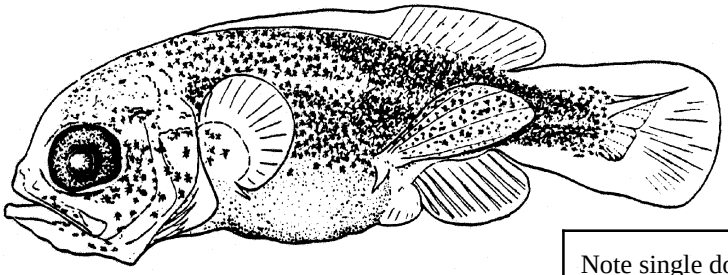
Figures: Adult: Goode and Bean, 1896; **A–E**: Kotlyar and Evseenko, 1989

References: Ebeling and Weed, 1973; Keene and Tighe, 1984; Tighe and Keene, 1984

Acanthochaenus luetkenii

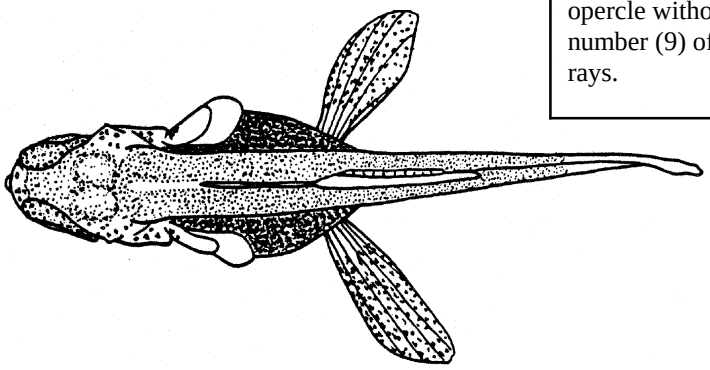


A. 5.3 mmTL

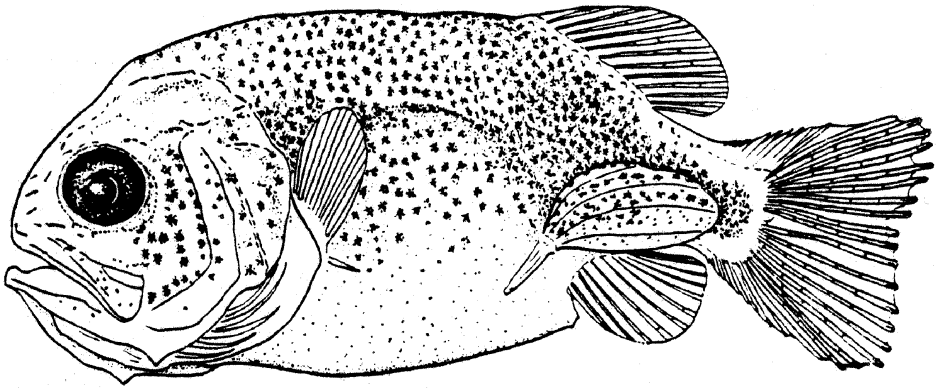


B. 8.7 mmSL

Note single dorsal fin, lacking spines, abdominal position of large pelvic fins, also lacking spines and high on body, opercle without spines, and high number (9) of branchiostegal rays.

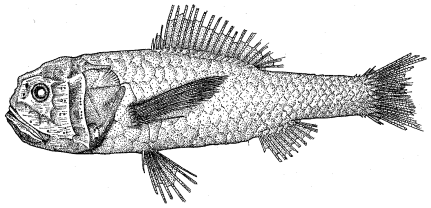


C. 8.7 mmSL (Ventral View)



D. 17.0 mmSL

Melamphaes microps (Günther, 1878)
Melamphaidae
No common name



Range: Occurs in all major oceans, worldwide, but absent from tropical waters; in the western North Atlantic from Flemish Cap to Southern New England

Habitat: Bathypelagic in depths >800 m

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

Myomeres:	28–30
Vertebrae:	28–30
Dorsal fin rays:	III, 16–18
Anal fin rays:	I, 7–8
Pectoral fin rays:	14–15
Pelvic fin rays:	I, 8
Caudal fin rays:	4+10+9+4

Larvae:
- Not well described
- Body elongate, with long caudal peduncle
- Preanus length about 60% SL
- Head moderate, with large eye and mouth
- Note 'hump' in profile over eye
- Weak spine at upper angle of opercle
- Sequence of fin formation undescribed; pelvic fin rays form early
- Pigment includes patch of melanophores on upper body under dorsal fin base; small patch of pigment on middle of caudal peduncle; few spots over posterior third of anal fin base

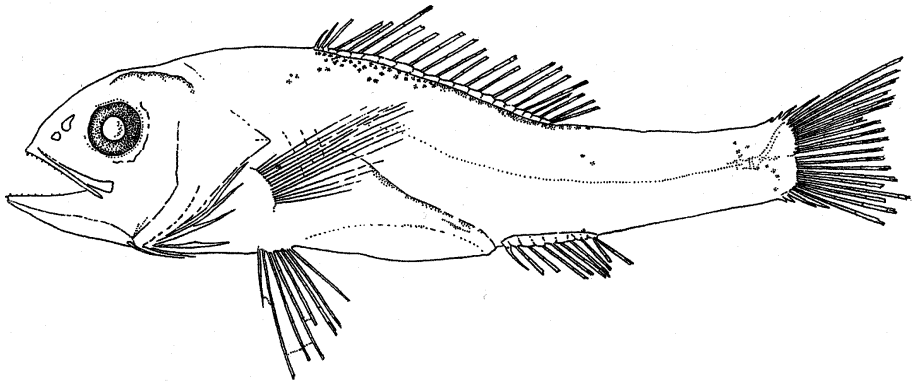
Note:
1. High pelvic fin ray count (I, 8) distinguishes members of the *Melamphaes microps* complex from other species. See Ebeling (1962).
2. See box on figure for page discussion of the closely related *M. ebelingi*.

Melamphaes microps is a member of the "*Lugubris* Group" of melamphaids (*sensu* Ebeling, 1962). The table below summarizes selected characters compared between the four "groups" that occur in the study area. Most characters are more easily observable in adults or juveniles after transformation.

	"*Lugubris* Group"	"*Suborbitalis* Group"	"*Typhlops* Group"	"*Simus* Group"
Dorsal fin rays	14–18	14–18	14–17	14–16
Caudal vertebrae	16–18	16–18	14–17	15–18
Gill rakers, lower first arch	15–18	14–17	11–15	12–14
Gill raker shape	Long and wide	Long and wide	Long and slender	Moderately long and wide
Pelvic fin origin	Behind pectoral	Behind/under pectoral	Well behind pectoral	Well behind pectoral
Anal fin origin	Under last 2 D rays	3–5 from last D ray	Under last D ray	2–4 from last D ray
Body size (adults)	"Giant"	"Giant"	Small/"Giant"	"Dwarf"

Figures: Adult: Ebeling, 1962; **A**: Ebeling, 1962; **B**: J. R. Schroeder (Keene, 1973)
References: Ebeling, 1962; Ebeling and Weed, 1973; Keene, 1973

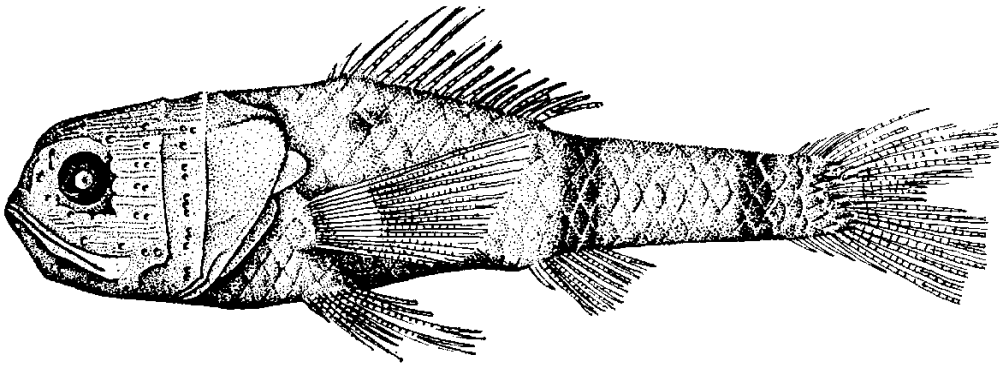
Melamphaes microps



A. 21.8 mmSL

(Specimen in Fig. A collected from waters off southwest tip of Africa)

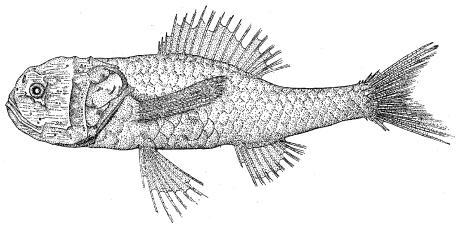
Melamphaes ebelingi



B. 29.3 mmSL

Melamphaes ebelingi Keene, 1973 (Fig. B) occurs in the tropical and subtropical Atlantic Ocean, south of the present study area (in the Bermuda area), but may occur farther north if transported by the Gulf Stream. Larvae are undescribed. Later larvae and juveniles are characterized by bands of pigment circling the body at the level of the anal fin and around the caudal peduncle. It is closely related to *M. microps*, especially because of its pelvic fin ray count. Meristic characters are: vertebrae: 26-27; dorsal fin rays: III, 14-16; anal fin rays: I, 8; pectoral fin rays: 15; pelvic fin rays: I, 8; caudal fin rays: 4+9-10+9+4. See Keene (1973) for information on distribution, biology and ecology.

Melamphaes pumilus Ebeling, 1962
Melamphaidae
No common name



Range: Western North Atlantic Ocean from Grand Bank to the Caribbean Sea

Habitat: Meso- to bathypelagic in depths of 551–1,300 m (shallower at night)

Spawning: Year-round, with peak in spring-summer, based on sampling near Bermuda; sexual maturity reached by 18 mm

Meristic Characters

Myomeres:	27–28
Vertebrae:	27–28
Dorsal fin rays:	III, 14–16
Anal fin rays:	I, 7–9
Pectoral fin rays:	14–16
Pelvic fin rays:	I, 7–8
Caudal fin rays:	4+10+9+4

Eggs:
- Undescribed

Larvae:
- Body moderately elongate with long caudal peduncle
- Body becomes deep through pectoral region
- Bulky, rounded head with large eye and mouth
- Preanus length increases from about 55% SL to >60% SL
- Predorsal length 42–44% SL
- Head spination lacking
- Sequence of fin formation undescribed; pelvic fins form early
- Pelvic fin origin anterior to pectoral fin initially, then under pectoral fin
- Pigmentation includes linear cluster of melanophores along dorsum, from just before dorsal fin origin to base of caudal fin; few spots on venter near insertion of anal fin; few spots on sides of body near pectoral fin base; few spots on crown, behind eye and on middle of caudal peduncle; caudal fin rays never pigmented

Note:
1. *Melamphaes pumilus* is a "dwarf" species, adults only reaching 23 mmSL. Scales are larger in this species than in 2 other "dwarf" species, *M. simus* and *M. hubbsi*.

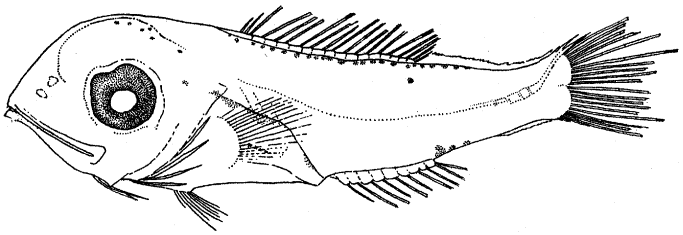
Melamphaes pumilus is a member of the "*Simus* Group" of melamphaids (*sensu* Ebeling, 1962). The table below summarizes selected characters compared between the four "groups" that occur in the study area. Most characters are more easily observable in adults or juveniles after transformation.

	"*Lugubris* Group"	"*Suborbitalis* Group"	"*Typhlops* Group"	"*Simus* Group"
Dorsal fin rays	14–18	14–18	14–17	14–16
Caudal vertebrae	16–18	16–18	14–17	15–18
Gill rakers, lower first arch	15–18	14–17	11–15	12–14
Gill raker shape	Long and wide	Long and wide	Long and slender	Moderately long and wide
Pelvic fin origin	Behind pectoral	Behind/under pectoral	Well behind pectoral	Well behind pectoral
Anal fin origin	Under last 2 D rays	3–5 from last D ray	Under last D ray	2–4 from last D ray
Body size (adults)	"Giant"	"Giant"	Small/"Giant"	"Dwarf"

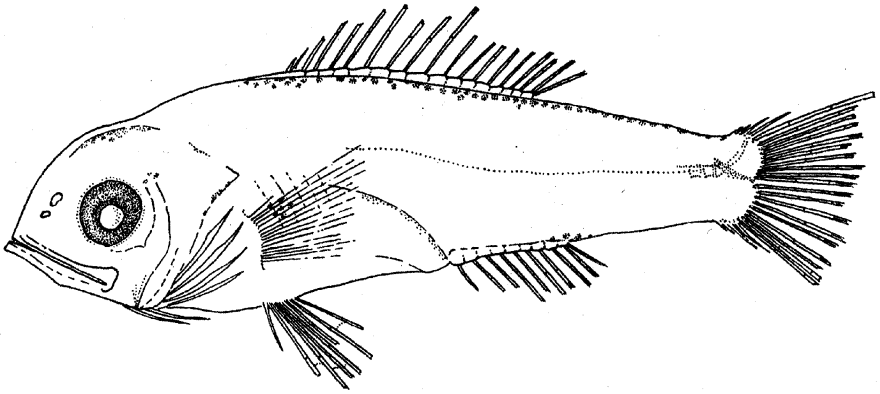
Figures: Adult: Ebeling, 1962; **A–C**: Ebeling, 1962

References: Ebeling, 1962; Ebeling and Weed, 1973; Keene and Tighe, 1984; Keene *et al.*, 1987

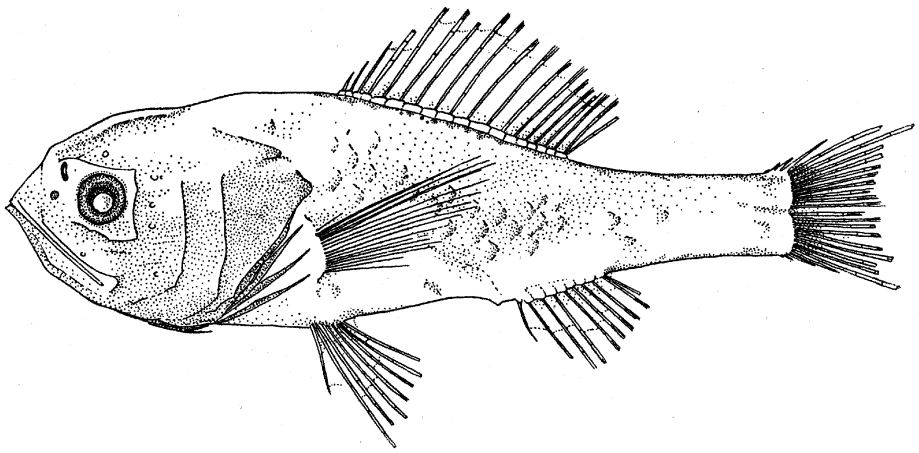
Melamphaes pumilus



A. 4.0 mmSL

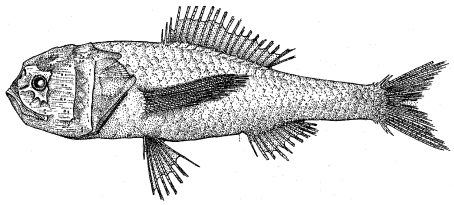


B. 9.8 mmSL



C. 10.1 mmSL

Melamphaes simus Ebeling, 1962
Melamphaidae
No common name



Range: Atlantic, Indo-Pacific and Central North Pacific oceans; in the western North Atlantic from south of Grand Bank to Bahamas and Gulf of Mexico

Habitat: Meso- to bathypelagic in depths of 400–1,000 m during day, 0–600 m at night

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

Myomeres:	28–30
Vertebrae:	28–30
Dorsal fin rays:	III, 15–17
Anal fin rays:	I, 8–10
Pectoral fin rays:	14–16
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

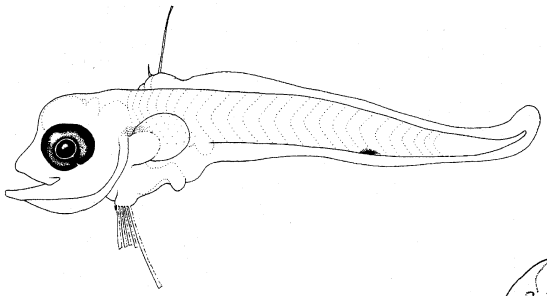
Larvae:
- Body elongate with moderate head; body remains elongate through development
- Head with 'bulge' in profile over eye; mouth large
- Preanus length increases from 29–35% SL in preflexion larvae to 61–64% SL in juveniles
- Predorsal length 30–35% SL
- Head spination lacking
- Sequence of fin ray formation: P_2, D – C_1 – P_1, D_2, A – C_2
- Pelvic fin origin under or slightly posterior to level of pectoral fin base
- Pigmentation includes early-forming spot on ventral edge in mid-tail; this expands to form line of spots from posterior anal fin to caudal fin base; line of melanophores grows to cover dorsum from in front of dorsal fin to base of caudal fin; small cluster of spots on caudal peduncle; peritoneal pigment and internal pigment over brain; pigment may be present on distal portion of pelvic fin rays, but is usually absent. A specimen 11.0 mmSL (Fig. E), collected in the eastern North Atlantic Ocean, has a series of internal melanophores above notochord, between the insertions of dorsal and anal fins.

Melamphaes simus is a member of the "*Simus* Group" of melamphaids (sensu Ebeling, 1962). The table below summarizes selected characters compared between the four "groups" that occur in the study area. Most characters are more easily observable in adults or juveniles after transformation.

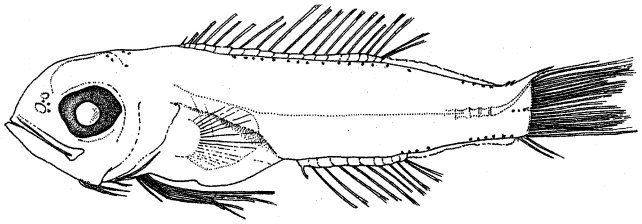
	"*Lugubris* Group"	"*Suborbitalis* Group"	"*Typhlops* Group"	"*Simus* Group"
Dorsal fin rays	14–18	14–18	14–17	14–16
Caudal vertebrae	16–18	16–18	14–17	15–18
Gill rakers, lower first arch	15–18	14–17	11–15	12–14
Gill raker shape	Long and wide	Long and wide	Long and slender	Moderately long and wide
Pelvic fin origin	Behind pectoral	Behind/under pectoral	Well behind pectoral	Well behind pectoral
Anal fin origin	Under last 2 D rays	3–5 from last D ray	Under last D ray	2–4 from last D ray
Body size (adults)	"Giant"	"Giant"	Small/"Giant"	"Dwarf"

Figures: Adult: Ebeling, 1962; **A**, **C–D**, **F**: R. C. Walker (Sandknop and Watson, 1996a); **B**, **E**: Ebeling, 1962
References: Ebeling, 1962; Ebeling and Weed, 1973; Sandknop and Watson, 1996a

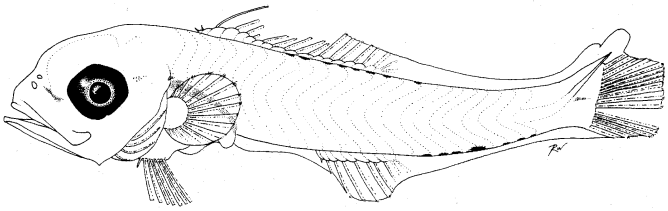
Melamphaes simus



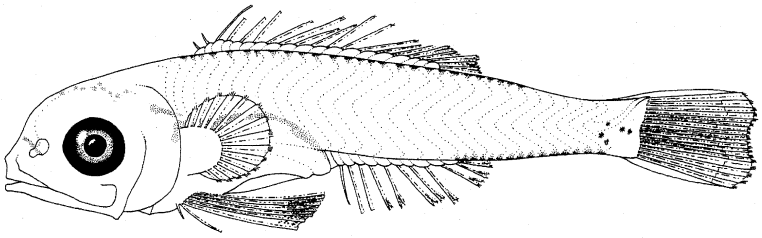
A. 3.9 mmSL



B. 5.0 mmSL

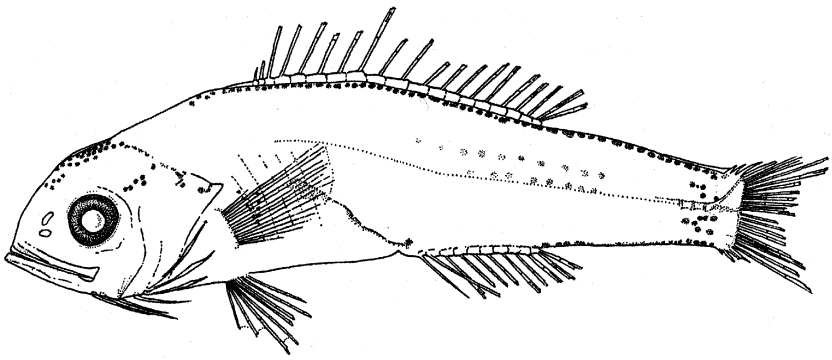


C. 5.1 mmSL

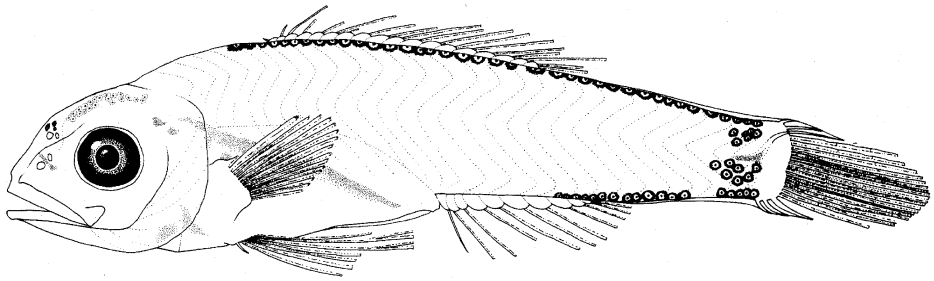


D. 6.6 mmSL

Figs. A, C, D, F based on specimens collected in eastern Pacific

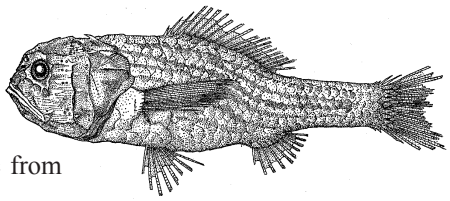


E. 11.0 mmSL



F. 11.0 mmSL

Melamphaes suborbitalis (Gill, 1883)
Melamphaidae
No common name



Range: North Atlantic Ocean and Tasman Sea; in the western North Atlantic from Grand Bank to Cape Hatteras and Sargasso Sea

Habitat: Meso- to bathypelagic in depths >900 m during the day and >300 m at night

Spawning: Undescribed

Eggs: – Undescribed

Larvae:
- Early larvae undescribed; notes below based on 14.5–mm specimen
- Body moderately elongate; caudal peduncle elongate
- Head moderately proportioned, with 'bulging' profile over eye
- Head length 35–38% SL; remains about the same into adulthood
- Preanus length 61–64% SL; remains about the same into adulthood
- Sequence of fin ray formation undescribed; pelvic fin rays presumably form early
- Pigmentation includes line of melanophores under dorsal fin base

Meristic Characters

Myomeres:	28–29
Vertebrae:	28–29
Dorsal fin rays:	III, 15–16
Anal fin rays:	I, 7–8
Pectoral fin rays:	15–16
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

Note: 1. An antrorse shoulder spine forms (on the posttemporal bone) during larval stage, becomes obvious after transformation; unique among congeners

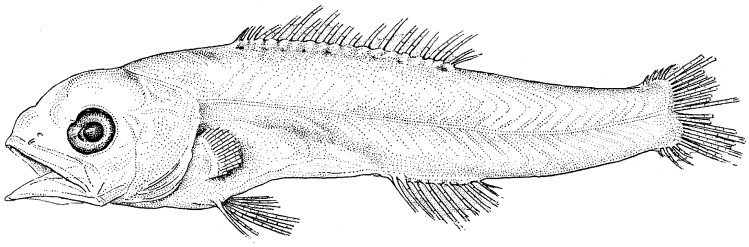
Melamphaes suborbitalis is a member of the "*Suborbitalis* Group" of melamphaids (*sensu* Ebeling, 1962). The table below summarizes selected characters compared between the four "groups" that occur in the study area. Most characters are more easily observable in adults or juveniles after transformation.

	"*Lugubris* Group"	"*Suborbitalis* Group"	"*Typhlops* Group"	"*Simus* Group"
Dorsal fin rays	14–18	14–18	14–17	14–16
Caudal vertebrae	16–18	16–18	14–17	15–18
Gill rakers, lower first arch	15–18	14–17	11–15	12–14
Gill raker shape	Long and wide	Long and wide	Long and slender	Moderately long and wide
Pelvic fin origin	Behind pectoral	Behind/under pectoral	Well behind pectoral	Well behind pectoral
Anal fin origin	Under last 2 D rays	3–5 from last D ray	Under last D ray	2–4 from last D ray
Body size (adults)	"Giant"	"Giant"	Small/"Giant"	"Dwarf"

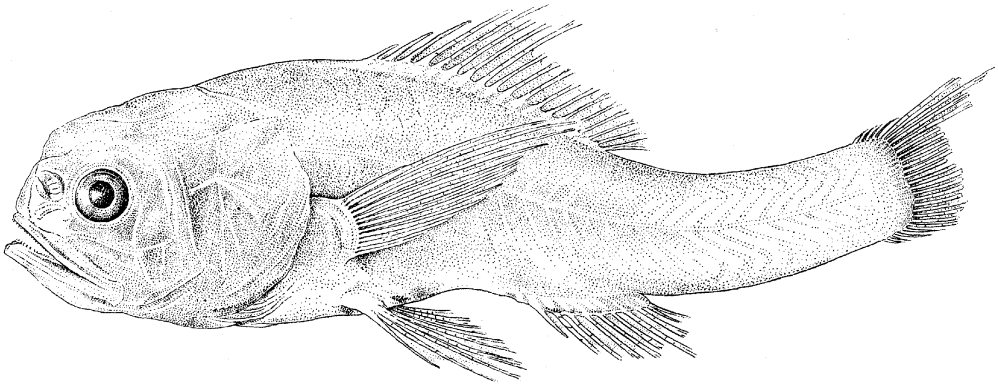
Figures: Adult: Ebeling, 1962; **A–B**: Ebeling, 1962

References: Ebeling, 1962; Ebeling and Weed, 1973; Keene *et al*., 1987

Melamphaes suborbitalis

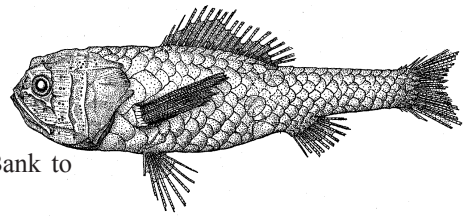


A. 14.5 mmSL Note formation of forward pointing spine on posttemporal bone



B. 28.2 mmSL

Melamphaes typhlops (Lowe, 1834)
Melamphaidae
No common name



Range: North Atlantic Ocean; in the western North Atlantic from Grand Bank to Lesser Antilles, including Gulf of Mexico

Habitat: Meso- to bathypelagic in depths >700 m during the day, 51–2,000 m at night

Spawning: Winter through summer, with no obvious peaks, based on sampling near Bermuda; probably spawns twice in life, earliest when 45–50 mm in length

Meristic Characters

Myomeres:	25–27
Vertebrae:	25–27
Dorsal fin rays:	III, 14–15
Anal fin rays:	I, 8
Pectoral fin rays:	14–16
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

Eggs: – Undescribed

Larvae:
- Body stubby with bulbous head; caudal peduncle not exceptionally elongate until later stages
- Head length 38–42% SL in early stages, decreases to 32–36% SL in adults
- Preanus length 68–74% SL; changes little during transformation to adults
- Body depth 32–38% SL in early larvae, decreases to 25–28% SL in adults
- Spines absent, but opercle edge weakly pointed
- Sequence of fin ray formation undescribed
- Pelvic fin early-forming, voluminous and long
- Pigmentation includes a broad swath of pigment crossing the body between the dorsal and anal fins; pelvic fins uniformly blackish; few melanophores in cluster on top of head, on opercle, and between pectoral and pelvic fin bases; small cluster of pigment crosses caudal fin base

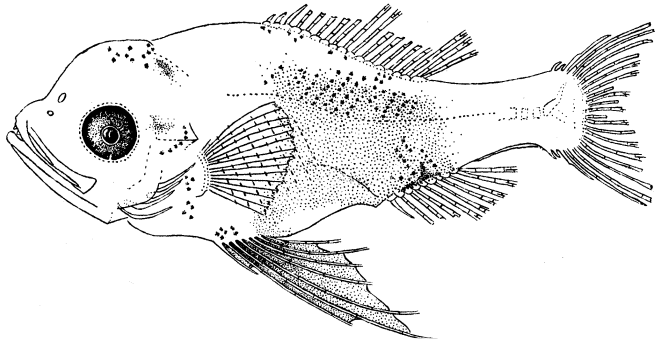
Melamphaes typhlops is a member of the "*Typhlops* Group" of melamphaids (*sensu* Ebeling, 1962). The table below summarizes selected characters compared between the four "groups" that occur in the study area. Most characters are more easily observable in adults or juveniles after transformation.

	"*Lugubris* Group"	"*Suborbitalis* Group"	"*Typhlops* Group"	"*Simus* Group"
Dorsal fin rays	14–18	14–18	14–17	14–16
Caudal vertebrae	16–18	16–18	14–17	15–18
Gill rakers, lower first arch	15–18	14–17	11–15	12–14
Gill raker shape	Long and wide	Long and wide	Long and slender	Moderately long and wide
Pelvic fin origin	Behind pectoral	Behind/under pectoral	Well behind pectoral	Well behind pectoral
Anal fin origin	Under last 2 D rays	3–5 from last D ray	Under last D ray	2–4 from last D ray
Body size (adults)	"Giant"	"Giant"	Small/"Giant"	"Dwarf"

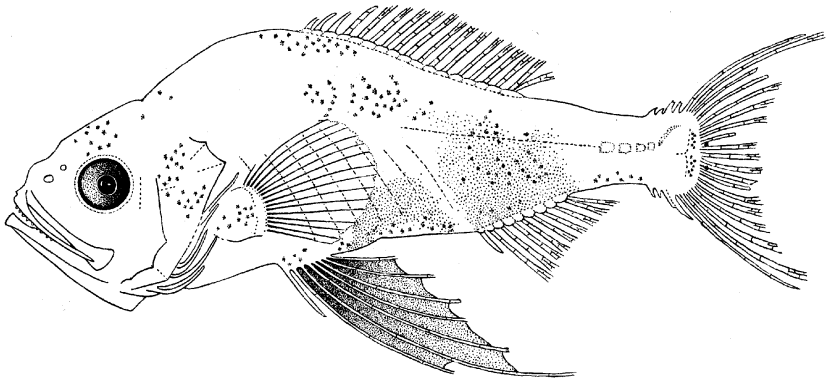
Figures: Adult: Ebeling, 1962; **A–C**: Ebeling, 1962

References: Ebeling, 1962; Ebeling and Weed, 1973; Keene *et al*., 1987

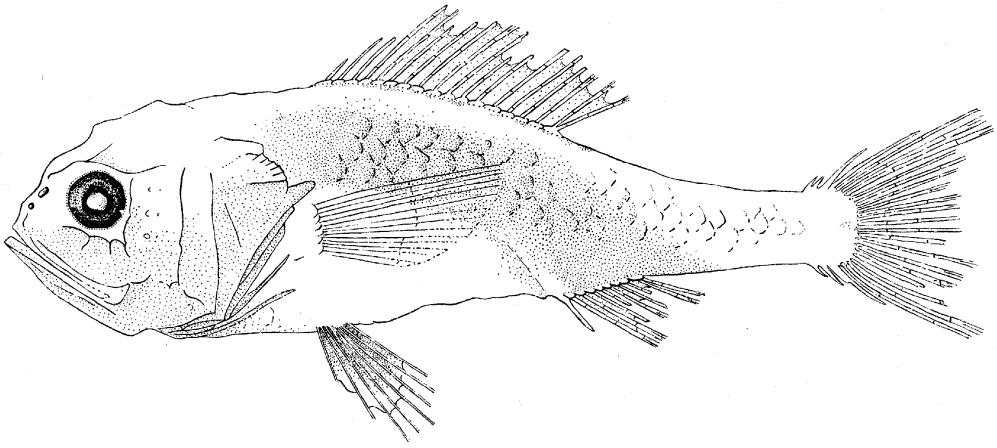
Melamphaes typhlops



A. 6.2 mmSL

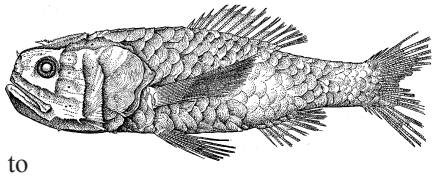


B. 10.9 mmSL



C. 13.0 mmSL

Poromitra capito Goode and Bean, 1883
Melamphaidae
No common name



Range: North Atlantic Ocean; in the western North Atlantic from Flemish Cap to the Bahamas

Habitat: Meso- to bathypelagic in depths of 750–1,550 m during the day and 100–>750 m at night

Spawning: Peaks in Nov–Dec, based on sampling near Bermuda; begin spawning in third year

Meristic Characters

Myomeres:	25–26
Vertebrae:	25–26
Dorsal fin rays:	III, 11–12
Anal fin rays:	I, 8–9
Pectoral fin rays:	13–14
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

Eggs: – Undescribed

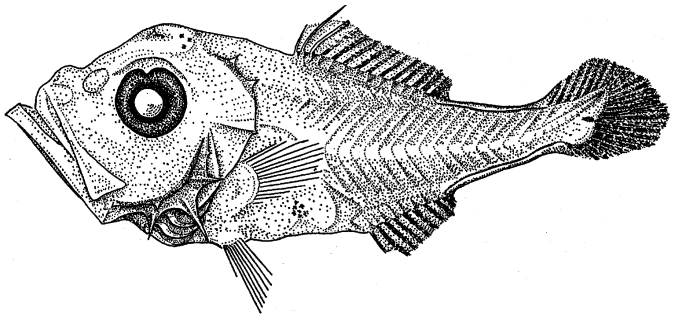
Larvae:
- Body laterally compressed, deep through level of pectoral fin origin, then tapers to narrow caudal peduncle
- Caudal peduncle moderately elongate
- Head length about 40% SL in larvae, remains about the same into adulthood
- Eye moderately large, mouth large; maxillary ends under mid-eye
- Preanus length about 60% SL throughout development
- Body depth about 40% SL in early larvae, decreases to 27–32% SL in adults
- 3–4 strong spines at angle of preopercle; other spiny ridges on nasal, frontal and posttemporal bones
- Sequence of fin ray formation undescribed; pectoral and pelvic fin rays presumably form at small size
- Anal fin origin under mid-dorsal fin in larvae, under 4th from last dorsal fin ray in adults
- Pelvic fin origin slightly anterior to pectoral fin base
- Pigment light; a few melanophores on lateral gut and top of head; no series of black dashes on body

Note: 1. Formation of larval head spines in the Melamphaidae restricted to *Poromitra*

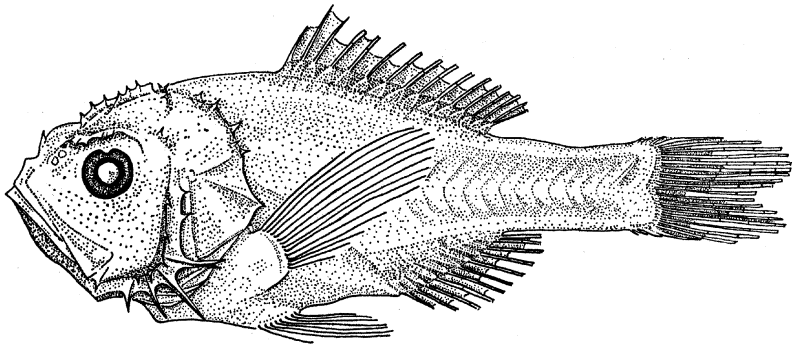
Figures: Adult: T. R. Chen (Ebeling and Weed, 1973); **A–C**: T. R. Chen (Ebeling and Weed, 1973)

References: Ebeling and Weed, 1973; Keene *et al*., 1987

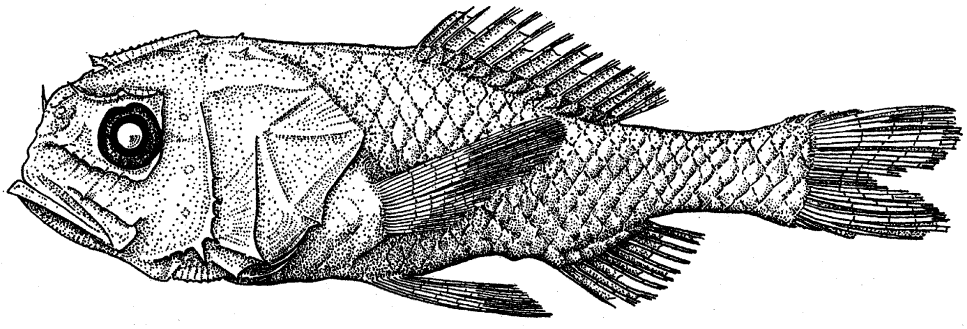
Poromitra capito



A. 4.1 mmSL

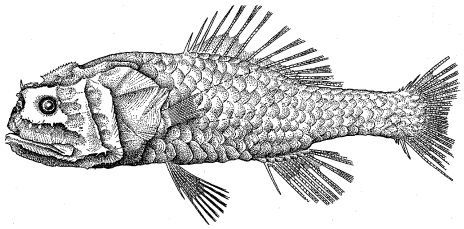


B. 13.2 mmSL



C. 22.5 mmSL

Poromitra crassiceps (Günther, 1878)
Melamphaidae
No common name



Range: Worldwide except Arctic Ocean and Mediterranean Sea; in the western North Atlantic from Greenland to Gulf of Mexico and Caribbean Sea

Habitat: Meso- to bathypelagic in depths of 750–2,400 m

Spawning: Probably year-round in the eastern Pacific Ocean with a maximum in spring-summer; undescribed in Atlantic Ocean

Meristic Characters

Myomeres:	26–29
Vertebrae:	26–29
Dorsal fin rays:	III, 11–14
Anal fin rays:	I, 8–11
Pectoral fin rays:	13–15
Pelvic fin rays:	I, 7–8
Caudal fin rays:	4+10+9+4

Eggs: – Undescribed

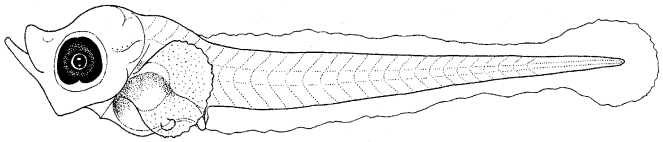
Larvae:
- Hatching occurs at sizes <3.0 mm
- Body laterally compressed, elongate; deepest through level of pectoral fin origin, then tapers to very narrow, elongate, caudal peduncle
- Head length about 19–27% SL in larvae, increases to 41–46% SL in adults
- Eye moderately large, becomes proportionately smaller
- Mouth large; maxillary ends under mid-eye
- Preanus length initially about 33–42% SL, increases to 61–64% SL in juveniles
- Body depth about 18–22% SL in early larvae, increases to 28–32% SL in juveniles
- Flexion occurs at 7.2–9.9 mmSL
- 3–4 slender spines at angle of preopercle; other spines formed on opercle and posttemporal bones during flexion stage, on nasal, frontal and pterotic bones during postflexion stage
- Sequence of fin ray formation: P_2, $P_1 - C_1$, $D - C_2$, A
- Anterior dorsal fin rays (1–3) can be elongate
- Anal fin origin under mid-dorsal fin
- Pelvic fin origin under pectoral fin base
- Transformation occurs at 18.0–21.6 mmSL
- Pigment includes series of melanophores along dorsal and ventral edges of body, merging across caudal peduncle in larger larvae; top of head covered with cluster of spots; a small cluster of spots in front of eye; peritoneal pigment dense; scattered pigment covers proximal portion of caudal fin; pectoral and pelvic fins peppered with fine pigment; some internal pigment near brain and eye in all stages

Note: 1. Formation of larval head spines in the Melamphaidae restricted to *Poromitra*

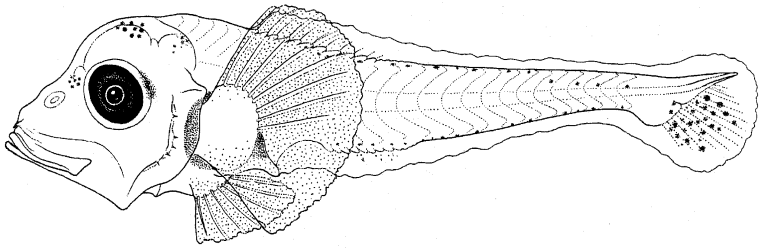
Figures: Adult: Shirley G. Hartman (Ebeling and Weed, 1973); **A–D**: Barbara Sumida M^{ac}Call (Sandknop and Watson, 1996a)

References: Ebeling and Weed, 1973; Keene and Tighe, 1984; Keene *et al*., 1987

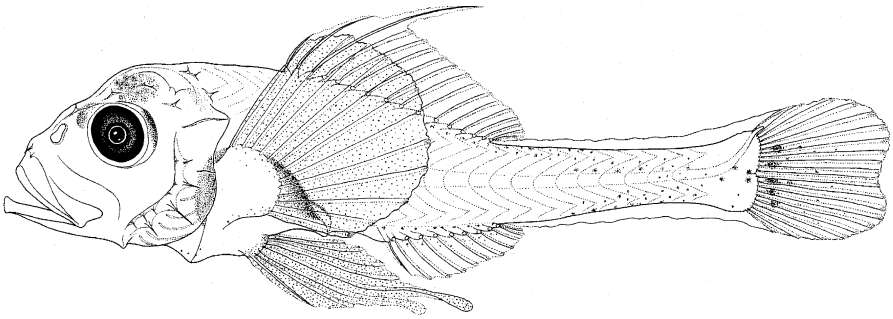
Poromitra crassiceps



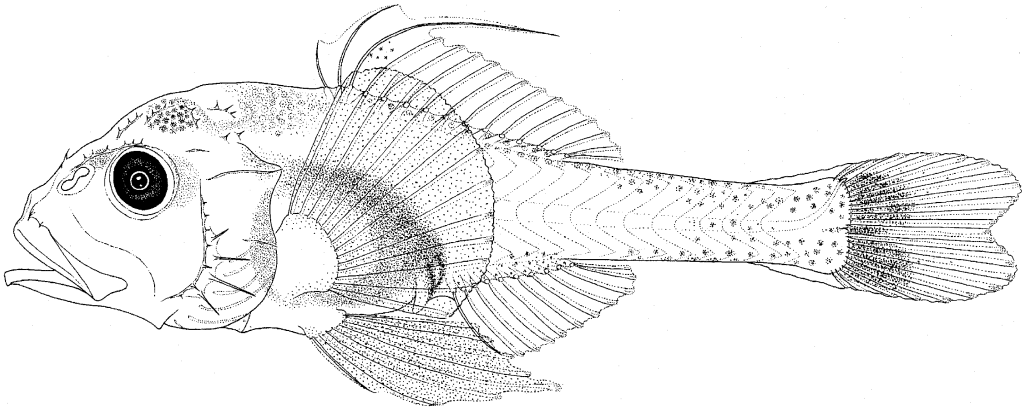
A. 4.2 mmSL



B. 7.9 mmSL

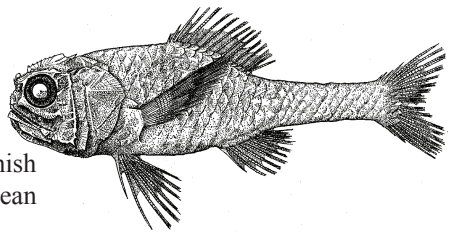


C. 10.7 mmSL



D. 14.2 mmSL

Poromitra megalops (Lütken, 1877)
Melamphaidae
No common name



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

Habitat: Meso- to bathypelagic in depths of >700 m during the day, >500 m at night

Spawning: Probably year-round in the eastern Pacific Ocean with a maximum in spring-summer; undescribed in Atlantic Ocean

Meristic Characters

Myomeres:	26–30
Vertebrae:	26–30
Dorsal fin rays:	II–III, 10–12
Anal fin rays:	I, 8–10
Pectoral fin rays:	13–15
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

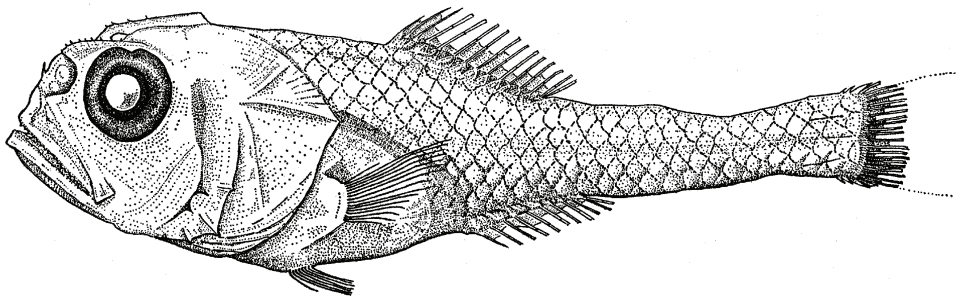
Eggs: – Undescribed

Larvae:
- Hatching occurs at sizes <2.4 mm
- Body laterally compressed, elongate; deepest through level of pectoral fin origin, then tapers to very narrow, elongate, caudal peduncle
- Head length about 26–34% SL in larvae, increases to 34–38% SL in adults
- Eye moderately large, becomes proportionately smaller
- Mouth large; maxillary ends under mid- to posterior edge of eye
- Preanus length initially about 36–47% SL, increases to 53–56% SL in juveniles
- Body depth about 25–32% SL in early larvae, remains about the same through development
- Flexion occurs at 4.5–6.8 mmSL
- 3–4 relatively weak spines at angle of preopercle; other spines formed on opercle and posttemporal bones during flexion stage, on nasal and frontal bones during postflexion stage; spines weakly developed
- Sequence of fin ray formation: $D_1 - D_2$, A, $P_2 - C_1 - C_2$
- Third dorsal fin rays can be slightly elongate
- Anal fin origin under mid-dorsal fin
- Pelvic fin origin under pectoral fin base (slightly anterior to pectoral fin base in juveniles and adults)
- Transformation occurs at 11.0–14.0 mmSL
- Pigment includes series of dash-like melanophores on body; early stages have series of melanophores along anal fin base; internal pigment occurs under brain, behind eye, on air bladder and gut; few spots on caudal fin; little or no pigment on pectoral or pelvic fins

Note: 1. Formation of larval head spines in the Melamphaidae restricted to *Poromitra*

Early Juvenile:

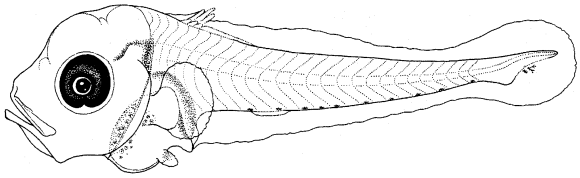
G. 14.4 mmSL



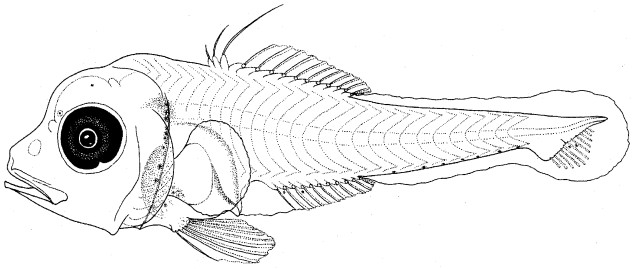
Figures: Adult: T.R. Chen (Ebeling and Weed, 1973); **A–C**: Barbara Sumida MacCall (Sandknop and Watson, 1996a); **D–G**: T. R. Chen (Ebeling and Weed, 1973

References: Ebeling and Weed, 1973; Sandknop and Watson, 1996a

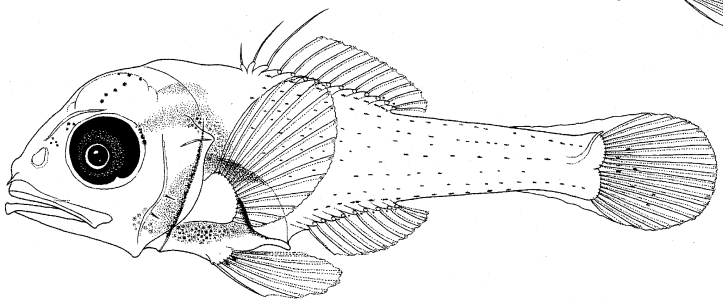
Poromitra megalops



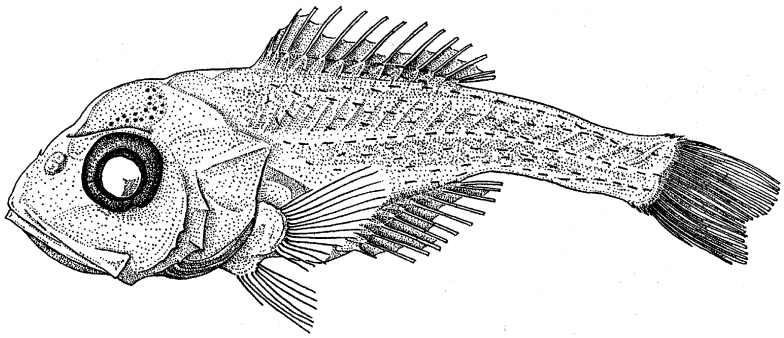
A. 4.0 mmSL



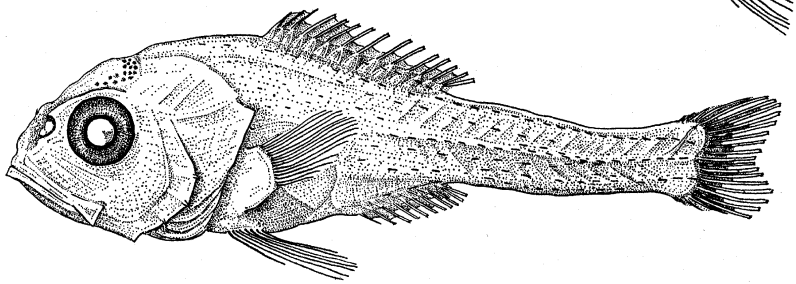
B. 5.2 mmSL



C. 6.4 mmSL

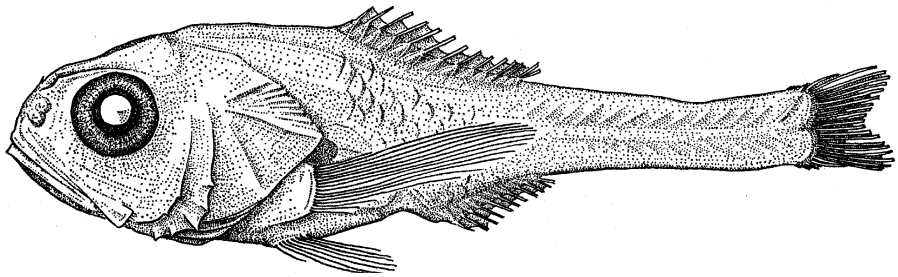


D. 7.3 mmSL



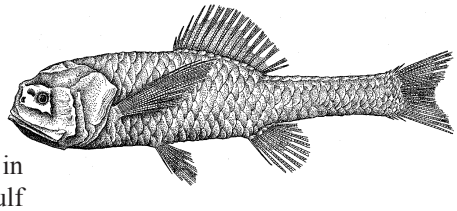
Head spines more weakly developed than in other *Poromitra* larvae

E. 11.0 mmSL



F. 13.5 mmSL

Scopeloberyx opisthopterus (Parr, 1933)
Melamphaidae
No common name



Range: Western North Atlantic, Indian and eastern Pacific oceans, primarily in tropical waters; in the western North Atlantic from Flemish Cap to Gulf of Mexico and Caribbean Sea

Habitat: Meso- to bathypelagic in depths >800 m

Spawning: Spring through summer, based on sampling near Bermuda; adults begin spawning at start of their second year

Eggs: – Undescribed

Larvae:
- Not well described, although larvae not uncommonly collected in waters near Bermuda
- Body rather chunky compared to other melamphaids
- Preanus length about 70% SL in larva, decreases to 60% SL in adult
- Body depth about 35% SL
- No head spines in larvae
- Sequence of fin ray formation undescribed
- Anal fin origin under 3rd from last dorsal fin ray
- Pelvic fin origin well posterior to pectoral fin base
- Pigmentation includes dense collection of melanophores covering most of body from just behind level of pectoral fin base to base of caudal fin; cluster of spots on top of head, on opercle behind eye and dorsum of gut; a line of spots along anal fin base; caudal and pelvic fins well pigmented

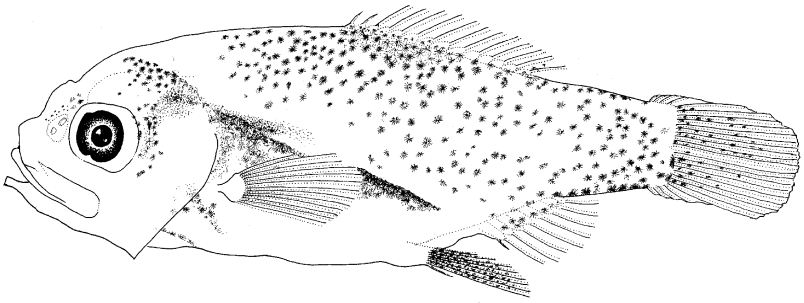
Meristic Characters

Myomeres:	24–27
Vertebrae:	24–27
Dorsal fin rays:	II–III, 11–12
Anal fin rays:	I, 7–8
Pectoral fin rays:	12–15
Pelvic fin rays:	I, 7–8
Caudal fin rays:	4+10+9+4

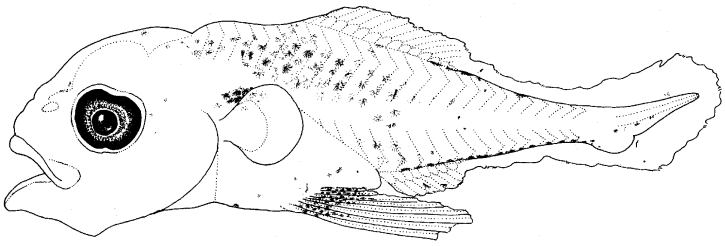
Figures: Adult: Shirley G. Hartman (Ebeling and Weed, 1973); **A–B**: Betsy Washington (Keene and Tighe, 1984);

References: Ebeling and Weed, 1973; Keene and Tighe, 1984; Keene, 1987; Keene et al., 1987; Kotlyar, 2005

Scopeloberyx opisthopterus



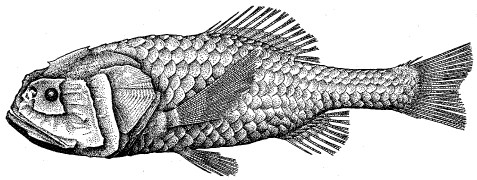
A. 9.1 mmSL



B. 4.4 mmTL (*Scopeloberyx* sp.)

This larva may pertain to an undescribed species of melamphaid that occurs in the western North Atlantic from the southern flank of Georges Bank to the Caribbean Sea (Keene, 1987; Keene *et al.*, 1987). It may have been confused with *S. robustus* in published accounts. The species is meso- to bathypelagic, occurring deeper than 900 m. It reaches a maximum size of only 28 mm. The larval illustration was published without further comments or descriptive details by Keene and Tighe (1984), and does not necessarily relate to the undescribed species.

Scopeloberyx robustus (Günther, 1887)
Melamphaidae
No common name



Range: Worldwide in all oceans except Arctic Ocean and Mediterranean Sea; in the western North Atlantic from La Have Bank to Cape Hatteras

Habitat: Bathypelagic in depths >1,200 m (at least to 2,562 m)

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

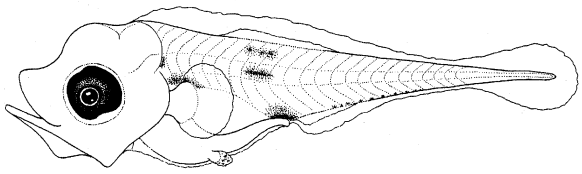
Myomeres:	23–27
Vertebrae:	23–27
Dorsal fin rays:	II–III, 10–13
Anal fin rays:	I, 7–9
Pectoral fin rays:	12–14
Pelvic fin rays:	I, 7–8
Caudal fin rays:	4+10+9+4

Larvae:
- Hatching occurs at sizes <2.2 mm
- Body slightly compressed, but robust; deepest through level of pectoral fin origin, then tapers to narrow caudal peduncle
- Head profile develops pronounced hump over eye
- Head length about 23–34% SL in larvae, increases to 39–43% SL in adults
- Eye moderately large, becomes proportionately much smaller in juveniles
- Mouth large; maxillary ends under posterior margin of eye
- Preanus length initially about 43–56% SL, increases slightly to 61–66% SL in juveniles
- Body depth about 17–30% SL in early larvae, increases to 33–34% SL in juveniles
- Flexion occurs at 3.3–4.1 mmSL (relatively small size for melamphaids)
- No obvious head spines, but a hook-like projection forms at anterior end of maxilla
- Sequence of fin ray formation: P_2 – D, A, C_1 – P_1, C_2
- Anal fin origin slightly behind mid-dorsal fin
- Pelvic fin origin well behind pectoral fin base; pelvic fin rays become elongate
- Transformation occurs at 10.5–14.3 mmSL
- Pigment includes 3 corresponding blotches on the body at level of the anus: on the dorsolateral surface, on the midline, and over the terminus of the anus; a series of melanophores along anal fin base and ventral edge of caudal peduncle; a few spots on top of head; internal pigment occurs over air bladder and dorsum of gut; pigment spreads over much of body in larger larvae; small cluster of spots behind eye; pelvic fin well pigmented; proximal portion of caudal fin heavily spotted

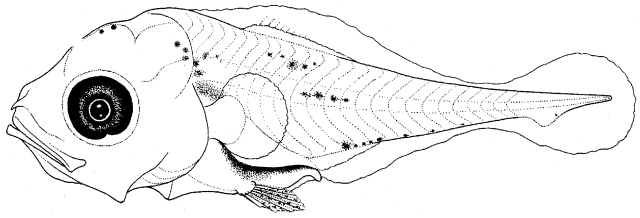
Figures: Adult: Shirley G. Hartman (Ebeling and Weed, 1973; **A–D**: Barbara Sumida M^{ac}Call (Sandknop and Watson, 1996a); **E**: Betsy Washington (Keene and Tighe, 1984)

References: Ebeling and Weed, 1973; Sandknop and Watson, 1996a; Keene *et al.*, 1987

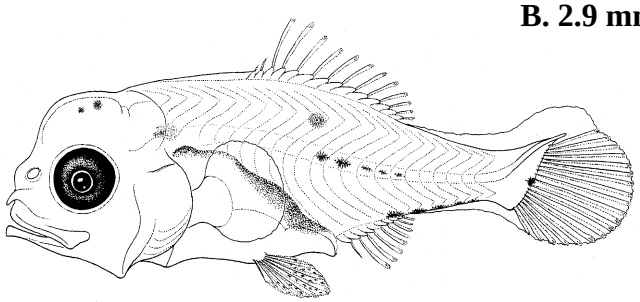
Scopeloberyx robustus



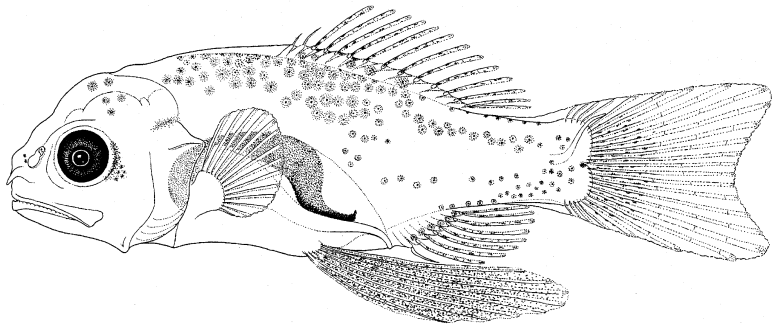
A. 2.4 mmSL



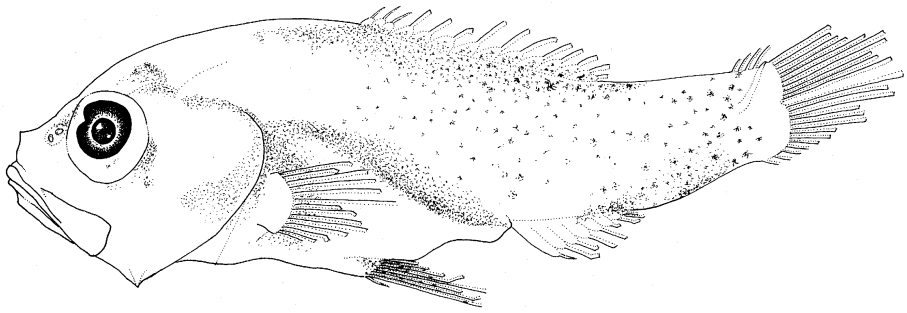
B. 2.9 mmSL



C. 3.9 mmSL

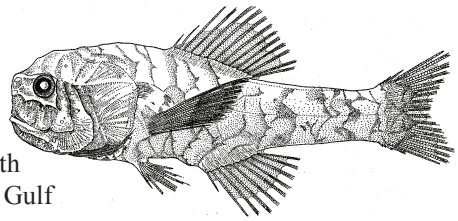


D. 7.8 mmSL



E. 13.0 mmSL

Scopelogadus beanii (Günther, 1887)
Melamphaidae
No common name



Range: Atlantic, southern Indian and South Pacific oceans; in the western North Atlantic from eastern Greenland and Flemish Cap to the Bahamas and Gulf of Mexico

Habitat: Meso- to bathypelagic in depths of 800–1,000 m during the day, >400 m at night

Meristic Characters

Myomeres:	26–27
Vertebrae:	26–27
Dorsal fin rays:	II, 11
Anal fin rays:	I, 8
Pectoral fin rays:	14–15
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

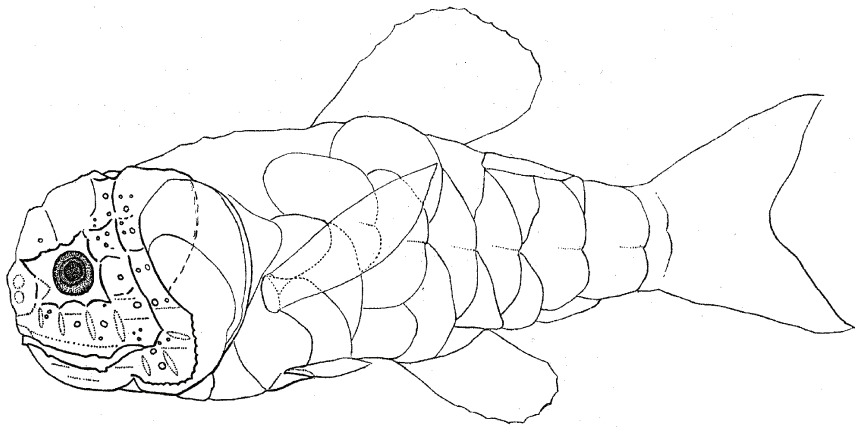
Spawning: Undescribed

Eggs: – Undescribed

Larvae:
- Hatching occurs at sizes <5.0 mm
- Body laterally compressed, deep; deepest through level of dorsal fin to anus; tapers to narrow, long caudal peduncle in later stages
- Head length about 34–48% SL in larvae, decreases to 32–38% SL in adults
- Eye moderately large, becomes proportionately smaller
- Mouth large; maxillary ends under mid-eye
- Preanus length initially about 60% SL, does not change markedly until adult stage, when about 50% SL
- Body depth about 27–35% SL in early larvae, remains 27–31% SL in juveniles
- No head spination
- Sequence of fin ray formation undescribed
- Anal fin origin under mid-dorsal fin
- Pelvic fin origin under, or slightly anterior to, pectoral fin base
- Pigment light in early stages; by 8.1 mm dense clusters of melanophores on most of body, top of head, preopercle and opercle, pectoral fin base, and on midline at caudal fin base; note especially a densely pigmented wedge internally before the eye, in the palatoethmoid region (above roof of mouth)

Juvenile:

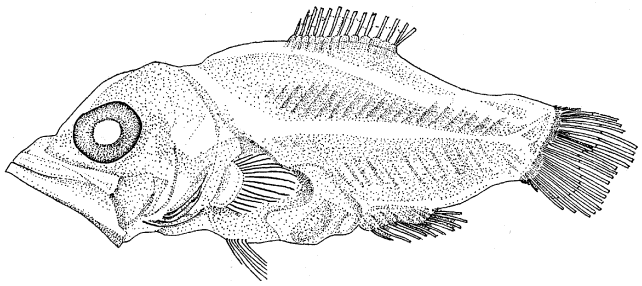
D. 61.5 mmSL



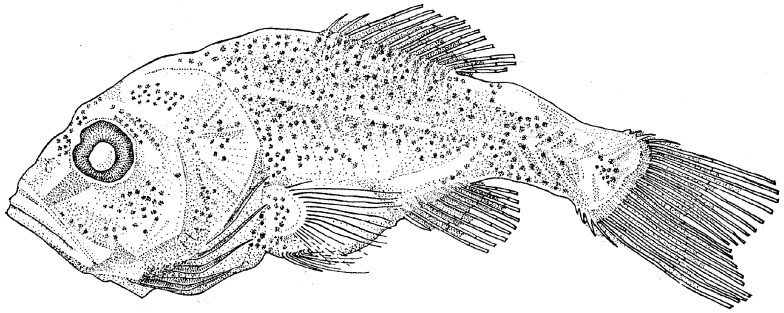
Note development of deciduous scales and sensory pores on head

Figures: Adult: Ebeling and Weed, 1963; **A–D**: Ebeling and Weed, 1963
References: Ebeling and Weed, 1963; Ebeling and Weed, 1973

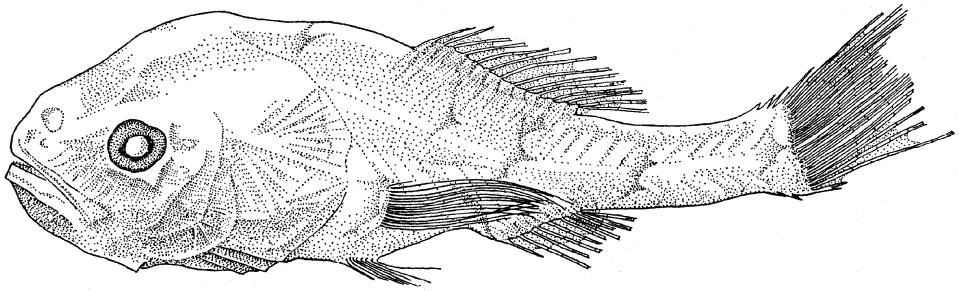
Scopelogadus beanii



A. 5.1 mmSL

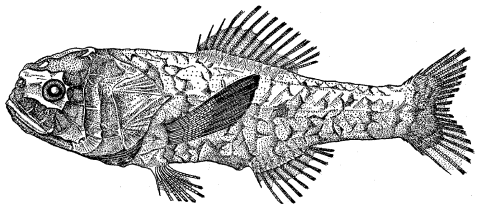


B. 8.1 mmSL



C. 13.3 mmSL

Scopelogadus mizolepis (Günther)
Melamphaidae
No common name



Range: Atlantic, Pacific and Indian oceans, in tropical waters; in the western North Atlantic from Grand Bank to southern Brazil

Habitat: Mesopelagic in depths >500 m during the day, >200 m at night

Spawning: Probably does not spawn north of southern Sargasso Sea (late winter to summer).

Meristic Characters	
Myomeres:	24–25
Vertebrae:	24–25
Dorsal fin rays:	I–II, 11
Anal fin rays:	I, 8
Pectoral fin rays:	14–16
Pelvic fin rays:	I, 7
Caudal fin rays:	4+10+9+4

Eggs:
- Undescribed

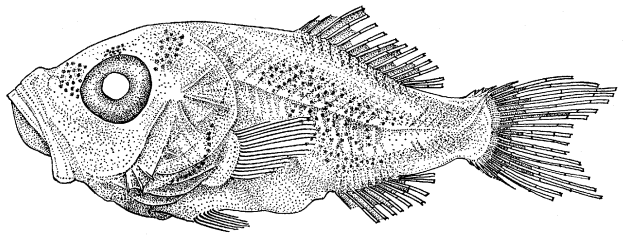
Larvae:
- Hatching occurs at sizes <5.0 mm
- Body laterally compressed, deep; deepest through level of pectoral fin base; tapers to narrow, long caudal peduncle in later stages
- Head length about 35–46% SL in larvae, decreases slightly to 38–40% SL in adults
- Eye moderately large, becomes proportionately much smaller
- Mouth large; maxillary ends under front edge of eye
- Preanus length initially about 60% SL, does not change markedly to adult stage
- Body depth about 25–30% SL in early larvae, remains 23–27% SL in juveniles
- No strong head spination; weak spines develop on opercle in late larvae
- Sequence of fin ray formation undescribed; (P_1 early, P_2 late in *Scopelogadus m. bispinosus*)
- Anal fin origin under mid-dorsal fin
- Pelvic fin origin under, or slightly anterior to, pectoral fin base
- Pigment includes a dense concentration of melanophores on middle of flank; another cluster occurs over hindbrain, in front of eye, and in a linear series under the opercle; densely pigmented wedge internally before the eye (as in *S. beanii*) lacking

Note:
1. The subspecies *Scopelogadus mizolepis mizolepis* (Günther) occurs in the study area. Another subspecies, *Scopelogadus mizolepis bispinosus* (Gilbert) occurs in the eastern, tropical Pacific Ocean. It is sometimes treated as a separate species, *S. bispinosus*. Complete developmental series of the latter have been described (Ebeling and Weed, 1963; Sandknop and Watson, 1996a).

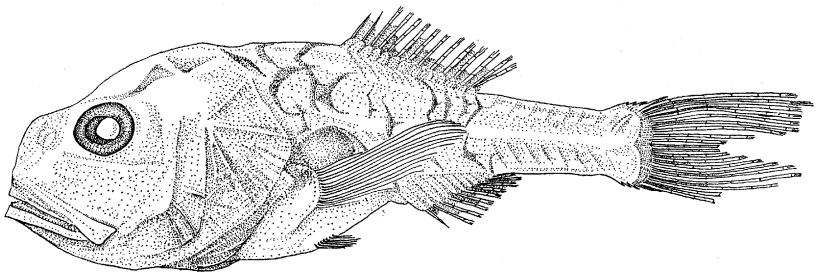
Figures: Adult: Ebeling and Weed, 1963; **A–C**: Ebeling and Weed, 1963

References: Ebeling and Weed, 1963; Ebeling and Weed, 1973; Keene *et al*., 1987

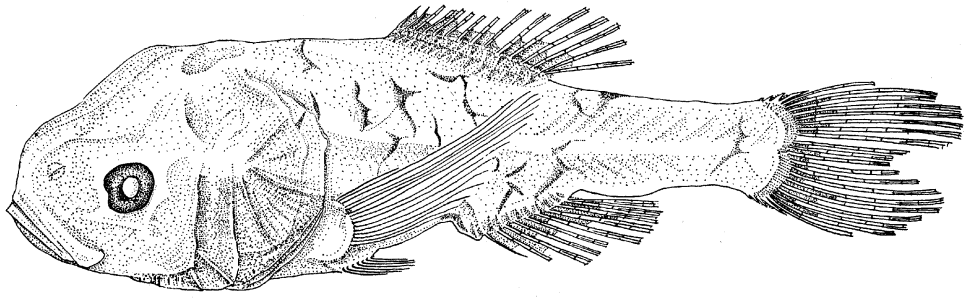
Scopelogadus mizolepis



A. 5.0 mmSL

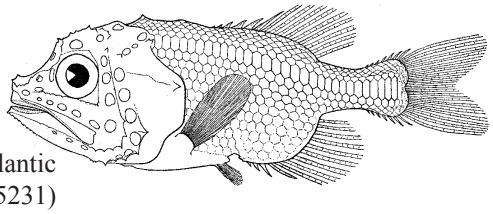


B. 8.5 mmSL



C. 14.6 mmSL

Gibberichthys pumilus Parr, 1933
Gibberichthyidae
No common name



Range: North Atlantic and South Pacific oceans; in the western North Atlantic from Bermuda to northern South America; a 9.0-mm larva (MCZ 95231) has been collected off the southern flank of Georges Bank

Habitat: Bathy- to benthopelagic in depths of 320–1,100 m; young stages migrate to near-surface layers at night

Spawning: Undescribed

Meristic Characters

Myomeres:	30–31
Vertebrae:	30–31
Dorsal fin rays:	V–VI, 8–9
Anal fin rays:	II–III, 7–8
Pectoral fin rays:	14–15
Pelvic fin rays:	I, 5
Caudal fin rays:	7+10+9+6 (PrC)

Eggs: – Undescribed

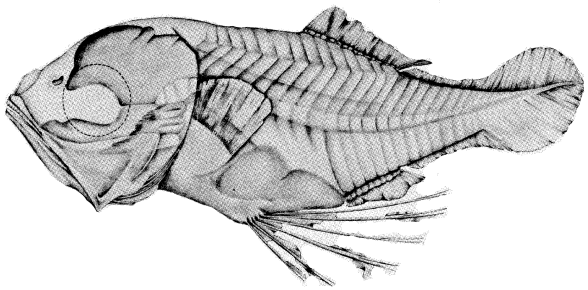
Larvae:
- Very few specimens known
- Body very deep anterior to dorsal and anal fin origins
- Head bears obvious series of pores; eye very large
- Mouth large, the end of maxilla reaching level of posterior edge of eye
- Anus well-separated from anal fin origin
- Air bladder present
- Fin spines weak; resemble fin rays in early stages
- Dorsal and anal fins short-based, opposite each other
- Caudal peduncle elongate
- Lateral line characterized by series of short, vertical rows of sensory organs in larger larvae
- Late larvae and juveniles have third ray of pelvic fins modified into long, trailing, highly ornamented structure; suggested to mimic *Sargassum* or a siphonophore by various authors
- End of elongate third pelvic fin ray equipped with numerous large, black sacs, each with a clear, oval 'window' at tip
- Pigment largely black over entire body, with white papillae; fins clear and lacking pigment

Note:
1. Stages exhibiting long, trailing pelvic fins known as "kasidoron", (based on specimens 7.8–21.2 mmSL) were once assigned to their own family, Kasidoroidae (Robins and deSylva, 1965). These were later relegated to the Gibberichthyidae (Rosen and Patterson, 1969; deSylva and Eschmeyer, 1977)
2. A photograph of a 6.0 mmSL specimen indicates elongate 3rd pelvic fin ray, heavily pigmented peritoneum, large eye, long caudal peduncle and short-based dorsal and anal fins opposite each other (Lyczkowski-Shultz *et al*., 2000).

Figures: Adult: Parr, 1933; **A**: Keene and Tighe, 1984; **B**: deSylva and Eschmeyer, 1977

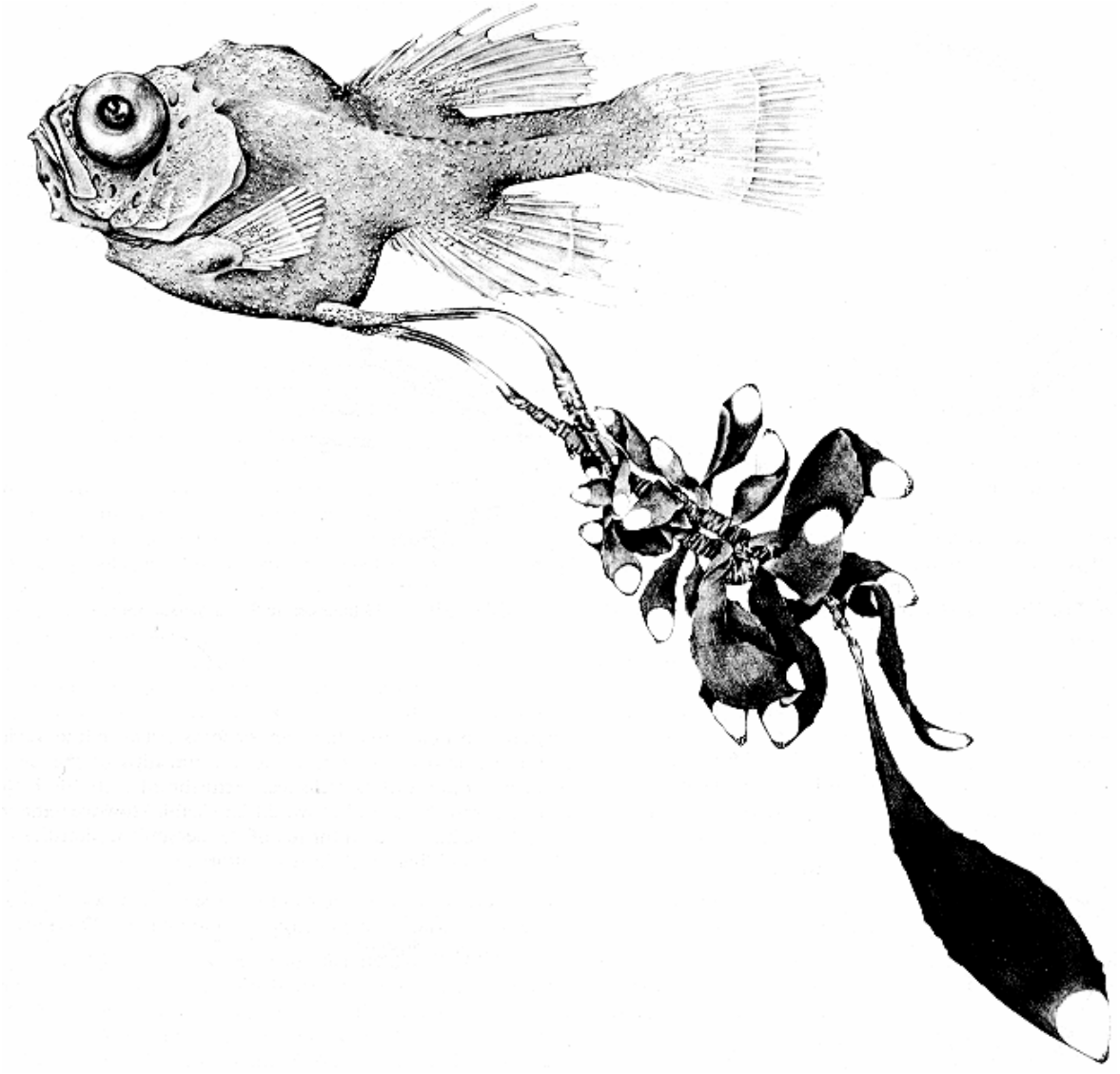
References: Robins and deSylva, 1965; deSylva and Eschmeyer, 1977; Kotlyar, 1985; Moore, *et al.*, 2003

Gibberichthys pumilus
("Kasidoron" larvae)

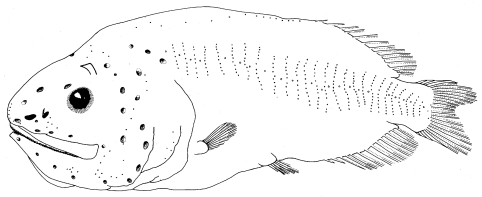


A. 6.2 mmNL

B. 15.3 mmSL



Rondeletia bicolor Goode and Bean, 1895
Rondeletiidae
No common name



Range: North Atlantic and South Pacific oceans; in the western North Atlantic from vicinity of Norfolk, Hudson and Munson canyons and Bear Seamount to Caribbean Sea

Habitat: Meso- to bathypelagic in depths to at least 500 m

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

Myomeres:	about 27
Vertebrae:	27
Dorsal fin rays:	14–15
Anal fin rays:	14–15
Pectoral fin rays:	10–11
Pelvic fin rays:	6
Caudal fin rays:	5+10+9+4

Larvae:
- Head and body moderately deep and short; head length about 40% SL
- Mouth moderately large, oblique; grows in juveniles until maxilla reaches level of mid-eye (as in adults)
- Gut cavity very large; preanus length about 70+% SL; terminus of gut protrudes slightly
- Air bladder not obvious, apparently absent
- Teeth appear early in development; widely spaced on premaxilla, close-set on dentary
- In the smallest larva, a series of small, circular, cycloid scales occur in 2 parallel rows from opercle to end of vertebral column. Scales arranged about 1 per myomere (24–25 per row), increase in size and become slightly embedded in juveniles
- Two minor rows of widely spaced, smaller scales form along each side of dorsal midline, well anterior to dorsal fin origin
- A third group of scales forms in ventral area under pectoral fin origin
- Sequence of fin ray formation unknown; all complements complete in 7.2 mm larva; fin spines lacking
- Dorsal and anal fins far posterior and opposite each other
- Note 6 supraneurals anterior to dorsal fin origin
- Pelvic fins abdominal, and initially positioned high on sides
- Head spines lacking (except for 2 very weak spines on upper angle of opercle)
- Head pores and lateral line (see note below) form at sizes as small as 14 mm
- Pigmentation poorly known, due to scarcity of specimens, and length of preservation in those available; juveniles as small as 14 mm have loose, dark brown skin over the entire body, as in adults

Note:

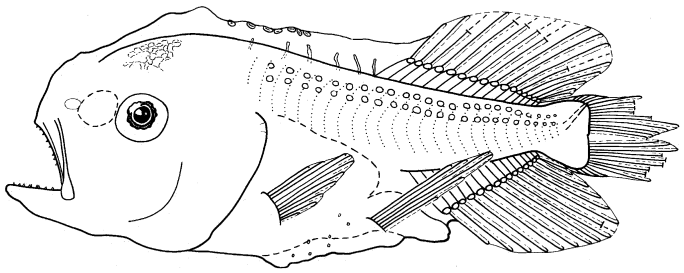
1. The adult is characterized by series of vertical rows of papillae along the lateral line, and by the presence of a "Tominaga's organ" (*sensu* Paxton *et al*., 2001) located anterior to the eye. The function of this organ is unknown, but may be at least partly secretory. Early development of this organ is indicated with a dotted line in the larval illustrations.

2. Note also the presence of a bony hook over the eye in adults. An early expression of this character may be visible in juveniles as small as 13.5 mm.

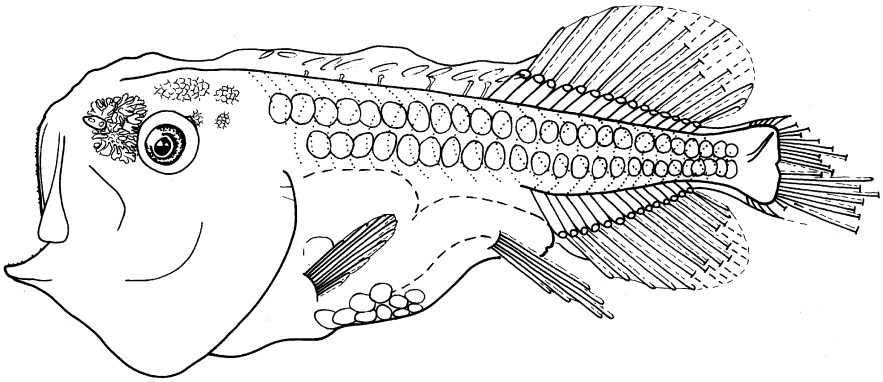
Figures: Adult: Thomas Trnski (Paxton, *et al.*, 2001); **A–B**: Thomas Trnski (Paxton *et al.*, 2001)

References: Kotlyar, 1996; Paxton *et al.*, 2001; Moore, *et al.*, 2003

Rondeletia bicolor

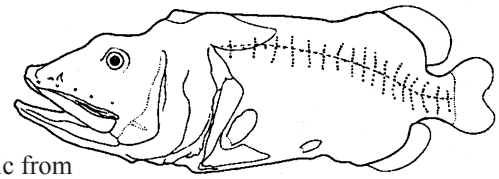


A. 7.2 mmSL



B. 13.5 mmSL

Rondeletia loricata Abe and Hotta, 1963
Rondeletiidae
No common name



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

Habitat: Meso- to bathypelagic in depths of 750–1,150 m during the day, >100 m at night

Spawning: Undescribed

Eggs: – Undescribed

Meristic Characters

Myomeres:	24–26
Vertebrae:	24–26
Dorsal fin rays:	13–14
Anal fin rays:	12–13
Pectoral fin rays:	9–11
Pelvic fin rays:	5–6
Caudal fin rays:	5+10+9+4

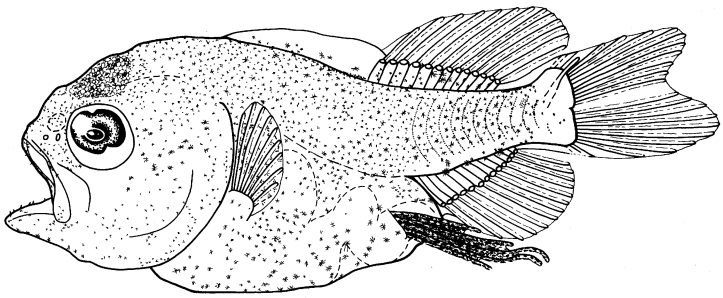
Larvae:
- Head and body moderately deep and short; head length >40% SL
- Mouth moderately large, oblique; grows in juveniles until maxilla reaches level of mid-eye (as in adults)
- Gut cavity very large; preanus length about 70% SL; terminus of gut protrudes slightly
- Air bladder not obvious, apparently absent
- Teeth appear early in development; close-set on dentary
- In larvae >8.8 mm, a series of small, circular, cycloid scales occur in 2 parallel rows from opercle to end of vertebral column.
- A minor row of widely spaced, smaller scales forms along dorsal midline, well anterior to dorsal fin origin
- A third group of scales forms in ventral area under pectoral fin origin
- Sequence of fin ray formation: dorsal, anal and pelvic fin complements complete at 3.5 mm; pectoral and caudal fin (principal rays) complements complete by 4.5 mm; procurrent caudal fin rays complete >9.6 mm; fin spines lacking
- Dorsal and anal fins far posterior and opposite each other
- Note 3 supraneurals anterior to dorsal fin origin
- Pelvic fins abdominal, and initially positioned high on sides; fin rays elongate, reaching well past anal fin origin
- Head spines lacking
- Pigmentation includes covering of small melanophores over the head and body, except near tip of caudal peduncle; fins unpigmented, except for densely pigmented pelvic fins; gut region darkly pigmented; see figures for difference between internal and external pigment in 9.6–mm larva

Note:
1. The adult is characterized by the presence of a "Tominaga's organ" (*sensu* Paxton *et al.*, 2001) located anterior to the eye. The function of this organ is unknown, but may be at least partly secretory. Early development of this organ is indicated with a dotted line in Fig. B.
2. A bony hook over the eye is not present in adults (as in *Rondeletia bicolor*). Note presence in adults of this species of large, posterior bony extensions on the supratemporal and cleithrum; early expressions of these extensions are visible (in the form of spongy bone) in the 9.6-mm larva (Figs. B and C).

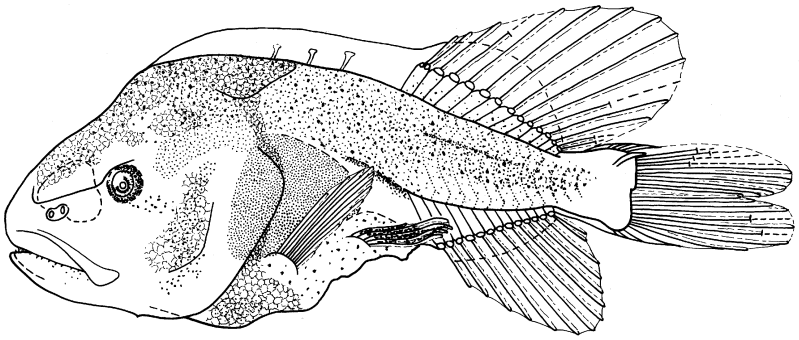
Figures: Adult: Moore, 2003; **A–C**: Thomas Trnski (Paxton *et al*., 2001)

References: Kotlyar, 1996; Paxton *et al.*, 2001; Moore, *et al.*, 2003

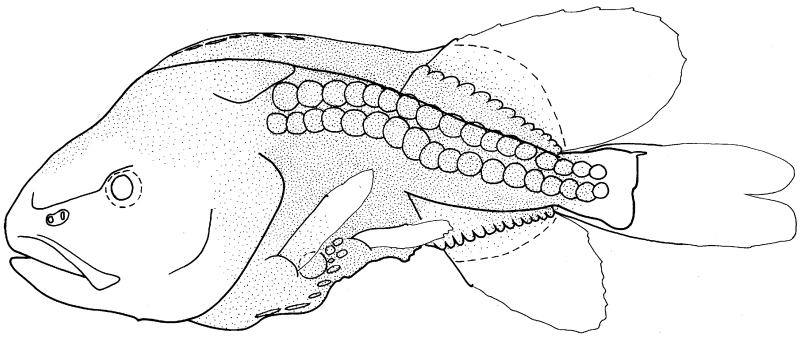
Rondeletia loricata



A. 4.6 mmSL

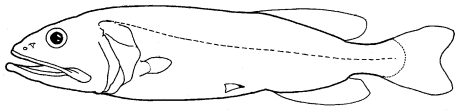


B. 9.6 mmSL (Internal Pigment)



C. 9.6 mmSL (Predorsal, Trunk and Tail Scales, External Pigment)

Barbourisia rufa Parr, 1945
Barbourisiidae
Red velvet whalefish



Range: Atlantic, Pacific and southern Indian oceans, in tropical and temperate waters; in the western North Atlantic from Greenland to northern South America, including Gulf of Mexico and Caribbean Sea

Habitat: Meso- to bathypelagic in depths of 120–2,000 m (mostly >600 m); larvae (n=11) have all been collected near the surface (<33 m)

Spawning: Undescribed

Meristic Characters

Myomeres:	40–43
Vertebrae:	40–43
Dorsal fin rays:	19–22
Anal fin rays:	15–18
Pectoral fin rays:	13–14
Pelvic fin rays:	6
Caudal fin rays:	10+10+9+9

Eggs: – Undescribed

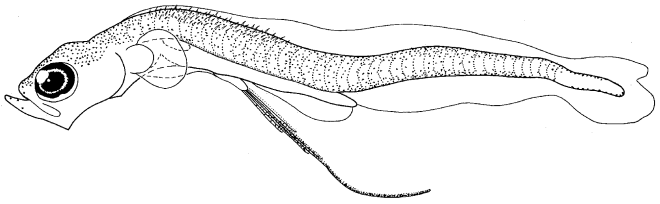
Larvae:
- Body form changes from long and slender in small larvae to deeper anteriorly, slender posteriorly at about 6.0 mmNL (about the size of flexion), to deep and globose in postflexion larvae
- Jaws relatively short and oblique; snout short in smallest larvae
- Single rows of small teeth present on both jaws in 6.2 mm larvae
- Gut appears thick and folded, then straightens before anus; preanus length increases from 55–70% SL
- Eye diameter, pectoral and pelvic fin lengths and body depth are greater in larvae than in juveniles and adults
- Snout length increases in juvenile stages
- In larger larvae (>13 mm), skin is inflated, balloon-like
- Small air bladder present
- Nostrils visible as slits anterior to eye in larger larvae
- Sequence of fin ray formation: P_2 – D, A, C_1 – P_1 – C_2
- Pelvic fin rays elongate; fin origin moves from closer to pectoral fin to closer to anal fin
- Head spines absent in preflexion larvae, but develop on rim of each infraorbital bone, on the interopercle, and 2 sets develop on the preopercle; the supraorbital ridge is serrate in preflexion larvae, and after 13 mm several spiny ridges form on the frontal bones; extrascapular spines form anterior to posttemporal, on the nasal bone, and on the dentary in postflexion larvae
- Small, round scales, each with a single, central, upright spine, cover the body from preflexion stage into adult stages
- Pigmentation includes scattered melanophores over head and anterior body, and internal pigment on gut and brain; few spots on tip of notochord in smallest larvae; melanophores on top of head in early larvae; spots added to circumorbital bones in larger larvae; pigment dense on distal part of pelvic fin rays

Note: 1. Transformation involves change in body form from globose to the slim outline of the adult

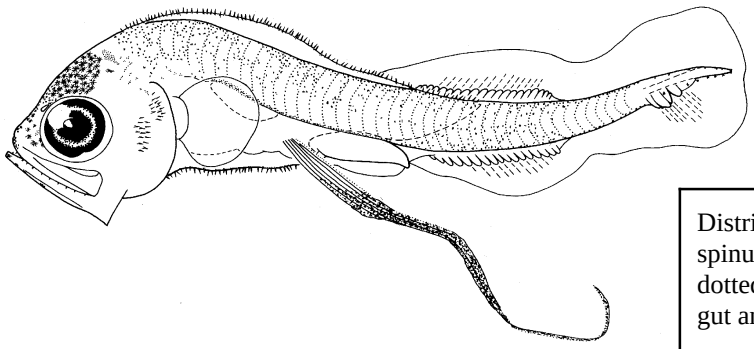
Figures: Adult: Paxton, 2002; **A–C**: Thomas Trnski (Paxton *et al*., 2001); **D**: Betsy Washington (Paxton *et al*., 2001)

References: Rofen, 1959; Kotlyar, 1995; Paxton *et al*., 2001; Paxton, 2002

Barbourisia rufa

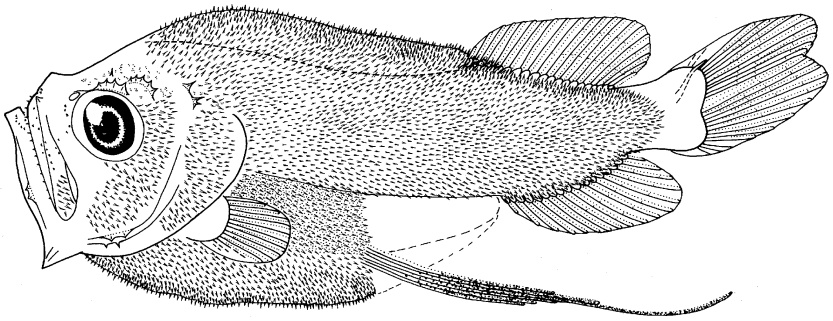


A. 4.8 mmNL

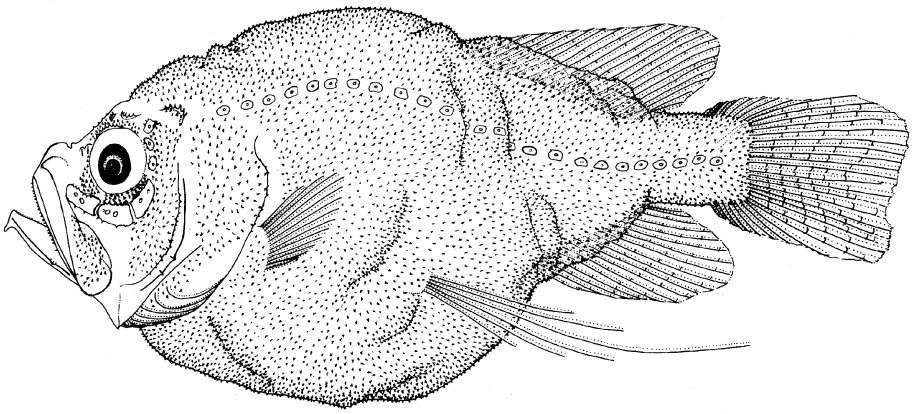


Distribution of body spinules indicated by dotted line over posterior gut and anterior part of tail

B. 6.6 mmNL



C. 7.5 mmSL (Posterior part of gut missing)



D. 14.1 mmSL

Parataeniophorus gulosus Bertelsen and Marshall, 1956
Mirapinnidae
Tapertail

Adult Unknown

Meristic Characters	
Myomeres:	49
Vertebrae:	49
Dorsal fin rays:	28–33
Anal fin rays:	23–29
Pectoral fin rays:	19–20
Pelvic fin rays:	9–10
Caudal fin rays:	10+9 (PrC)

Range: North Atlantic and southwest Indian oceans; in the North Atlantic from 42°N to 20°N, but may be restricted to areas east of study area

Habitat: Undescribed for adults; juveniles bathypelagic in depths of 700–1,400 m

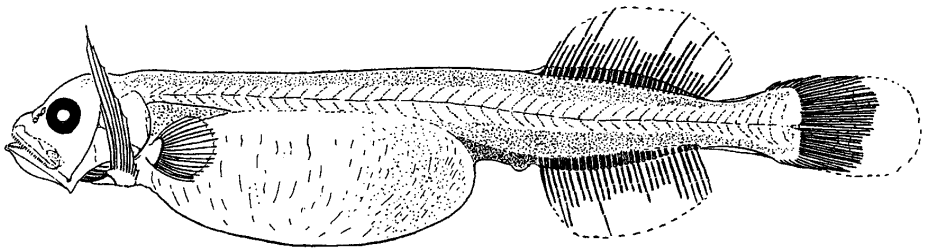
Spawning: Undescribed

Eggs: – Undescribed

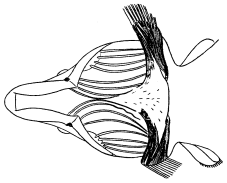
Larvae:
- Elongate body with small head, wide posteriorly (Fig. D)
- Snout moderately blunt; mouth oblique, extending to level of mid-eye
- Gut long, straight, relatively thick
- Sequence of fin ray formation undescribed; dorsal and anal fin rays may form earliest, followed by pelvic
- Dorsal and anal fins positioned far posteriorly, opposite each other; dorsal fin rays outnumber anal fin rays
- Pelvic fin rays present, in jugular position (Fig. D); fin rays elongate
- Note caudal fin "streamer" of skin
- Tiny papillae cover skin (external scales absent)
- Pigment light and scattered on top of head and tail; pigment on dorsal peritoneum and distal pelvic fin rays

Note:
1. Previous classifications have included mirapinnids in a close relationship with Aulopiformes, Myctophiformes or with the Ateleopodidae. More recently, it has been considered to be a member of the Lampridiformes (Rosen and Patterson, 1969). It is presently thought to reside within the Beryciform-Stephanoberyciform lineage (Nelson, 1994), possibly most closely related to Cetomimidae. Alternately, the larvae may be the early stages of the Megalomycteridae (Paxton and Johnson, 2006).
2. A number of specimens have been collected with stomach distended and filled with copepods

Early Juvenile:



C. 35.0 mmSL (Juvenile and Holotype)

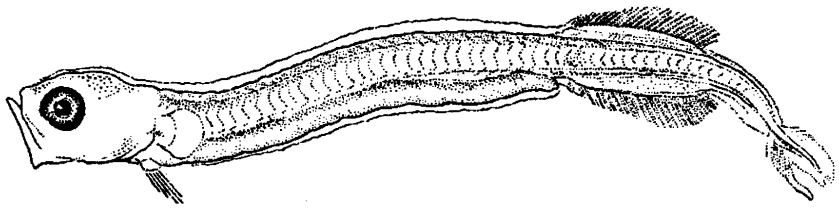


D. 35.0 mmSL (Ventral View of Head)

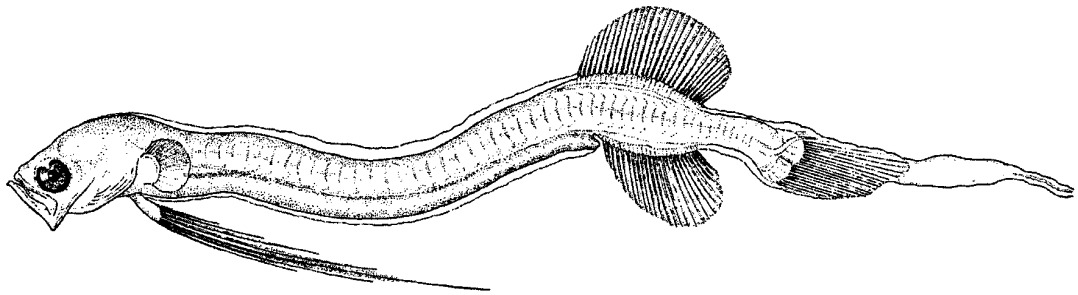
Figures: **A–D**: Bertelsen and Marshall, 1956

References: Bertelsen and Marshall, 1956; 1984; Paxton and Johnson, 2006

Parataeniophorus gulosus



A. 8.5 mmNL



B. 21.0 mmSL