

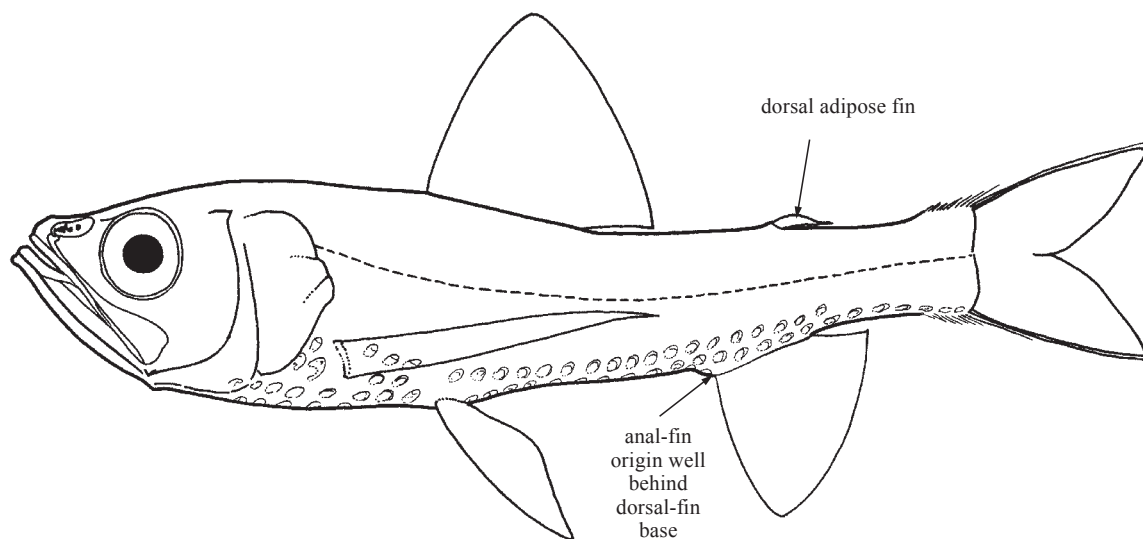
Order MYCTOPHIFORMES

NEOSCOPELIDAE

Neoscopelids

By K.E. Hartel, Harvard University, Massachusetts, USA and
J.E. Craddock, Woods Hole Oceanographic Institution, Massachusetts, USA

Diagnostic characters: Small fishes, usually 15 to 30 cm as adults. Body elongate with no photophores (*Scopelengys*) or with 3 rows of large photophores when viewed from below (*Neoscopelus*). Eyes variable, small to large. Mouth large, extending to or beyond vertical from posterior margin of eye; **tongue with photophores around margin in *Neoscopelus***. Gill rakers 9 to 16. Dorsal fin single, its origin above or slightly in front of pelvic fin, **well in front of anal fins**; 11 to 13 soft rays. **Dorsal adipose fin** over end of anal fin. **Anal-fin origin well behind dorsal-fin base**, anal fin with 10 to 14 soft rays. Pectoral fins long, reaching to about anus, anal fin with 15 to 19 rays. Pelvic fins large, usually reaching to anus. Scales large, cycloid, and deciduous. **Colour:** reddish silvery in *Neoscopelus*; blackish in *Scopelengys*.

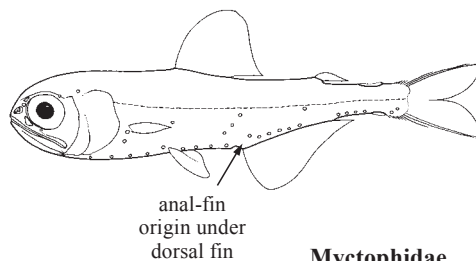


Habitat, biology, and fisheries: Large adults of *Neoscopelus* usually benthopelagic below 1 000 m, but subadults mostly in midwater between 500 and 1 000 m in tropical and subtropical areas. *Scopelengys* meso- to bathypelagic. No known fisheries.

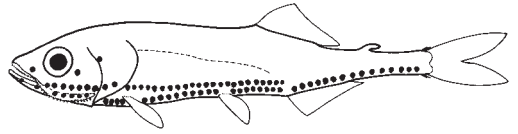
Remarks: Three genera and 5 species with *Solivomer* not known from the Atlantic. All Atlantic species probably circumglobal.

Similar families in occurring in area

Myctophidae: photophores arranged in groups not in straight horizontal rows (except *Taaningichthys paurolychnus* which lacks photophores). Anal-fin origin under posterior dorsal-fin base.

**Myctophidae**

Gonostomatidae, Phosichthyidae, Sternoptychidae: certain genera with similar body form to, and might be confused with, neoscoleids. Almost all with 1 or 2 horizontal rows of photophores on body but lack median ventral row. Lack edentulate maxilla that is expanded posteriorly.



Phosichthyidae

Key to the species of Neoscopelidae in the area

- 1a. Photophores present; eye large, about 1 in snout; upper jaw extending to about posterior margin of eye (Fig. 1). . . (*Neoscopelus*) → 3
- 1b. Photophores absent; eye small, about 3 in snout; upper jaw extending at least 1 eye diameter beyond eye (Fig. 2) . . . *Scopelengys tristis*
- 2a. Upper lateral series of photophores extends well past midpoint of anal-fin base (Fig. 1); gill rakers usually 14 (rarely 15 or 16) *Neoscopelus microchir*
- 2b. Upper lateral series of photophores extends only to about anus (Fig. 3); gill rakers usually 11 (rarely 12 to 14) *Neoscopelus macrolepidotus*

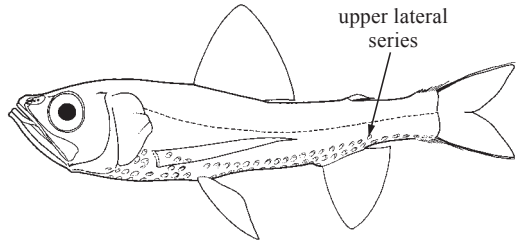


Fig. 1 *Neoscopelus microchir*

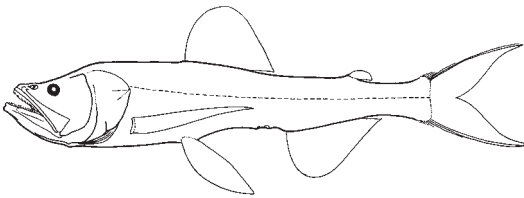


Fig. 2 *Scopelengys tristis*

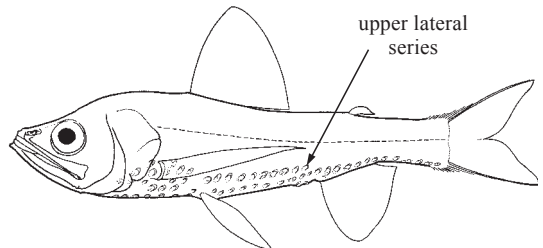


Fig. 3 *Neoscopelus macrolepidotus*

List of species occurring in the area

- Neoscopelus macrolepidotus* Johnson, 1863. To 23 cm. Tropical-subtropical.
- Neoscopelus microchir* Matsubara, 1943. To 30 cm. Tropical-subtropical.
- Scopelengys tristis* Alcock, 1890. To 20 cm. Tropical-subtropical.

References

Burgess, G.H. and S. Branstetter. 1985. Status of *Neoscopelus* (Neoscopelidae) in the Gulf of Mexico with distributional notes on *Caulolatilus chrysops* (Branchiostegidae) and *Etelis oculatus* (Lutjanidae). *Northeast Gulf Sci.*, 7(2):157-162.

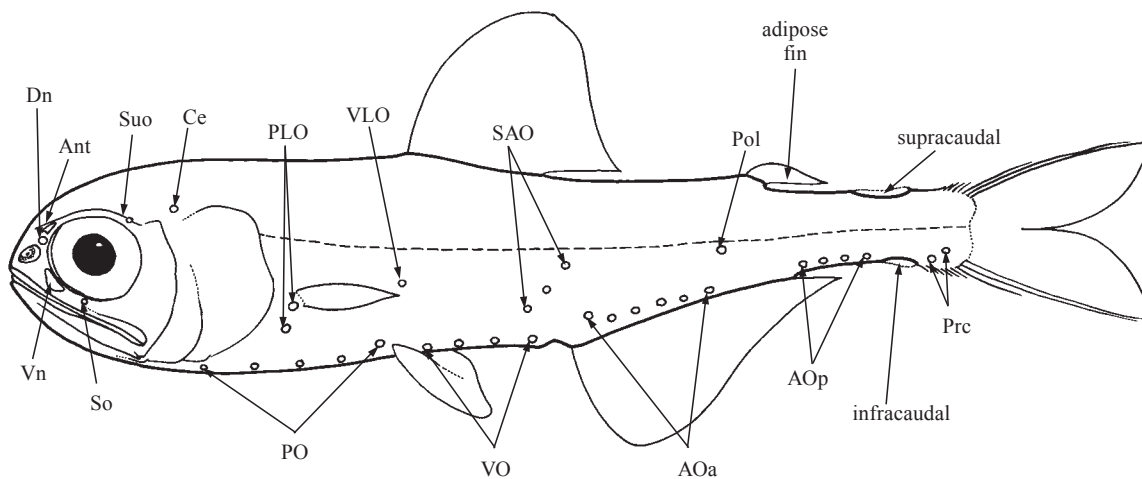
Nafpaktitis, B.G. 1977. Family Neoscopelidae. In *Fishes of the western North Atlantic*, edited by R.H. Gibbs, Jr. *Mem. Sears Found. Mar. Res.*, 1(7):1-12.

MYCTOPHIDAE

Lanternfishes

By J.E. Craddock, Woods Hole Oceanographic Institution, Massachusetts, USA and K.E. Hartel, Harvard University, Massachusetts, USA

Diagnostic characters: Small fishes, from 2 to 30 cm as adults. Body typically elongate although 2 area species, *Electrona risso* and *Myctophum selenops*, quite deep-bodied. Head large with jaws reaching posterior margin of eye and beyond. Eye large. Small teeth in bands on the premaxillaries and dentaries, sometimes flattened but seldom enlarged. Gill rakers well developed but absent in *Centrobranchus*. **Dorsal-fin base at midbody**, fin sometimes relatively high; posterior dorsal-fin base nearly above or behind anal-fin origin; 10 to 26 soft rays. **Dorsal adipose fin present**. Anal fin under or just behind base of dorsal fin; 12 to 27 soft rays. Principal caudal-fin rays 10 + 9 = 19. Pectoral fins rudimentary to very long; 10 to 18 soft rays. Pelvic fins under or just before anterior base of dorsal fin; pelvic-fin soft rays usually 8 but 6 in *Notolychnus* and sometimes 7 in *Gonichthys*. Scales deciduous. Photophores present in groups on head and body in all but 1 area species, *Taaningichthys paurolychnus*. Additional **luminous tissue** may be found on head, scales, fins, and as **glands on the upper and/or lower caudal peduncle**. **Colour:** mainly brown to black in deeper water species, silvery in shallower water species; often with metallic blue or green scales.



Dn	-	dorso-nasal	Vn	-	ventronasal
Ant	-	antorbital	So	-	suborbital
Suo	-	supraorbital	PO	-	thoracic
Ce	-	cervical	VO	-	ventral
PLO	-	suprapectoral	AOa	-	anterior anal
VLO	-	supraventral	AOp	-	posterior anal
SAO	-	supra-anal	Prc	-	precaudal

general distribution and terminology of the luminous organs (photophores)

Habitat, biology, and fisheries: Typically, myctophids are pelagic fishes of the open ocean. Most species are found in the upper 1 000 m of the water column (mesopelagic). A few species live deeper than 1 000 m (bathypelagic). Some species are associated with continental and island slopes (pseudoceanic). Daily vertical migrations from about 400 to 1 000 m during the day into the upper 200 m at night are common; some species reach the surface. The light produced by the various light-producing organs is the result of relatively simple oxidation of luciferin in the presence of the enzyme luciferase. Myctophids are abundant in some areas, making up a large portion of the total biomass. Many myctophid species are found in Area 31 because it includes elements of tropical, sub-tropical, and even temperate faunas. Myctophids are very important food for larger

fishes, sea birds, and marine mammals. The only myctophid fisheries have been in the South Atlantic, Gulf of Oman, and Persian Gulf.

Remarks: Thirty-three genera and at least 240 species worldwide; 20 genera and 77 species in the area. It is possible that certain species with wide distributions are, in fact, species complexes. The life histories of many lanternfish species are poorly known, especially of those species larger than 10 cm. Distributions given in the list of species apply only to the Atlantic; space does not allow discussion of extra-Atlantic occurrences.

Similar families occurring in area

Separated from most other families in the area by a lack of photophores and a dorsal adipose fin. Further distinguishing characters of these families are the following:

Neoscopelidae: posterior dorsal-fin base well in advance of the anal-fin origin. *Neoscopelus* as large photophores in 3 longitudinal rows on body and along edge of tongue. *Scopelengys* lacks photophores and has a very small eye.

Gonostomatidae, Phosichthyidae (Photichthyidae), Sternoptychidae: teeth conical or needle-like on both premaxilla and maxilla, never in bands. Almost all have 1 or 2 horizontal rows of photophores on body. None with a set of 3 photophores (SAO) at midbody, elaborate head photophores (Ant, Dn, Vn), or the supra- or infracaudal glands of myctophids.

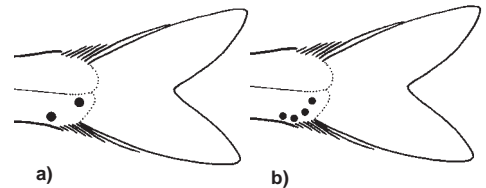
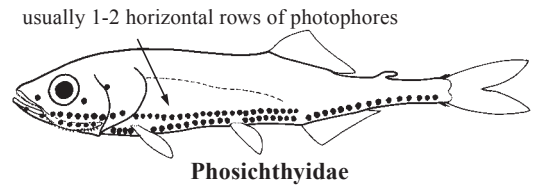
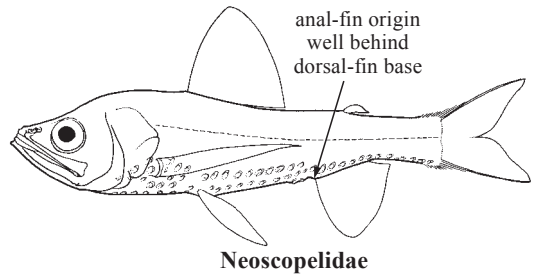
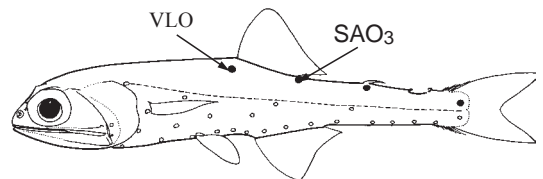


Fig. 1 Prc photophores

Key to the genera and monotypic species of Myctophidae occurring in the area

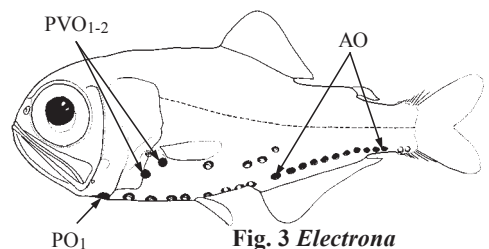
Note: Identification and taxonomy of Myctophidae are based heavily on the arrangement of the various photophore groups as shown above. Care must be taken in identifying the location and number of photophores. Photophores are often lost or damaged in nets so identification may be impossible.

- 1a. Two Prc photophores (Fig. 1a) → 2
- 1b. Three or more Prc (1 may be at or above lateral midline at base of caudal peduncle) or none in *Taaningichthys paurolychnus* (Fig. 1b) → 12



- 2a. Four photophores (VLO, SAO₃, Pol, Prc₂) well above the midlateral line (Fig. 2); specimens usually skinned and photophores often lost; small species, never over 2.5 cm *Notolychnus valdiviae*
- 2b. No photophores above lateral line. → 3

- 3a. AO in a single uninterrupted series (Fig. 3, 4); Pol absent → 4
- 3b. AO divided into 2 groups, AO_a and AO_p (Fig. 5); Pol present (Fig. 5) → 5



- 4a. PVO₁₋₂ inclined, in line with PO₁ (Fig. 3); interorbital wide; eye normal, pointing laterally
 *Electrona risso*
- 4b. PVO₁₋₂ in an almost horizontal line (Fig. 4), a line through them markedly above PO₁;
 interorbital very narrow; eyes pointed upward, almost telescopic
 *Protomyctophum arcticum* (not in Area 31)
- 5a. Mouth terminal, snout not projecting (Fig. 5); jaws short, extending less than 1/2 eye diam-
 eter behind orbit → 6
- 5b. Mouth subterminal, snout projecting (Fig. 10); jaws moderate, extending 1/2 eye diameter
 behind orbit → 10

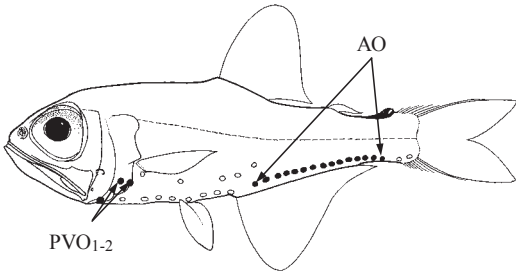


Fig. 4 *Protomyctophum arcticum*

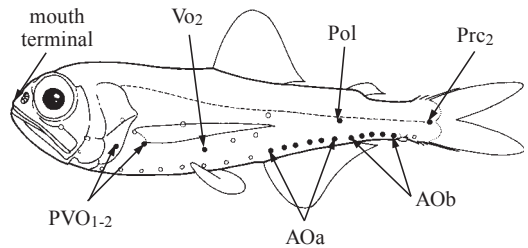


Fig. 5 *Benthosema*

- 6a. PVO₁₋₂ in a horizontal line (Fig. 5); VO₂ elevated → 7
- 6b. PVO₁₋₂ in an inclined line (Fig. 7), with PVO₂ usually more than 1 photophore diameter
 above PVO₁; all VO level (Fig. 7) → 8
- 7a. Prc₂ high, from 1 to 2 photophore diameters below, or on, midlateral line (Fig. 5); teeth sim-
 ple, never hooked *Benthosema*
- 7b. Prc₂ low, level with Prc₁ (Fig. 6); outer dentary teeth flattened and hooked forward
 *Diogenichthys atlanticus*

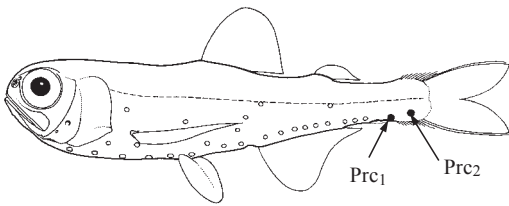


Fig. 6 *Diogenichthys atlanticus*

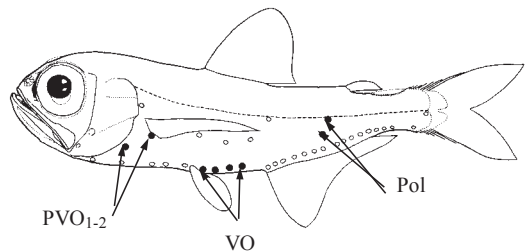


Fig. 7 *Hygophum*

- 8a. Two Pol (Fig. 7) *Hygophum*
- 8b. One Pol (Fig. 8) → 9

- 9a. SAO forming an almost right angle with SAO₁ over or in advance of VO₃ (Fig. 8) . . . *Symbolophorus*
- 9b. SAO in an almost straight or slightly angled line with SAO₁ well behind VO₃ (Fig. 9) . . . *Myctophum*

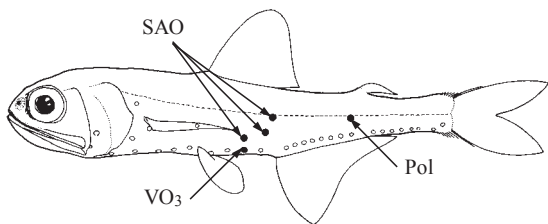


Fig. 8 *Symbolophorus*

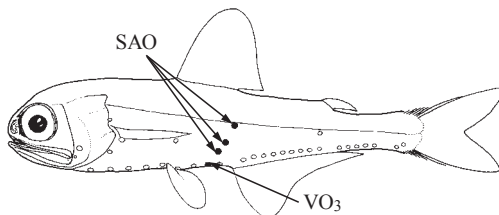


Fig. 9 *Myctophum*

- 10a. Gill rakers absent (Fig. 10)
 *Centrobranchus nigroocellatus*
- 10b. Gill rakers present → 11

- 11a. AOp 7 or fewer, at most 1 over anal base (Fig. 11); anal-fin origin about under middle of dorsal-fin base *Loweina*

- 11b. AOp 10 or more, with 5 to 7 over anal-fin base (Fig. 12); anal-fin origin under end of dorsal-fin base . . . *Gonichthys cocco*

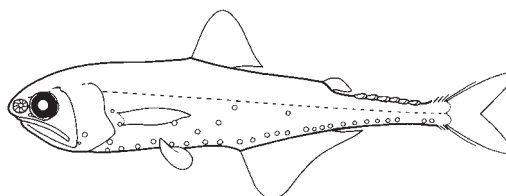


Fig. 10 *Centrobranchus nigroocellatus*

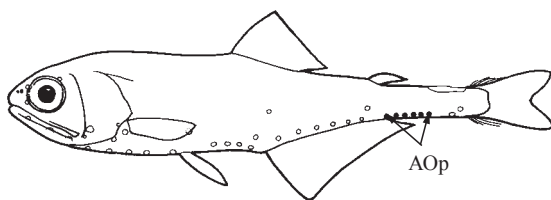


Fig. 11 *Loweina*

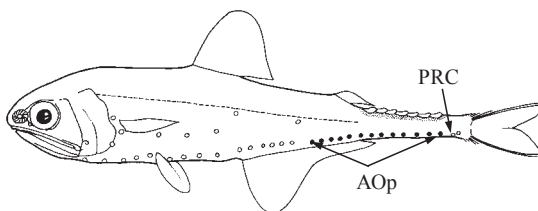


Fig. 12 *Gonichthys*

- 12a. Dn absent; VO and Pol never arranged as in 12b → 13
- 12b. Dn present; either 2 horizontal Pol (Fig. 13) near lateral line or VO₁₋₃ on a straight ascending line with VO₄₋₅ level (Fig. 14). → 19

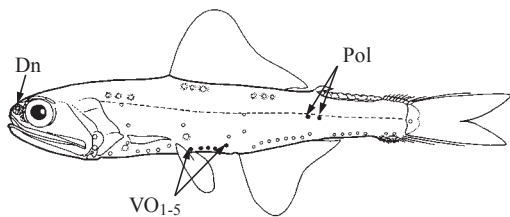


Fig. 13 *Notoscopelus*

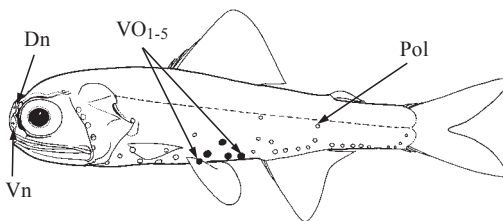


Fig. 14 *Diaphus*

- 13a. Supra- and infracaudal glands single organs bordered by heavy jet-black pigment (Fig. 15a) → 14
- 13b. Supra- and infracaudal glands overlapping scale-like plates, never bordered by jet-black pigment (Fig. 15b) → 15

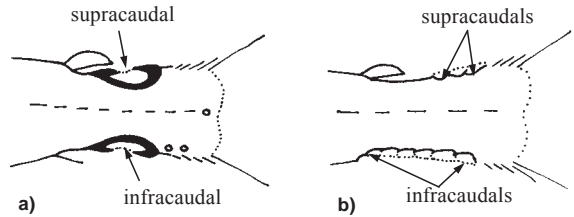


Fig. 15 caudal peduncle

- 14a. A large white crescent on posterior half of eye; dorsal-fin origin behind base of pelvic fin; only 1 SAO (at midbody) or none in *T. paurolychnus* (Fig. 16) *Taaningichthys*
- 14b. No large white crescent on posterior half of eye; dorsal-fin origin over or slightly in front of pelvic fin; 3 SAO (Fig. 17) *Lampadena*

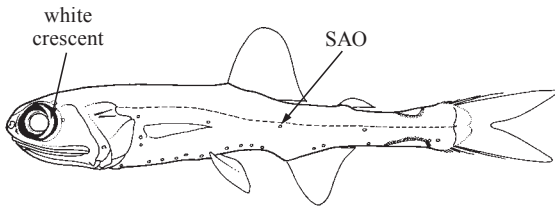


Fig. 16 *Taaningichthys*

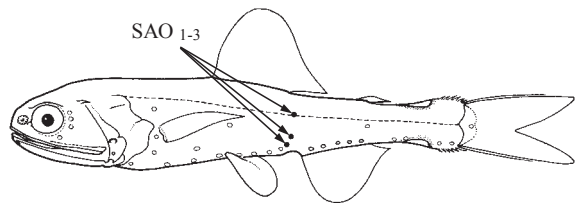


Fig. 17 *Lampadena*

- 15a. Luminous tissue restricted to caudal luminous glands and occasionally at base of adipose fin (Fig. 18) → 16
- 15b. Luminous tissue over base of anal or dorsal fins and on other portions of body (Figs. 19, 20, 21) → 17

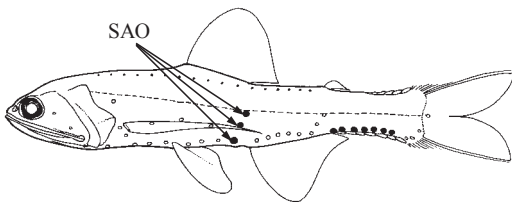


Fig. 18 *Lampanyctus*

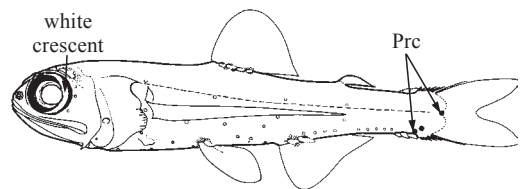


Fig. 19 *Bolinichthys*

- 16a. Pectoral fin long, at least reaching SAO photophores, often to anterior anal fin. (Fig. 18) *Lampanyctus*
- 16b. Pectoral fin rudimentary or short, seldom reaching PO₄ (note that *L. macdonaldi* is the only Atlantic *Lampanyctus* with a short pectoral fin but it has 21 or more gill rakers vs. fewer than 21 in all *Nannobranchium*) *Nannobranchium*

- 17a.** Three (2+1) Prc; a whitish crescent on posterior half of eye; luminous tissue above eyes in some species (Fig. 19) *Bolinichthys*
- 17b.** Four (3+1) Prc; eye without whitish crescent; no luminous tissue above eyes (Figs. 20, 21) → 18
- 18a.** PO₄ elevated; VO₂ elevated (Fig. 20); no medial luminous tissue either at bases of pelvic fins or between pelvic fins and anal-fin origin; pectoral fin long, reaching adipose origin . *Lepidophanes*
- 18b.** PO₄ not elevated; VO only slightly arched (Fig. 21); medial luminous tissue present at bases of pelvic fins or between pelvic fins and anal-fin origin; pectoral fins moderate, not reaching adipose fin *Ceratoscopelus*

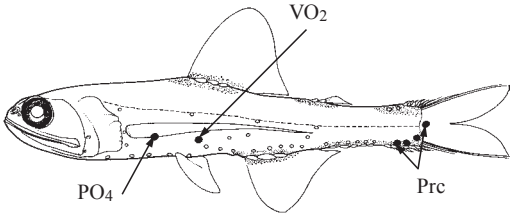


Fig. 20 *Lepidophanes*

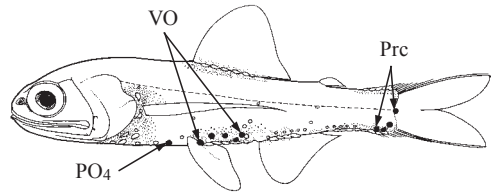


Fig. 21 *Ceratoscopelus*

- 19a.** VO₁₋₅ level; both supra- and infracaudal glands present in both sexes; 2 horizontal Pol near lateral line (Fig. 22) *Notoscopelus*
- 19b.** VO₁₋₃ on a straight, inclined, ascending line with VO₄₋₅ level (Figs 23, 24); no caudal glands (*Diaphus*) or only 1 caudal gland (*Lobianchia*); 1 Pol → 20

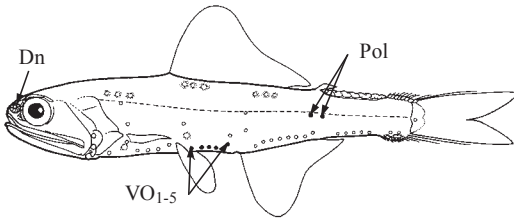


Fig. 22 *Notoscopelus*

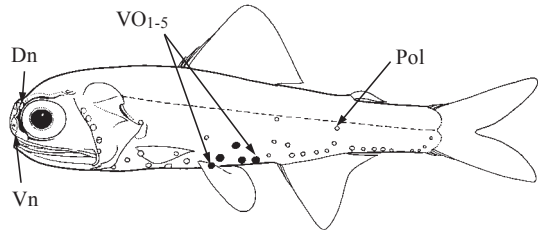


Fig. 23 *Diaphus*

- 20a.** Caudal glands absent; more than 1 pair of luminous glands on head (Ant, Dn, Vn, or So); usually a luminous scale at PLO (Fig. 23) *Diaphus*
- 20b.** Supracaudal (males) and infracaudal (females) well developed; 1 pair (Dn) of luminous organs on head; luminous scale at PLO absent (Fig. 24) *Lobianchia*

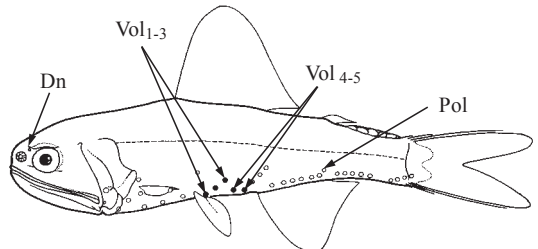


Fig. 24 *Lobianchia*

List of species occurring in the area

Note: All are mesopelagic unless otherwise stated. Species list based on MCZ database with *D. adenomus* and *T. paurolychnus* from Nafpaktitis et al. (1977). *L. gemmifer* Goode and Bean 1896 was suggested for the Atlantic population of *L. crocodilus* by Stephnescu et al. (1994) who restricted *L. crocodilus* to the Mediterranean Sea.

- Benthoosema glaciale* (Reinhardt, 1837). To 7 cm. Subarctic S to N31.
Benthoosema suborbitale (Gilbert, 1913). To 3.8 cm. Widespread, tropical to temperate.
Bolinichthys distofax Johnson, 1975. To 8.5 cm. Rare, tropical and S subtropical.
Bolinichthys indicus (Nafpaktitis and Nafpaktitis, 1969). To 4.5 cm. Bipolar subtropical.
Bolinichthys photothorax (Parr, 1928). To 6.5 cm. Tropical-subtropical, rarely N to Slope Water (SW21).
Bolinichthys supralateralis (Parr, 1928). To 11 cm. Widespread, tropical to temperate.
Centrobranchus nigroocellatus (Günther, 1873). To 5 cm. Widespread, tropical to temperate.
Ceratoscopelus maderensis (Lowe, 1839). To 7 cm. N temperate S to N 31.
Ceratoscopelus warmingii (Lütken, 1892). To 7.5 cm. Widespread, tropical to temperate.
Diaphus adenomus Gilbert, 1905. To 18 cm. Rare, pseudoceanic, W31 (and SE27).
Diaphus anderseni Täning, 1932. To 3 cm. S subtropical, rare to SE31.
Diaphus bertelseni Nafpaktitis, 1966. To 8 cm. Rare, tropical-subtropical.
Diaphus brachycephalus Täning, 1928. To 6 cm. Tropical-subtropical.
Diaphus dumerilii (Bleeker, 1856). To 8.6 cm. Tropical, common N to Slope Water (SW21).
Diaphus effulgens (Goode and Bean, 1896). To 15 cm. Bipolar subtropical.
Diaphus fragilis Täning, 1928. To 9 cm. Tropical, rare N to Slope Water (SW31).
Diaphus garmani Gilbert, 1906. To 6 cm. Tropical, possibly pseudoceanic as adult.
Diaphus lucidus (Goode and Bean, 1896). To 12 cm. Tropical, rare N to Slope Water (SW21).
Diaphus luetkeni (Brauer, 1904). To 6 cm. Tropical, rare N to Slope Water (SW21).
Diaphus metopoclampus (Cocco, 1829). 7.5 cm. Bipolar temperate-subtropical.
Diaphus minax Nafpaktitis, 1968. To 6.6 cm. Extremely rare, pseudoceanic, only W31.
Diaphus mollis Täning, 1928. To 6 cm. Widespread.
Diaphus perspicillatus (Ogilby, 1898). To 7 cm. Tropical, N to Slope Water (SW21).
Diaphus problematicus Parr, 1928. To 9 cm. Tropical.
Diaphus rafinesquii (Cocco, 1838). To 9 cm. Temperate, rare S to Gulf of Mexico.
Diaphus roei Nafpaktitis, 1974. To 11 cm. Rare, pseudoceanic, only 31.
Diaphus splendidus (Brauer, 1904). To 5.5 cm. Tropical-subtropical.
Diaphus subtilis Nafpaktitis, 1968. To 8.5 cm. Uncommon, tropical-subtropical.
Diaphus taaningi Norman, 1930. To 7 cm. Pseudoceanic, W31, Slope Water and off Africa.
Diaphus termophilus Täning, 1928. To 7.5 cm. Tropical.
Diogenichthys atlanticus (Täning, 1928). To 3 cm. Widespread, tropical to temperate.
Electrona risso (Cocco, 1829). To 8 cm. E Atlantic but rare stray to SE31.
Gonichthys cocco (Cocco, 1829). To 6 cm. Widespread, tropical to temperate.
Hygophum benoiti (Cocco, 1838). To 5.5 cm. N temperate-subtropical.
Hygophum hygomii (Lütken, 1892). To at least 6 cm. Bipolar temperate-subtropical.
Hygophum macrochir (Günther, 1864). To 6 cm. Tropical and S subtropical.
Hygophum reinhardtii (Lütken, 1892). To at least 5 cm. Probably tropical-subtropical.
Hygophum taaningi Bekker, 1965. To 5 cm. N tropical-subtropical.
Lampadena anomala Parr, 1928. To 15 cm. Rare, bathypelagic, tropical-subtropical.
Lampadena chavesi Collett 1905. To 7.5 cm. Bipolar subtropical.
Lampadena luminosa (Garman, 1899). To 18 cm. Tropical-subtropical.
Lampadena speculigera Goode and Bean, 1896. To 13 cm. Bipolar temperate to N31.
Lampadena urophaos atlantica Maul, 1969. To 23 cm. N subtropical.
Lampanyctus alatus Goode and Bean, 1896. To 6 cm. Widespread, mostly tropical.
Lampanyctus crocodilus (Risso, 1810). To 30 cm. N temperate to N31 and E 34.
Lampanyctus festivus Täning, 1928. To 12 cm. Bipolar subtropical.
Lampanyctus intricarius Täning, 1928. To 17 cm. Bipolar temperate, extremely rare N31.
Lampanyctus macdonaldi (Goode and Bean, 1896). To 14 cm. Bipolar temperate rare to N31.

- Lampanyctus nobilis* Tåning, 1928. To 11 cm. Tropical.
- Lampanyctus photonotus* Parr, 1928. To 7 cm. Widespread, tropical to temperate.
- Lampanyctus pusillus* (Johnson, 1890). To 4.3 cm. Bipolar, temperate-subtropical.
- Lampanyctus tenuiformis* (Brauer, 1906). To 12 cm. Tropical.
- Lampanyctus vadulus* Hully, 1981. To 9.9 cm. E tropical, W to SE31.
- Lepidophanes gaussi* (Brauer, 1906). To 4.8 cm. Bipolar subtropical.
- Lepidophanes guentheri* (Goode and Bean, 1896). To 7 cm. Widespread, tropical to temperate.
- Lobianchia dofleini* (Zugmayer, 1911). To 5 cm. Bipolar temperate-subtropical.
- Lobianchia gemellarii* (Cocco, 1838). To 11 cm. Tropical-subtropical.
- Loweina interrupta* (Tåning, 1928). To 3.9 cm. Extremely rare, temperate-subtropical.
- Loweina rara* (Lütken, 1892). To 4.5 cm. Rare, widespread.
- Myctophum affine* (Lütken, 1892). To 8 cm. Tropical, N in Slope Water.
- Myctophum asperum* Richardson, 1845. To 8.5 cm. Tropical, rare to Slope Water.
- Myctophum nitidulum* Garman, 1899. To 9.9 cm. Widespread, tropical to temperate.
- Myctophum obtusirostre* Tåning, 1928. To 9 cm. Tropical, rare to Slope Water.
- Myctophum punctatum* Rafinesque, 1810. To 10 cm. N subpolar-temperate.
- Myctophum selenops* Tåning, 1928. To 7.5 cm. Widespread, usually tropical-subtropical.
- Nannobranchium atrum* (Tåning, 1928). To 14 cm. Bipolar, temperate-subtropical.
- Nannobranchium cuprarium* (Tåning, 1928). To 11 cm. Bipolar, subtropical.
- Nannobranchium isaacsi* (Wisner, 1974). To 13 cm. E tropical to SE31.
- Nannobranchium lineatum* (Tåning, 1928). To 24 cm. Tropical-subtropical.
- Notolychnus valdiviae* (Brauer, 1904). To 2.5 cm. Widespread, tropical to temperate.
- Notoscopelus caudispinosus* (Johnson, 1863). To 14 cm. Tropical-subtropical.
- Notoscopelus resplendens* (Richardson, 1845). To 7.7 cm. Widespread, tropical to temperate.
- Symbolophorus rufinus* (Tåning, 1928). To 8.7 cm. Tropical-subtropical.
- Symbolophorus veranyi* (Moreau, 1888). To 5.8 cm. N temperate, rare to N31.
- Taaningichthys bathyphilus* (Tåning, 1928). To 8 cm. Bathypelagic, tropical-subtropical.
- Taaningichthys minimus* (Tåning, 1928). To 6.5 cm. Tropical-subtropical.
- Taaningichthys paurolychnus* Davy 1972. To 9.5 cm. Extremely rare, bathypelagic.

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