

Illustrated Keys to the Lanternfishes (Myctophidae: Myctophiformes) from Australian Waters

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Abstract. The lanternfishes (Family Myctophidae), represented by at least 254 extant species, are a diverse family of oceanic fishes which dominate fish biomass in world oceans. Most lanternfish species reside in the mesopelagic zone (the upper water column of open ocean in ~200–1,000 m depths) where many ascend vertically at night to feed. Lanternfishes are small-bodied (~25–280 mm SL) and are key prey for myriad fishes and squids (including numerous commercial species), seabirds and marine mammals. For these reasons, the ecological roles of lanternfishes and their relevance to food security are of increasing global research interest. Despite numerous lanternfish species being known from Australian waters, no comprehensive and regionally specific key is available to aid species-level identification of the Australian fauna. This paper meets that need by providing illustrated keys to 30 lanternfish genera and 141 species: 29 genera and 136 species present within Australia's Economic Zone (EZ), plus one genus and five species recorded close to the EZ boundary. About half the fauna is contained within the three most speciose genera – *Diaphus* (40 species), *Lampanyctus* (16) and the *Myctophum* complex (14) – while nine genera are represented by single species (*Ceratoscopelus*, *Hintonia*, *Idiolychnus*, *Krefflichthys*, *Lampanyctodes*, *Lampichthys*, *Notolychnus*, *Scopelopsis* and *Triphoturus*); four species remain undescribed (three *Dasyscopelus*, one *Lampanyctus*). There are new records from Australian waters of 21 species, and numerous distributional range extensions within Australian waters of previously recorded species. Synopses of the relationships between genera, taxonomic uncertainties, comparisons of morphological and molecular-based taxonomies, and ecological notes are provided for most genera.

Introduction

The lanternfish family Myctophidae, Order Myctophiformes, is the second-most diverse family of fishes (after Stomiidae) in the mesopelagic zone (depths from approximately 200 to 1000 m) in global oceans. Lanternfishes occur in all oceans, from the Antarctic Ocean to the Arctic area, and in most seas with waters exceeding 400 m depth. Presently, at least 254 species in 34 genera are recognised (Fricke *et al.*, 2026).

Lanternfishes are small-bodied fishes, with maximum size ranging from ~25 to ~280 mm SL at sexual maturity. Many species are broadly distributed and abundant. Collectively,

lanternfishes make up most of the biomass of mesopelagic fishes – estimated, variously by net capture, acoustic and modelling methods, to be in the range of 1 to ~16 Gt (10⁹ tonnes) (Gjøsæter & Kawaguchi, 1980; Irigoien *et al.*, 2014; Gascuel *et al.*, 2008; Jennings & Collingridge, 2015; Proud *et al.*, 2019). This extraordinarily high total dominates fish biomass in world oceans and is larger than any commercial fish stock.

Although the distributions of most lanternfish species are in the mesopelagic zone of the high-ocean, some species are pseudoceanic (*sensu* Hulley, 1981), being restricted to ocean margins overlying the continental and insular shelf

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edges and upper slope, while the adults of a few species are benthopelagic over continental slopes. Complex distributional sub-structure within these broad zones is determined by temperature and biological productivity – for example, in the North and South Atlantic Oceans (Hulley, 1981). Off Australia's east coast, zoogeographic boundaries for lanternfish distributions are represented by the Tasman Front, Subtropical Convergence and Subantarctic Front (Flynn & Marshall, 2013).

Lanternfish species have complex vertical distributions, and many ascend at night to feed, descending back to residence depths during the day (Go, 1980; Watanabe *et al.*, 1999; Dypvik *et al.*, 2012; Matsuura *et al.*, 2012; Dypvik & Kaartvedt, 2013; Eduardo *et al.*, 2021). This diel vertical migration may be to shallower depths within the mesopelagic zone, into the epipelagic zone (depths <200 m), or to the surface (Alverson, 1961; Kawaguchi *et al.*, 1972; Ovcharov, 1983; Ovcharov *et al.*, 1985; Greze & Salekhova, 1988; Nishimura *et al.*, 1997; Abookire *et al.*, 2002; Olivar *et al.*, 2025). Depth-stratified sampling using opening-closing nets enable these day-night distributions to be mapped, e.g. off SE Australia (Williams & Koslow 1997), and for the resulting flux of prey and carbon to be better understood (Hudson, 2014; Hidaka *et al.*, 2001; Williams *et al.*, 2001; Hudson, 2012; Anderson *et al.*, 2019; Belcher *et al.*, 2019; Cotte *et al.*, 2022).

Lanternfishes have two central roles in oceanic food chains. Firstly, they form short-chain linkages as consumers of mesozooplankton (myriad small animals ranging in size from ~0.2 to 20 mm) whilst being key prey for a wide variety of top predators. These are many larger fishes and squids, including important demersal and pelagic commercial species, and as well as marine mammals and seabirds, including iconic species. The trophic role of lanternfishes is exemplified in Antarctic waters where they form krill-based and krill-independent pathways to penguins, seals, whales, and important commercial fisheries species including toothfish and mackerel icefish (Tarling *et al.*, 2012; Ward *et al.*, 2012; Saunders *et al.*, 2014, 2015, 2019). Secondly, because most species are diel vertical migrators, ascending at night from deep (~500–1000 m) daytime residence depths to feed in shallower (< 200 m) depths – often at the surface or near-surface – they are exceptionally important in the trophic ecology of oceanic waters as major contributors to the vertical flux of biomass away from productive surface waters, and by regulating carbon and nutrient cycles globally (Robinson *et al.*, 2010; Cavan *et al.*, 2019).

Lanternfishes are batch (or serial) spawners with protracted or restricted breeding seasons (Gartner, 1993). Growth rates are high; most tropical species live only one or two years (Clarke, 1973), while higher latitude species can live longer, e.g. the southernmost species, *Electrona antarctica*, to 3.5 years (Greenly *et al.*, 1999). How the traits of mesopelagic fishes, including myctophids, relate to feeding, growth and reproduction, as well as the key functions that contribute to fitness, have been summarized by Andresen *et al.* (2024).

A few species are known to occur at high abundance, either locally as spawning aggregations, e.g. *Diaphus danae* in the Coral Sea (Flynn & Paxton, 2012), or as dense populations over broad areas where there have been several attempts establish commercial lanternfish fisheries. Historically, in the 1970s and 1980s, these were for *Diaphus coeruleus* and *Gymnoscopelus nicholsi* in the Southwest Indian Ocean and Southern Atlantic by the former Soviet Union (Payne & Hoagland, 2022); for *Lampanyctodes hectoris* off South Africa (Hulley & Prosch, 1987); and

Benthoosema pterotum in the Gulf of Oman (Gjøsæter, 1984). All were abandoned due to low profitability, but more recently, as the demand for and price of LC omega-3 oils has grown, there is renewed commercial interest in lanternfishes, particularly from nations with developed aquaculture industries, e.g. Norway and Peru (Zhang *et al.*, 2023; Zhang *et al.*, 2026).

The first lanternfish was described in 1810 from Sicily in the Mediterranean Sea, where beach strandings of deep-sea fishes are common. Some individual species were later described from various areas and early expeditions such as the voyages of the *Erebus* and *Terror* (Richardson, 1845). Regular deep-sea collecting began in the 1870's with voyages of HMS *Challenger*. Lütken (1892a, 1892b) was the first to comprehensively describe North Atlantic species in the collection of the Zoological Museum (Copenhagen). Brauer (1906) established the basic photophore terminology that is used today.

Fraser-Brunner (1949), following Bolin (1939), proposed an evolutionary scheme based on the hypothesis that the primitive photophore condition in the family involved three horizontal rows of photophores ventrally, exemplified by those of *Electrona*, with individual photophores positioned dorsally in the evolution of different lines. Hulley (1998) investigated the possible evolution of the Tribe Electronini in the Southern Ocean.

Paxton (1968, 1972) recognised two subfamilies, Myctophinae and Lampanyctinae, with two and four tribes respectively, based on the osteology and photophore patterns of adult specimens. The Myctophinae was considered the more generalized, following Fraser-Brunner's (1949) study. Moser and Ahlstrom (1970) recognised the same subfamilies and tribes, with some different generic placements in a few of the latter. They proposed the two subfamilies split early in the evolution of the family, with larval Myctophinae evolving specialized eyes and adult Lampanyctinae evolving specialized jaws. Moser and Ahlstrom (1972) considered *Scopelopsis* in the Lampanyctinae, with secondary photophores over each scale, to be the ancestral condition, with development of primary photophores from different secondaries in the evolution of different lines. Stiassny's (1996) preliminary survey of new adult characters did not answer the question of which subfamily is ancestral. That answer may come in future DNA studies, or from more detailed study of photophore patterns to reconcile the presence of smaller secondary scales associated with some elevated photophores (Fraser-Brunner, 1949) with the sequence of photophore development in larval lanternfishes (Moser & Ahlstrom, 1974) to determine homology of individual photophores and groups.

The first author began collecting lanternfishes off eastern Australia on surveys aboard HMAS *Kimbla* in 1969 and 1970 and FRV *Kapala* from 1971 to 1977, the latter association resulting in the collection of 1000's of specimens mostly offshore of the Sydney region. At that time Whitley's (1964) *Checklist of Australian Fishes* included 12 species in the family, while Munro's (1959) *Handbook of Australian Fishes* included 10 species. These new collections enabled the start of a draft key to Australian Myctophidae, with new species added as they were recognised. Substantial progress was made in 1977 during a visit to Australia by Basil Nafpaktitis who identified many lots of AMS specimens, especially those of the difficult genus *Diaphus*; a number of the new Australian records were mentioned in his papers on western North Atlantic myctophids (Nafpaktitis *et al.*, 1977) and Indian Ocean *Lobianchia* and *Diaphus* (Nafpaktitis, 1978). By the end of the 1970s the draft key was in use at the CSIRO

Marine Laboratory in Cronulla and, subsequently, various iterations of the key were provided to individual researchers and research laboratories for use and ‘road-testing’.

Despite increasing research interest in the ecological roles of lanternfishes in mesopelagic and oceanic ecosystems, and in the context of food security, no comprehensive guide was previously available to aid species-level identification of this taxonomically-complex group in Australian waters. The aim of this study, therefore, was to develop keys to the genera and species of the family Myctophidae known from the Australian region.

Materials and methods

Structure of keys

The Key to Genera includes all genera of Myctophidae recorded from Australian waters, including many from the sub-Antarctic region of the Southern Ocean, and ordered according to diagnostic features. Each genus diagnosis includes a figure of a representative species (two in the case of the large genus *Lampanyctus*). One genus (*Idiolychnus*) recorded just outside Australian waters, and expected to occur here, is also included. In the Keys to Species within genera, one genus follows another alphabetically. Five individual species recorded just outside Australian waters and expected to occur here are included.

Each key begins with an introduction that includes a brief summary of diagnostic/notable features; the world distribution pattern; total number of species in the genus, followed by the number of Australian species in the genus; and a list of references utilized to determine the presence and distributions of species within the genus. The references include, for every genus, the Zoological Catalogue of Australia (Hoese *et al.*, 2006), where taxonomic details such as the original description and Australian synonyms are found, as well as coordinates of distributional limits within, and references of the first records from, Australian waters.

The definitive couplet for each species includes firstly the diagnostic characters at that point in the key, followed by non-diagnostic characters within [] that can support an identification. Non-diagnostic characters always include (unless given previously as diagnostic) meristic counts of the AO photophores, gill rakers, and dorsal-, anal-, and pectoral-fin rays. Pelvic-fin rays are 8 for all species, except *Notolychnus valdiviae* and one east Pacific species of *Gonichthys*, so are not given. Often some details of the caudal luminous organs, SCO and ICO, are included.

The number of specimens counted for meristics, *n*, is given, as well as the size of the largest specimen (max., maximum size) in mm SL (millimetres, standard length). Counts of non-Australian specimens are given within {}. These data come either from Australia museum specimens or from one of the references listed at the end of the introductory paragraph.

The **remarks** section at the end of each genus key includes notes, for individual species, on topics including sources of data for non-Australian specimens, uncertainties in species identifications, distributions, and ecology. Recent distribution data from one author (PAH) are included for several genera. A short summary of recent molecular taxonomy is provided for some genera. However, the details provided vary from species to species, even being absent for some.

Species identifications

The position and number of body photophores are the most

important diagnostic characters in most genera, followed by the number of gill rakers. Details of caudal luminous organs and other patches of luminous tissue are also important in some genera. In the largest genus (*Diaphus*, with 40 species), the most important characters are found in the luminous organs on the front of the head around the eye. The size and shape of the headlight organs (Dn, Vn and Ant) are variable between species and sometimes difficult to discern. Damage to the head can make these characters difficult to interpret (and see note under *Diaphus*). It should be recognized that trawled specimens can often be in poor condition and photophores could be removed or sometimes displaced into an atypical position. For this reason, multiple specimens of the one species are sometimes required to accurately determine an identification; when all specimens are in poor condition, it may not be possible to get past identification to genus only.

Photophores and light organs

Photophore terminology follows that originally proposed by Brauer (1906), with additions and slight modifications in later papers (Fig. 1), where: Ant - Antorbital light organ; AO - Anal Organ photophores, anterior & posterior; Br - Branchiostegals (not figured); Ce - Cervical photophore; Dn - Dorsal nasal light organ; ICO - Infracaudal organ(s); LT - Luminous Tissue patches (not figured); Op - Opercular photophores; PLO - Pectoral Lateral Organ photophore; PO - Pectoral Organ photophores; Pol - Posterior Lateral photophore; Prc - Precaudal photophores; PVO - Pectoral Ventral Organ photophores; SAO - Supra Anal Organ photophores; So - Suborbital light organ; Suo - Supraorbital light organ; SCO - Supracaudal organ(s); VLO - Ventral Lateral Organ photophores; Vn - Ventral nasal light organ; VO - Ventral Organ photophores.

The relative positions of photophores are often diagnostic characters, and can be in relation to the lateral line or a body part, one photophore to another, or a line of photophores. Reference points can either be through the centres or margins of photophores (centres used in this key), over or under the ‘horizontal from’, or before or after the ‘vertical from’. Counts of photophores in series are from anterior to posterior; in some *Lampanyctus* species where the AO series is continuous with the Prc, the last 4 photophores are considered to be Prc and the remainder AOp (i.e. counting is posterior to anterior).

There are also a number of ‘headlight’ luminous organs on the head associated with the eye – the Dn, Vn, Ant, So, and Suo. The first two are most highly developed in the species of *Diaphus*, in which they show great variation in size and form, and moderately developed in species of *Gymnoscopelus*. The Ant is found only in some species of *Diaphus*. The So in single species of *Electrona*, *Metalelectrona*, and *Benthosema* apparently represents a Vn that has moved posteriorly, but both organs are present in all species of *Diaphus* that have an So (Paxton, 1972). The Suo’s of *Dasyscopelus lunatus* (underneath the sixth circumorbital without pigment) and *Diaphus adenomus* (over the edge of the frontal surrounded by much pigment) do not appear homologous, and that of *D. lunatus* should probably be considered a luminous patch on the anterodorsal portion of the head, like those in some species of *Bolinichthys* and *Ceratoscopelus* (Nafpaktitis & Nafpaktitis, 1969). The organs around the orbit (Ant, Dn, So, Suo, Vn) are sexually dimorphic in a few genera, most notably *Diaphus*, where males usually have a larger Vn.

Supra- and infra-caudal light organs (SCO and ICO respectively) are found on the dorsal and ventral surfaces of

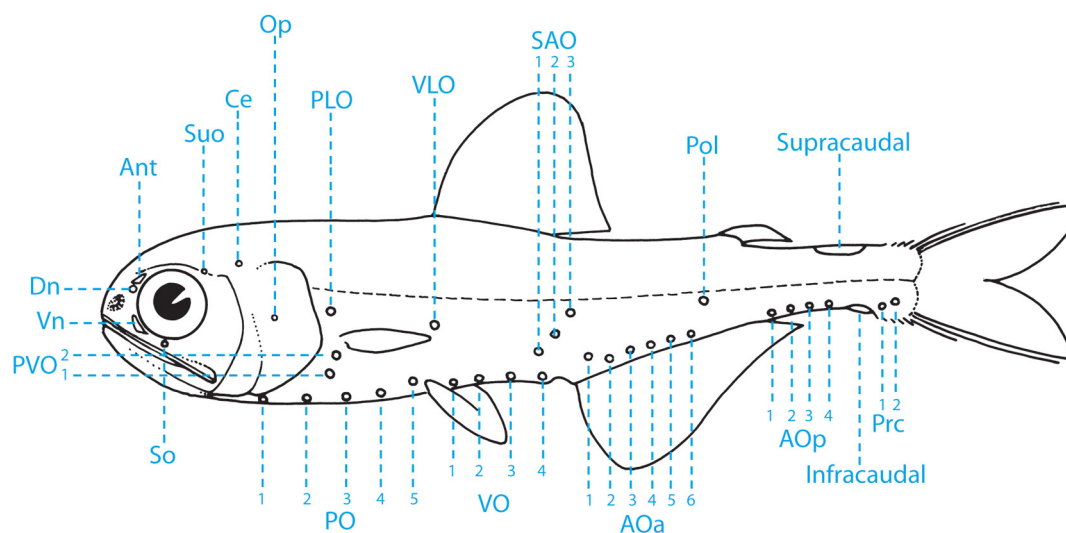


Figure 1. Hypothetical lanternfish with photophore and luminous tissue positions and abbreviations (after Hulley, 1986a).

the caudal peduncle in many genera. These are often sexually dimorphic, with SCO in males and ICO in females, although some genera have both organs. Fewer genera have neither. The structure of the SCO and ICO is variable, each being either a single organ, or composed of a series of individual plates, often with black margins and touching or overlapping. Both SCO and ICO are particularly prominent in *Lampadena* and *Taaningichthys* as large, single organs bordered by heavy black pigment. Caudal luminous organs are not fully developed in most species until maturity, so these characters are not available on juveniles.

There are also patches of luminous tissue on many other areas of the body in species of relatively few genera, limited to the subfamily Lampanyctinae (in addition to those light organs found on the dorsal and ventral surfaces of the caudal peduncle). Some of the luminous tissue patches are scale-shaped, and have been termed ‘luminous scales’ by some, including Nafpaktitis (1978) – “For purposes of simplicity and brevity rather than accuracy, the patch of luminous tissue at the PLO is referred to as “luminous scale.” Here they are all called luminous patches, regardless of their shape or position, that is often at fin bases.

Gill rakers

Counts of gill rakers (GR) are given as rakers in the upper arm of the first arch (GR upper) + lower arm including the single raker in the angle of the arch (GR lower). The range in GR upper counts is usually more conservative than in GR lower counts, and therefore more useful in differentiating species. In some genera it is necessary to carefully cut the branchiostegal membrane to almost the lower jaw symphysis using fine dissecting scissors to see the most anterior GRs on the lower arm. For small specimens, e.g. < 30 mm SL, these rakers can be teased apart effectively for counting using an insect pin. In most species, the anterior GRs of both arms are preceded by a few spines or spinous protuberances that are clearly different and not counted. In a few species there is a gradation from GR to non-GR. For these keys, the raker element is counted if it is longer than wide at the base and moveable. In some species, GRs are added with growth, so uncommon low counts are not unexpected in smaller specimens. For these keys, meristics of larger specimens were counted when possible.

Fin rays

The last ray of the dorsal and anal-fins is double, but the two rays share one radial and are counted as one. The small ray often found at the origin of these two fins is included in their counts, but the small splint rarely found at the top of the pectoral-fin base (and almost always at the origin of the pelvic-fin base) is excluded. The ventral-most pectoral rays can be very small, and are always included (in damaged specimens, the two halves of the individual rays can separate, making accurate counts difficult). Abbreviations used are: D (dorsal-fin), A (anal-fin), P (pectoral-fin), and C (caudal-fin).

Distributions

The geographical distribution of each species inside the Australian 200 n.m. EZ boundary is recorded in the key as species presence in the ocean regions adjacent to each Australian state and offshore territory (Fig. 2). This method of recording approximates that applied in the Zoological Catalogue of Australia (Hoese *et al.*, 2006). Determining whether species were taken inside or outside Australian EZ waters was assessed using published data from international (VERTNET, OBIS, GBIF) databases, databases of Australian specimen collections, and authors’ data - particularly distributions mapped by Hulley (1990a). A few species taken close (~10 n.m.) of the EZ boundary were included in the key, and identified as ‘not yet recorded from Australian waters’. Considering the lack of physical boundaries in oceanic waters, these species are also likely to occur here. Additional detailed distribution information is provided in **remarks** for some species from recent work completed by one of the authors (PAH), especially for the sub-Antarctic and the CCAMLR Area (Hulley, in preparation).

We were unable to provide information on species’ day/ night depth distributions because the vast majority of midwater trawl collections taken in Australian waters have been made with open nets. Studies using opening/ closing nets provide data for some species off southeast Australia (Williams & Koslow, 1997; Flynn & Kloser, 2012), while general patterns are described for many Australian-occurring species from studies elsewhere.

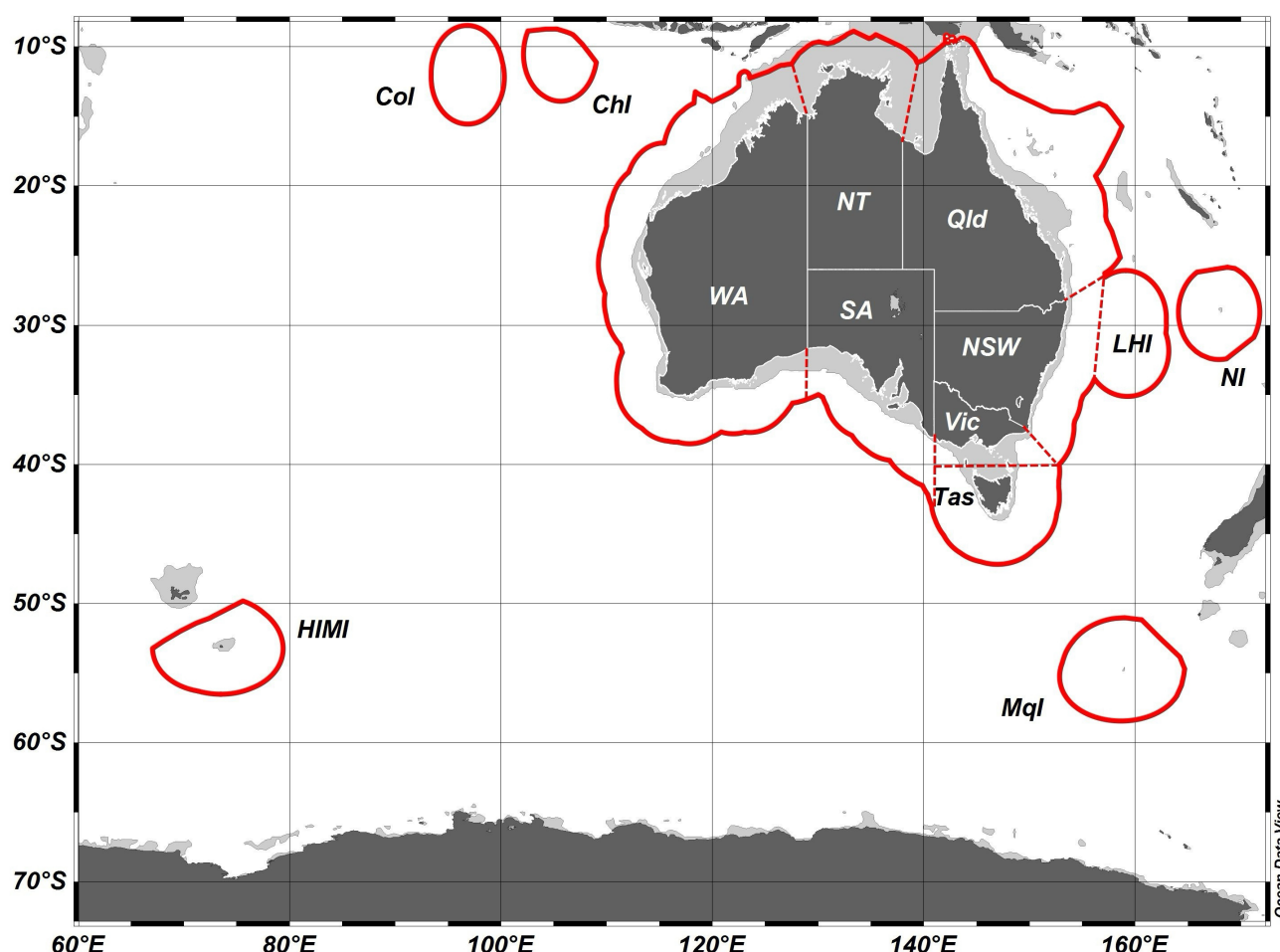


Figure 2. Myctophid species distributions inside the Australian 200 n.m. EZ boundary are recorded as their presence in the ocean regions adjacent to each Australian state and offshore territory: Qld – Queensland; LHI – Lord Howe Island; NI – Norfolk Island; NSW – New South Wales; Vic – Victoria; Tas – Tasmania; MI – Macquarie Island; SA – South Australia; HIMI – Heard and MacDonald Islands; WA – Western Australia; ChI – Christmas Island; CoI – Cocos Island; NT – Northern Territory.

Remarks

At the end of the Key to Species in each genus account, a **remarks** section provides some selective information on the genus and/or individual species. This is primarily discussion of genetics studies, and of possible problems with characters or how the Australian specimens differ from those described from other areas. In some cases, additional detailed distribution data are included from recent work by one of the authors (PAH); it is not possible to include similar detail for all species.

Figures

Dr Lindsay Marshall (LM) drew all whole fish and caudal organ illustrations, except for 11 whole fish drawn by Rhyll Plant (*Ceratoscopelus warmingii*, *Diaphus kapalae*, *Electrona subaspera*, *Hygophum hygomii*, *Lampadena speculigera*, *Lampanyctodes hectoris*, *Lampanyctus alatus*, *L. australis*, *L. pusillus*, *Lobianchia dofleini*, *Scopelopsis multipunctatus*). Each species is illustrated within the Keys to Species; the figures in the Key to Genera are duplicates of

an example species from that genus. These figures are mostly redrawn, using previously published figures as guides, to present a similar format; figure captions include the reference on which the illustration was based. Several illustrations are original, drawn using specimens and/or photo images of specimens, and show the artist's initials (LM) in the caption.

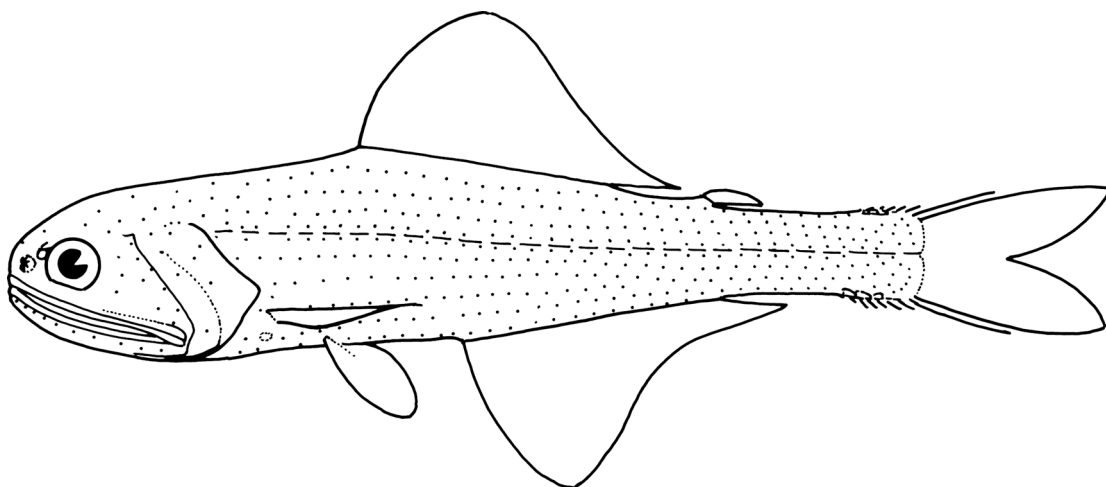
CAAB Numbers & Standard Names

The 8-digit numerical Code for Australian Aquatic Biota (CAAB) is a standard code applied to all fish species (and other taxa) in the Australian (and New Zealand) fauna that enables effective manipulation of data, e.g. for sorting, and not prone to misspelling of species names. The code number is provided for each species by CSIRO, including temporary codes for undescribed species. In these keys, the CAAB number and standard common name of each species is provided underneath each illustration. The first 2 digits code Phylum (37, Pisces); digits 3 to 5 are Family (122, Myctophidae); digits 6 to 8 are species, e.g. *Benthoosema suborbitale* = 37122024 Dimple Lanternfish.

Results

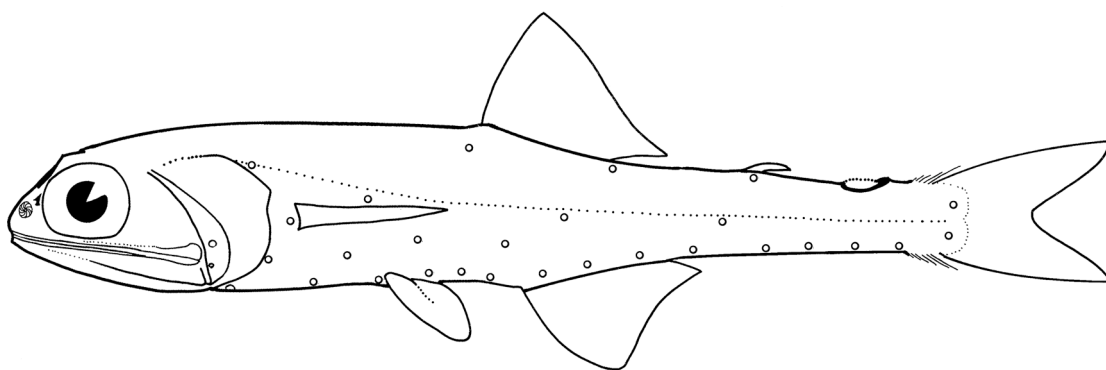
Key to the genera of Australian Myctophidae

- 1 Body, head, and fin membranes covered with minute secondary photophores, primary photophores indistinct [monotypic, [p. 102](#)] *Scopelopsis*



- Secondary photophores absent or, if present, always smaller than and distinct from primary photophores 2

- 2 Three photophores far above lateral line near dorsal profile; Prc₂ two diameters or more above lateral line; pelvic-fin rays 6 [monotypic, [p. 94](#)] *Notolychnus*



- No photophores far above lateral line near dorsal profile; Prc₂ never more than one diameter above lateral line; pelvic-fin rays usually 8, rarely 7 3

- 3 1–2 Prc, always clearly separate from AOp 4

- 3–9 Prc, sometimes continuous with AOp 15

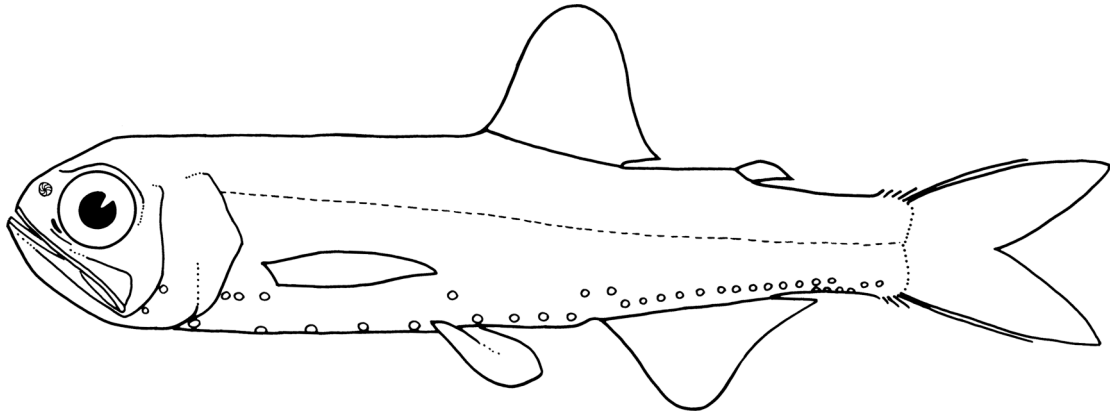
- 4 PLO below or opposite pectoral base, snout not projecting; no distinct Pol, AOa and AOp usually continuous, some with last 1 or 2 AOa raised and/or AOp depressed 5

- PLO dorsal to pectoral-fin base or, if opposite, snout weakly or strongly projecting; distinct Pol present, AOa and Aop always discontinuous 8

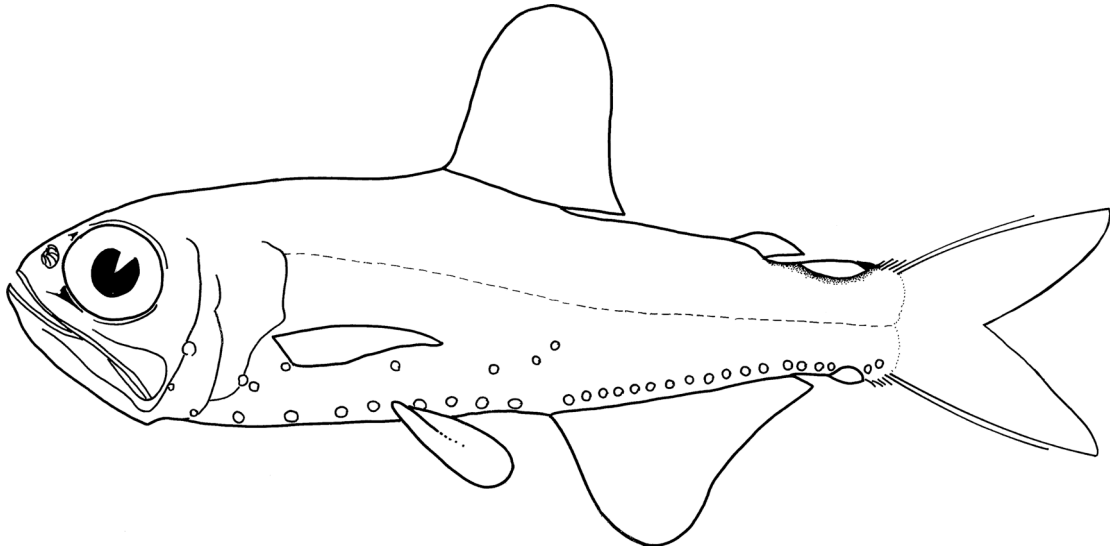
- 5 PVO₁ and PVO₂ horizontal, line connecting them markedly above PO₁ 6

- PVO₁ and PVO₂ angled, in line with PO₁ 7

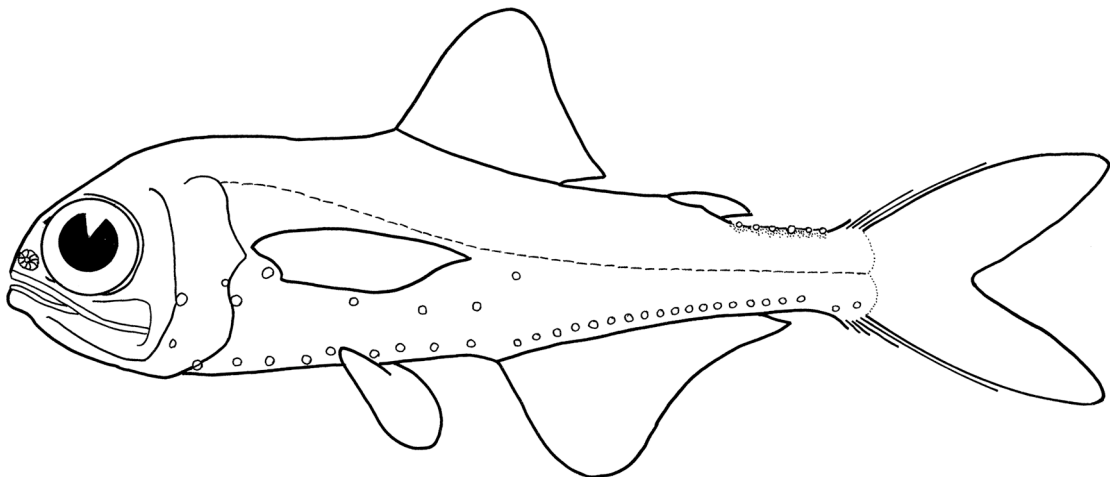
- 6 PLO, PVO₁ and PVO₂ on same horizontal line; 2 SAO, horizontal; SAO₁ behind level of VO₄; males with 6 (5–8) separate but contiguous, individually complex SCOs [monotypic, [p. 61](#)] *Kreffichthys*



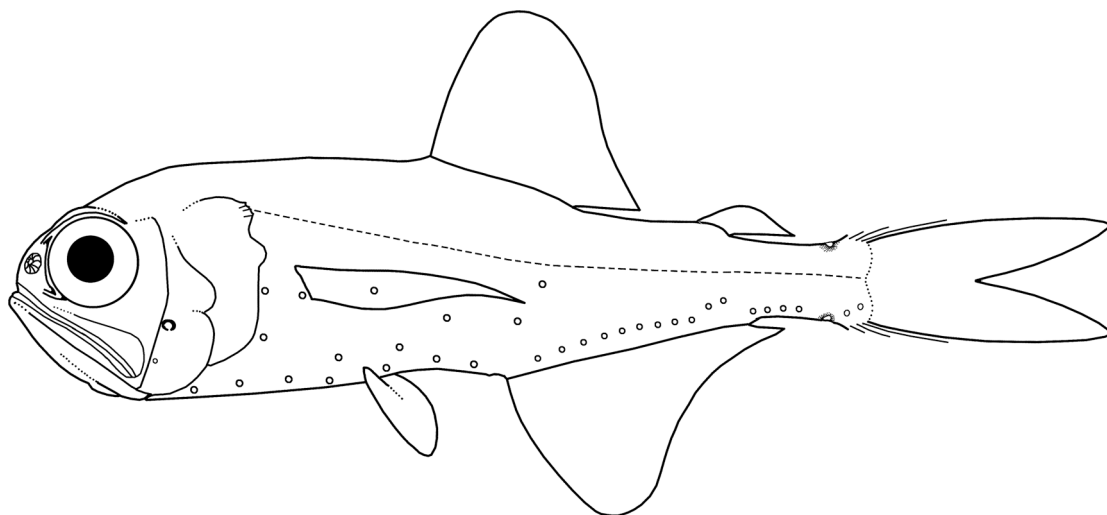
- PLO slightly above to well above PVO₁; 3 SAO, not horizontal; SAO₁ before level of VO₄; male SCO not as above [9 species, [p. 96](#)] *Protomyctophum*



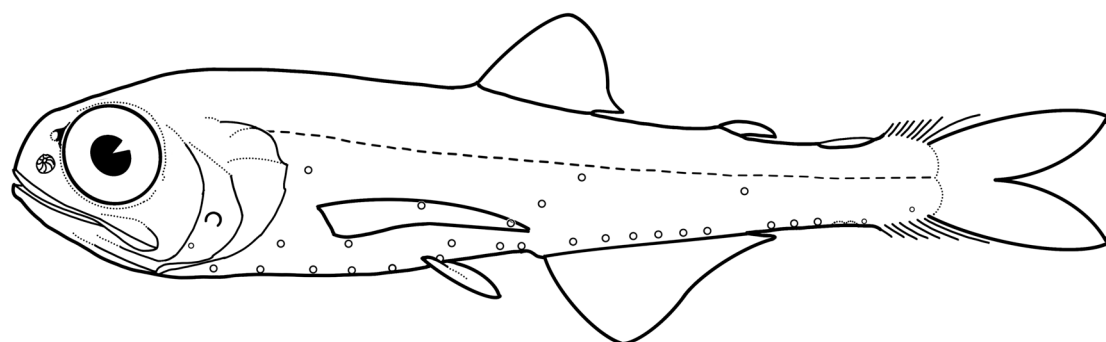
- 7 VO level; posterodorsal margin of operculum lacking lobe with notch; last AOa not, or only slightly, elevated [5 species, [p. 48](#)] *Electrona*



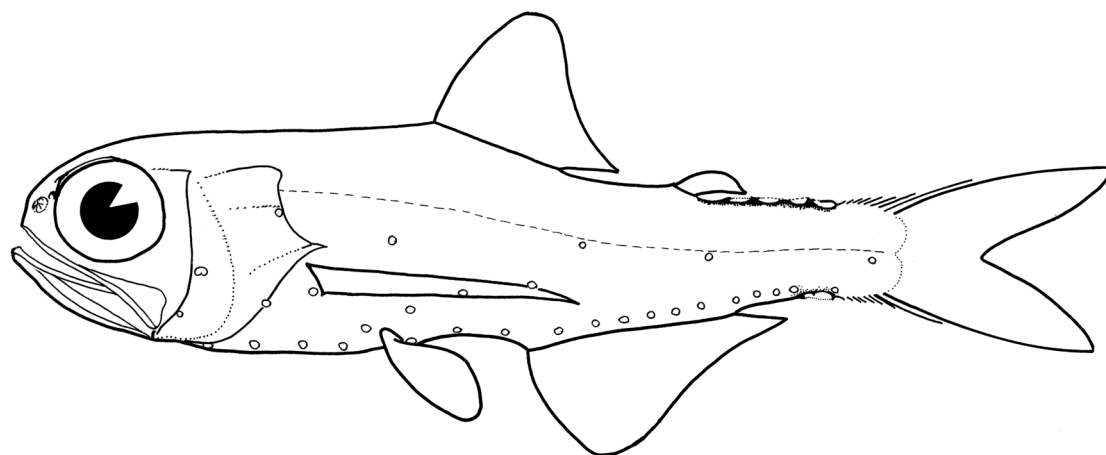
- VO₂ highly elevated; posterodorsal margin of operculum distinctly lobed, sometimes serrated, notch below; last 1–2 AOa elevated [2 species, [p. 79](#)] *Metelectrona*



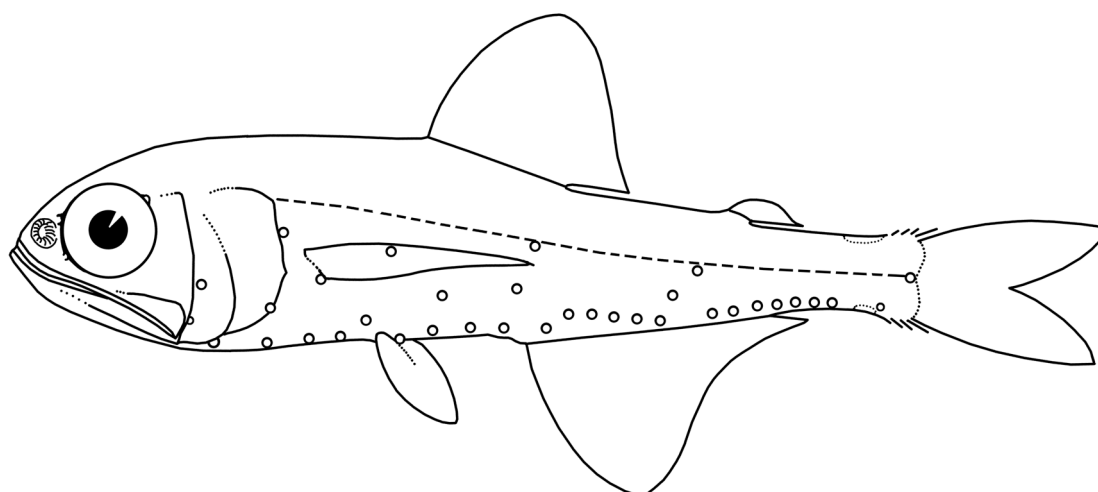
- 8 PLO distinctly dorsal to upper margin of pectoral-fin base; mouth terminal, snout not projecting 9
- PLO opposite or just dorsal to upper margin of pectoral-fin base; mouth subterminal, snout weakly or strongly projecting 13
- 9 VO₂ elevated out of VO series; PVO₁₋₂ horizontal or weakly angled, line connecting them above PO₁ 10
- VO level or slightly arched, VO₂ not elevated out of VO series; PVO₁₋₂ angled in line with PO₁ 11
- 10 Prc₂ more than 2 diameters below lateral line; SAO₃ before AOa₁; GR 2+1+11–12; max. size 32 mm SL (AO 6 (5–7) + 3 (2–4) [2 species, [p. 46](#)] *Diogenichthys*



- Prc₂ less than 1 photophore-diameter below lateral line; SAO₃ behind AOa₁; GR 3–8+1+9–16; max. size 90 mm SL; [3 species, [p. 16](#)] *Benthosema*

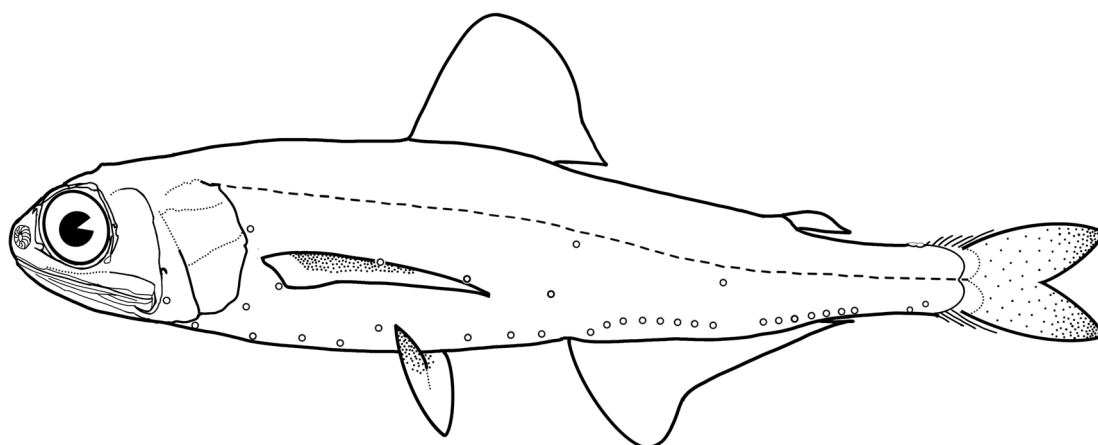


- 11 2 Pol; Prc₂ at or slightly below lateral line [4 species, p. 57] *Hygophum*

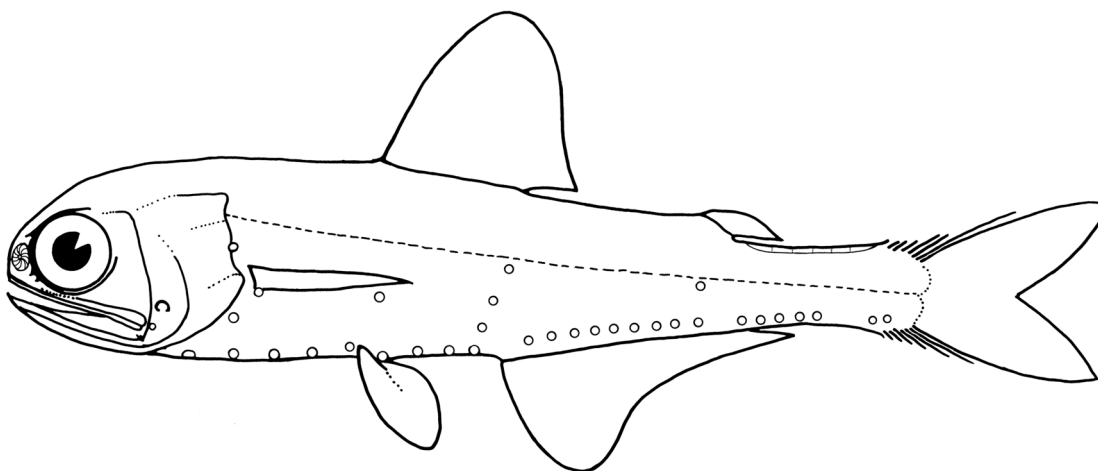


- 1 Pol; Prc₂ far below lateral line or, if at lateral line, SAO straight, not angled 12

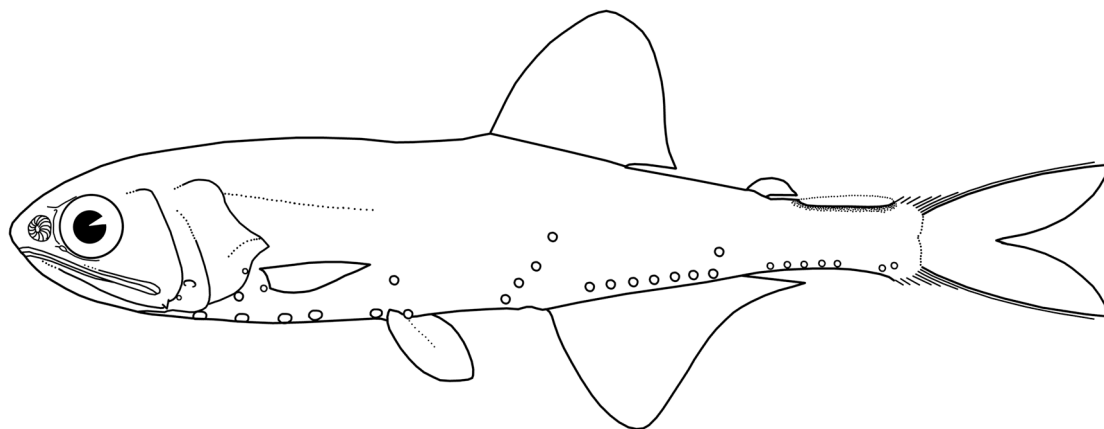
- 12 SAO₁₋₃ strongly angled, approaching right angle, with SAO₁ usually over or anterior to VO₂, over VO₃ in some specimens of one species; (scales always cycloid); 4 species, p. 102] *Symbolophorus*



- SAO₁₋₃ in a straight line or obtuse angle, SAO₁ usually closest to vertical of VO₄ (if closer to vertical of VO₃, scales cycloid or spinoid); [14 species, p. 80] *Myctophum* complex

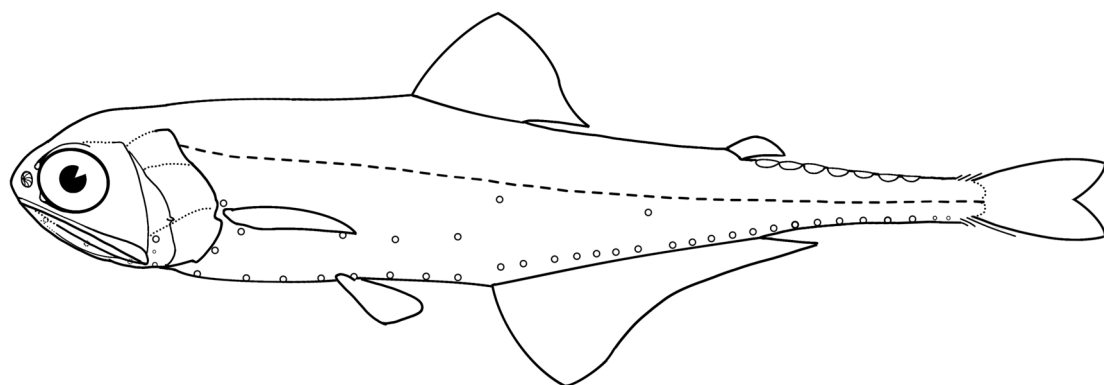


- 13 PLO opposite upper half of pectoral-fin base; snout weakly projecting; small Suo present behind level of posterior margin of pupil; palatine with enlarged teeth; SCO of mature males single, large; females without caudal luminous organs [2 species, [p. 78](#)] *Loweina*

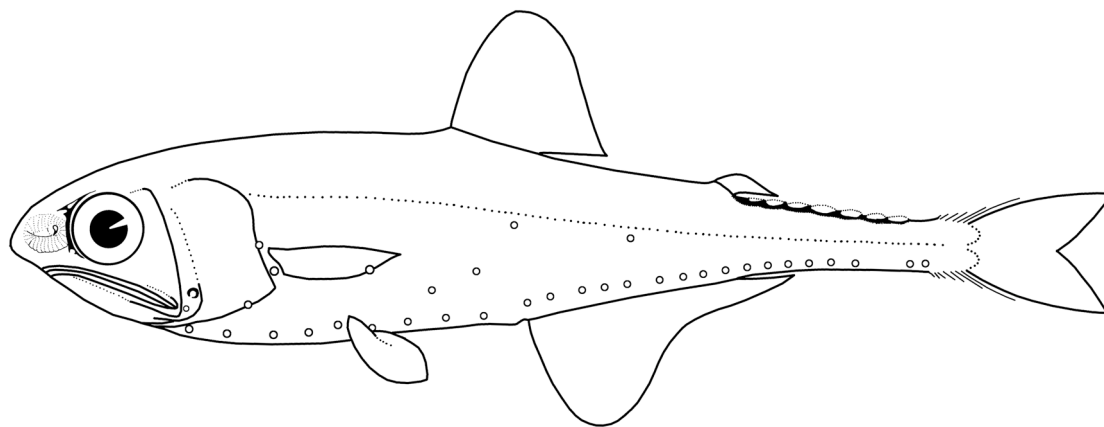


- PLO just dorsal to pectoral-fin base; snout strongly projecting; no Suo over eye; palatine without enlarged teeth; SCO of males and ICO of females 4–8 individual plates, with black margins and touching or slightly overlapping in largest specimens ... 14

- 14 Gill rakers normal; SAO_{1-3} strongly angled, SAO_1 on or near SAO_2 –VLO line; lateral line present, extending at least to near level of adipose-fin base [2 species, [p. 50](#)] *Gonichthys*



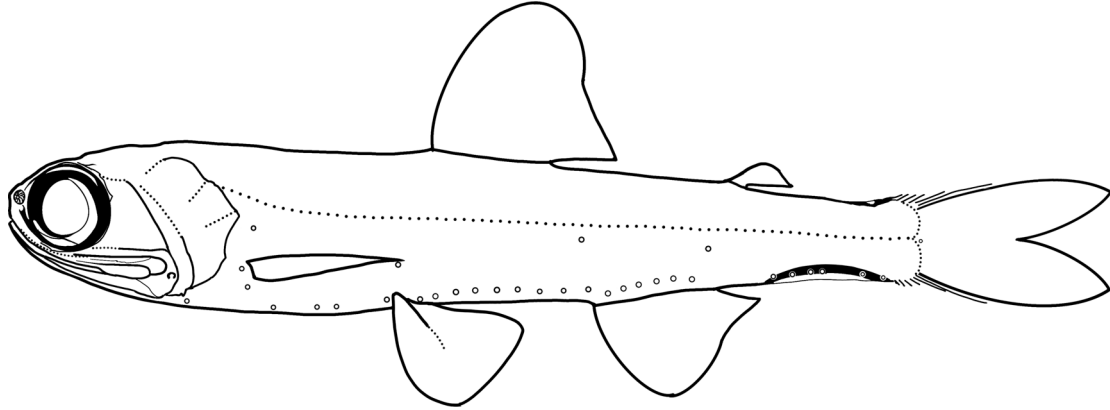
- Gill rakers reduced to spinoid protuberances; SAO_{1-3} straight to weakly angled, SAO_1 far below SAO_2 –VLO line; lateral line absent [2 species, [p. 22](#)] *Centrobranchus*



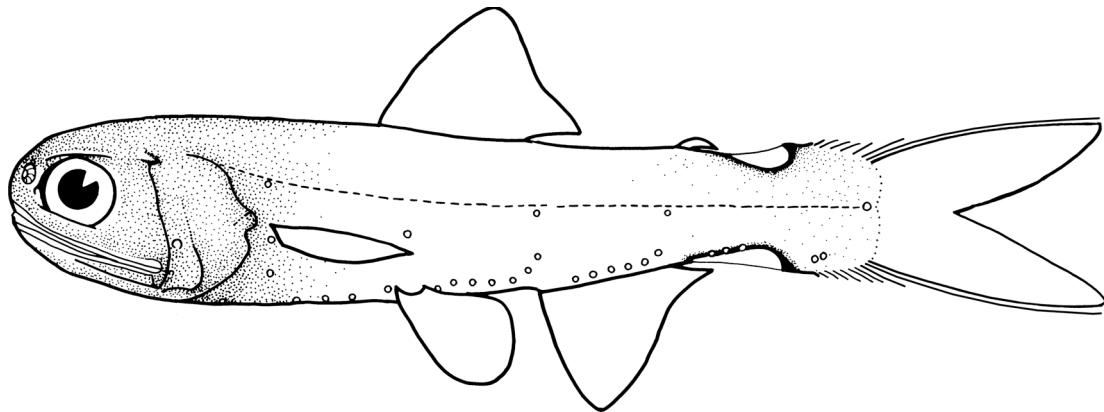
- 15 Supra- and infracaudal organs large, single, bordered by heavy black pigment; (strong pterotic spine present; $Prc\ 2 + 1$, always separate from AOp) 16

- Supra- and/ or infracaudal organs of narrow, overlapping plates sometimes difficult to distinguish, with or without pigment, or no caudal organs; (when plates difficult to distinguish, in some *Lampanyctus* and *Nannobranchium*, Prc 4, often continuous with AOp) 17

- 16 Pelvic-fin origin anterior to dorsal-fin origin; white crescent around posterior half of iris; no vomerine teeth [2 species, p. 105] *Taaningichthys*



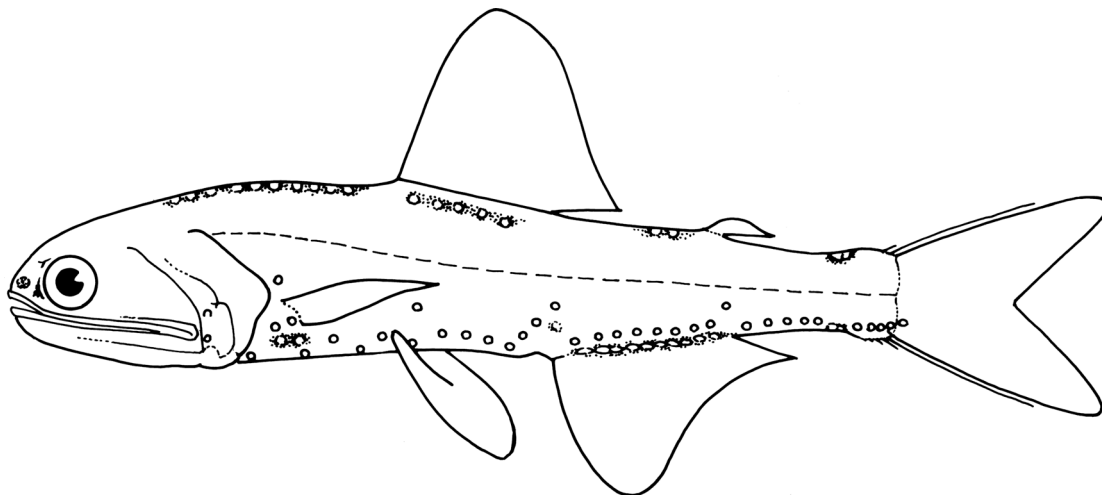
- Pelvic-fin origin under dorsal-fin base; no white crescent around posterior half of iris (1 species around dorsal half of iris); vomerine teeth present; [6 species, p. 61] *Lampadena*



- 17 SCO and ICO present in both sexes [some populations of *Ceratoscopelus* with SCO of males developing only at sexual maturity] 18

- Either SCO and ICO absent, or only one, its position depending on sex 22

- 18 PO₃ and PO₅ moderately elevated; Prc 5; all photophores at least two diameters below lateral line; Dn present; PVO₁₋₂ almost horizontal; [monotypic, p. 64] *Lampanyctodes*

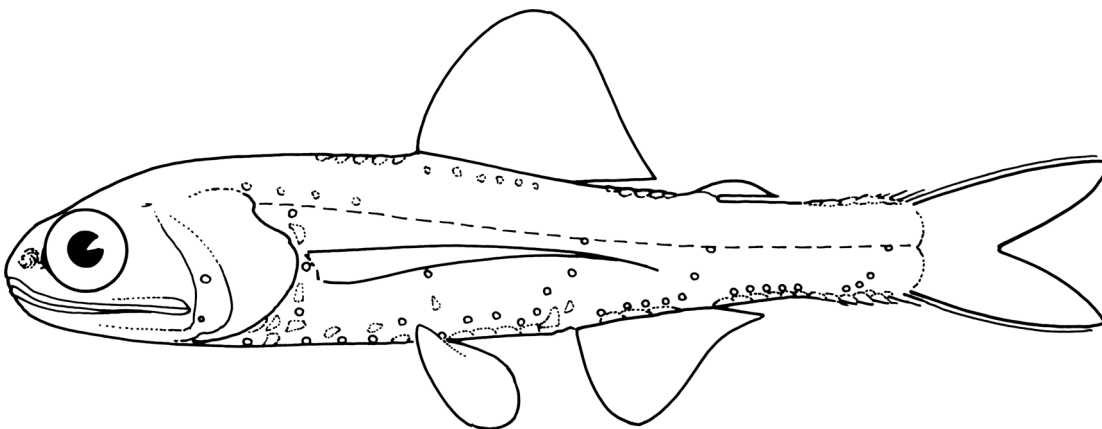


— PO level (PO₃ slightly elevated in one, PO₅ slightly elevated in another) or PO₄ highly elevated; Prc 3–4; at least one photophore on or within one diameter of lateral line; Dn absent; PVO_{1–2} vertical or subvertical 19

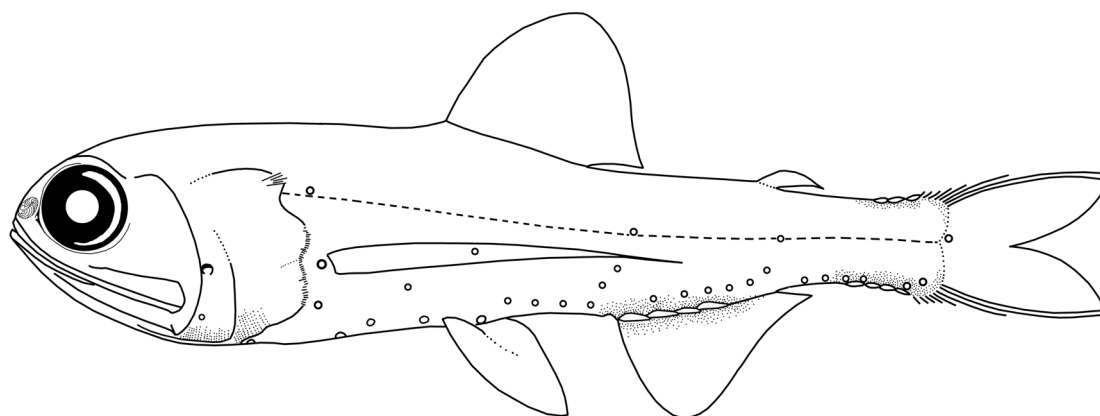
19 Vertical from anal-fin origin posterior to or under end of dorsal-fin base; luminous patches at bases of most fins and other areas of head and body in addition to the SCO and ICO 20

— Vertical from anal-fin origin anterior to posterior end of dorsal-fin base, often closer to middle of dorsal-fin base; luminous patches only at SCO, ICO, and a small patch at adipose-fin origin in some species 21

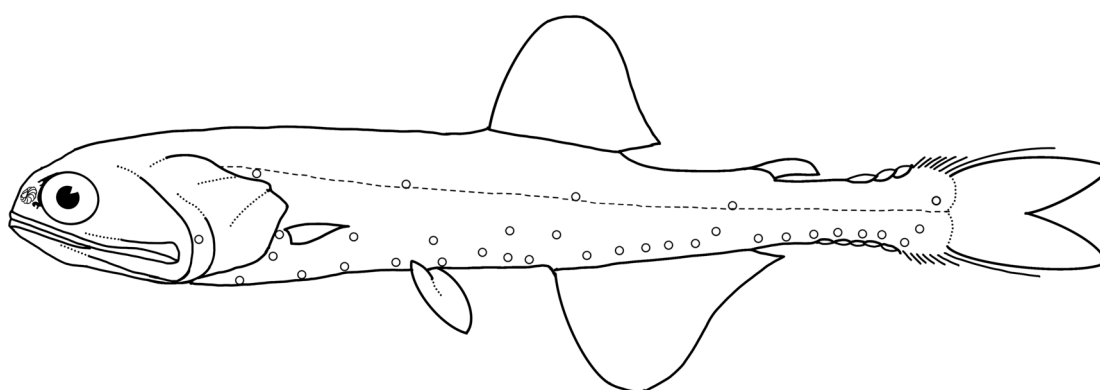
20 PO level (PO₃ slightly elevated); Prc 4; extensive midventral luminous tissue between anus and pelvic-fin bases (not reaching pelvic-fin bases in some small, less than 35 mm SL, southern specimens) and over entire anal-fin base; other luminous tissue patches on head and body, but often rubbed off; no white crescent of posterior half of iris; [1 species, p. 24] *Ceratoscopelus*



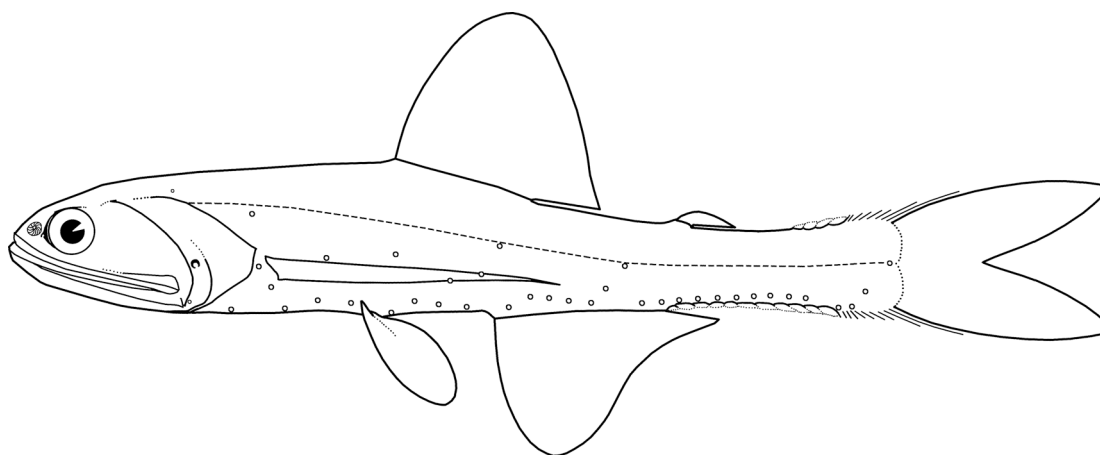
— PO₄ distinctly elevated; Prc 3; no extensive luminous tissue between pelvic-fin bases and anus (1 patch at pelvic-fin base in some species); white crescent on posterior half of iris; [7 species, p. 18] *Bolinichthys*

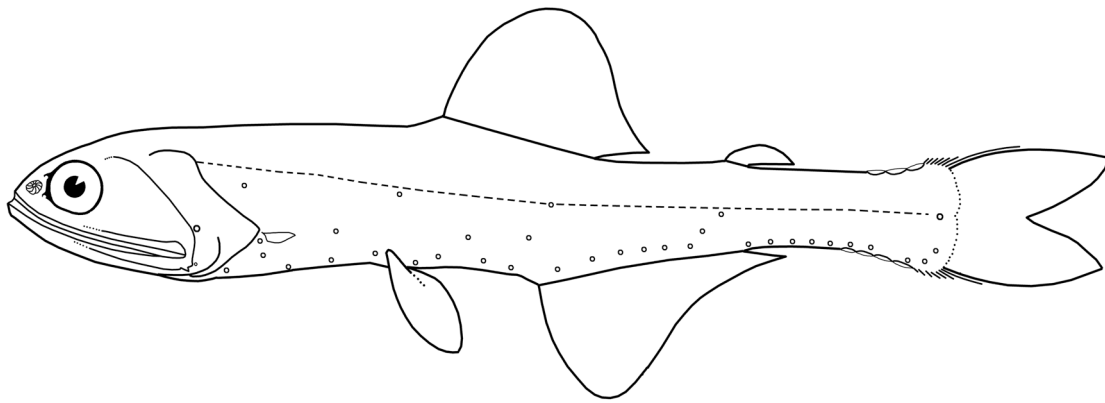


- 21 5 VO with VO₂ elevated above level of, and anterior to, VO₁;
 3 Prc continuous with AOp, last 1 photophore-diameter above
 lateral line [1 species, [p. 106](#)] *Triphoturus*

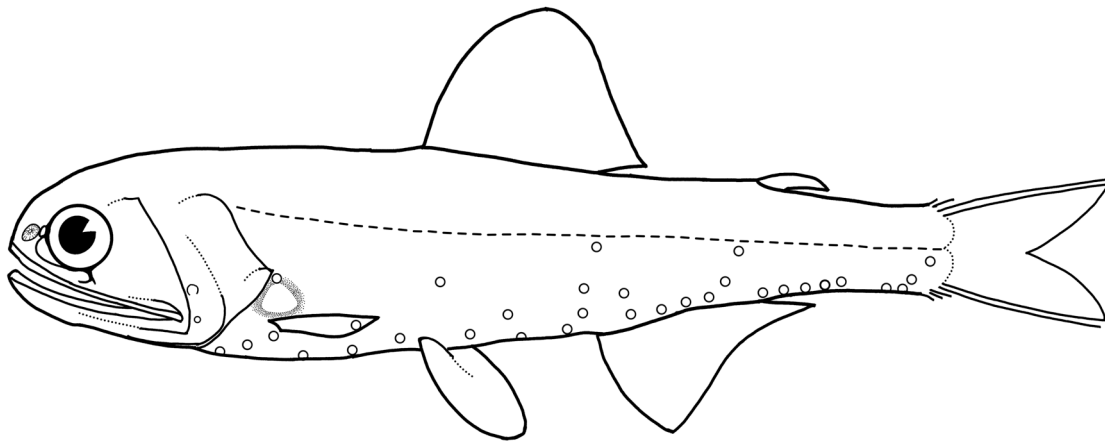


- 4 VO, level, arched or with VO₂ elevated and advanced;
 4 Prc, last on or less than half photophore-diameter above
 lateral line, continuous or separate from AOp series; some
 species with luminous tissue at adipose-fin origin [16 species,
 [p. 65](#)] *Lampanyctus* including *Nannobrachium*

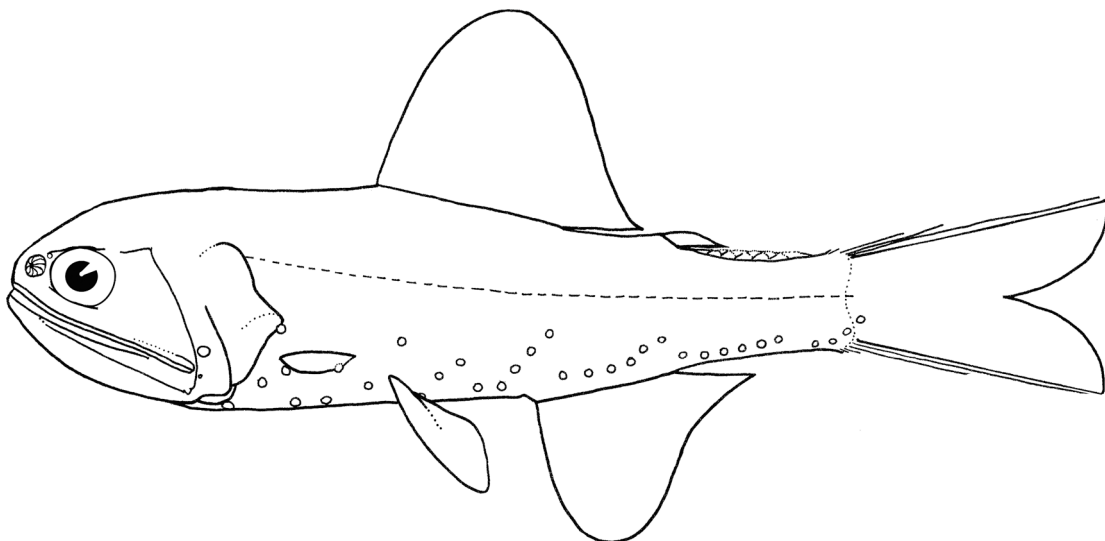




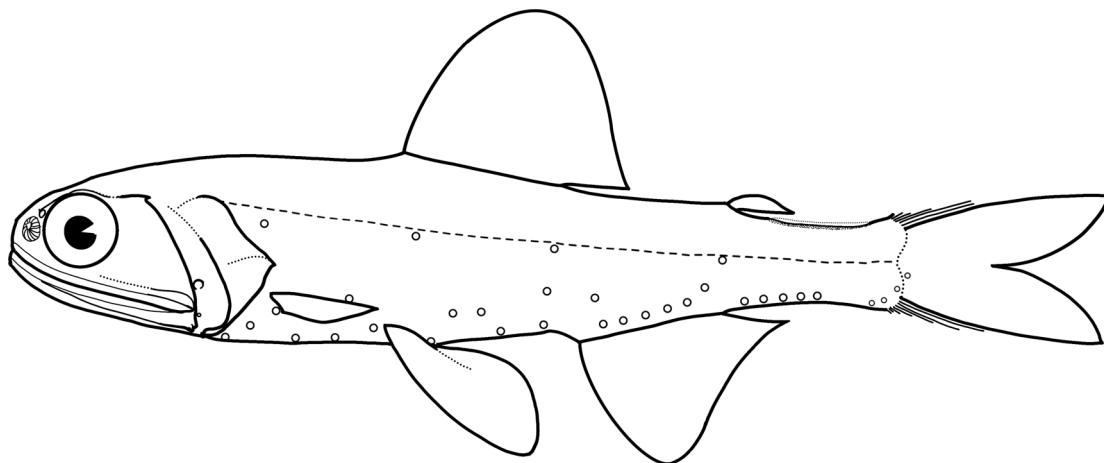
- 22 PO₄ elevated; VO₂₋₃ elevated (slightly elevated in *Diaphus drachmanni*) 23
- PO level; VO level or VO₂ elevated 25
- 23 No SCO or ICO present; Vn almost always present, often well developed; luminous patch near PLO usually present (if luminous patch absent, Vn and So present under eye); (AOa₁ usually elevated); [40 species, [p. 24](#)]..... *Diaphus*



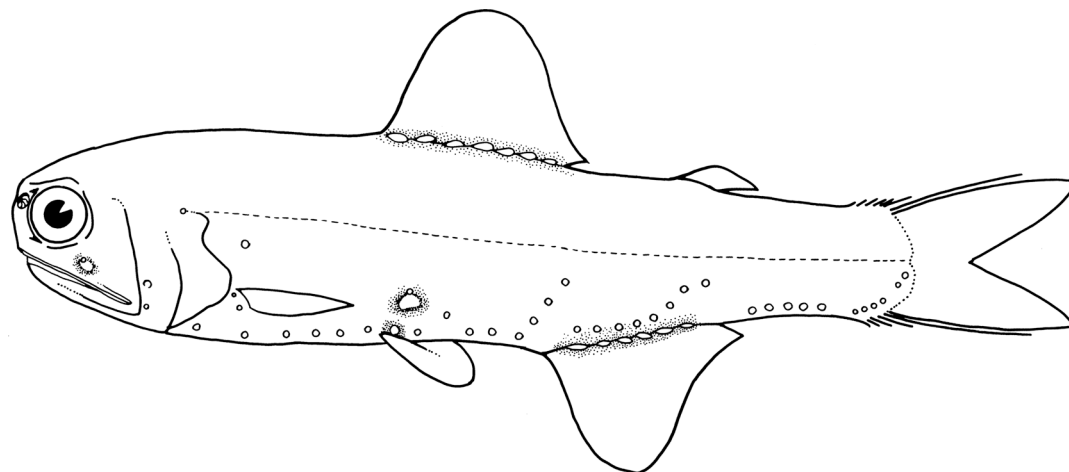
- Males with SCO, females with ICO; no Vn; no luminous patch near PLO 24
- 24 SAO₃; VO₁₋₃ in a straight diagonal line; AOa₁ level with AOa₂₋₄; PLO, VLO, SAO₃, and Pol₂ at least 2 diameters below lateral line; [2 species, [p. 76](#)] *Lobianchia*



- SAO₂; VO₂₋₃ in a horizontal line dorsoposterior to VO₁; AOa₁ elevated above level of AOa₂₋₄; PLO, VLO, SAO₂ and Pol₂ just below lateral line; [monotypic, yet to be recorded from Australian waters, [p. 60](#)] *Idiolychnus*

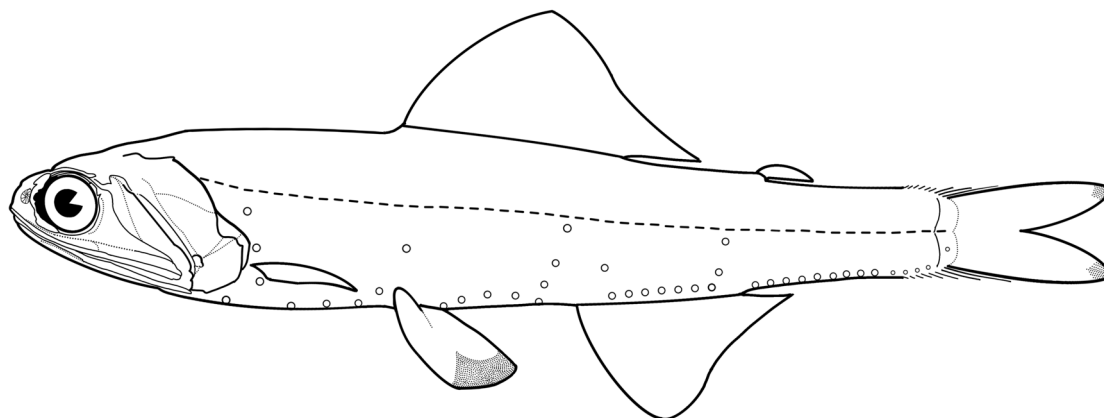


- 25 1 cheek photophore, with associated luminous tissue patch; VO₂ elevated; A 12–14 [monotypic, [p. 57](#)] *Hintonia*

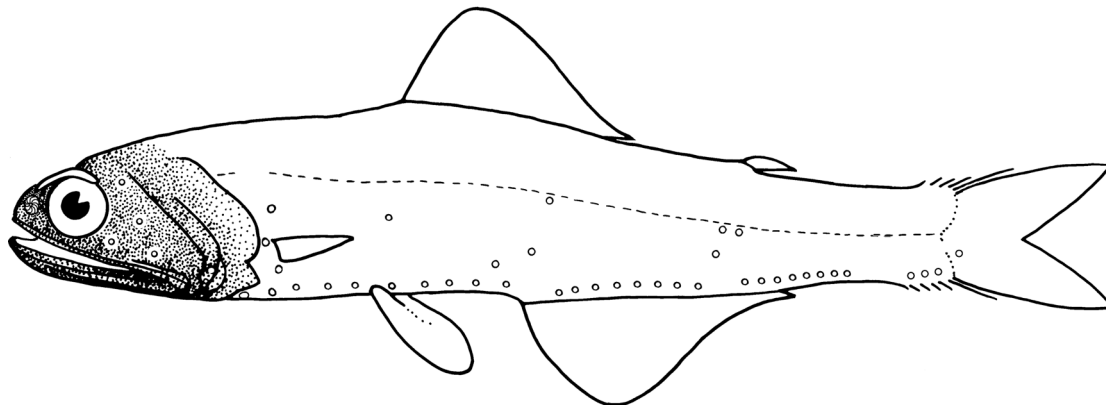


- 0 or 3–7 cheek photophores; VO level or evenly arched; A 17–22 26

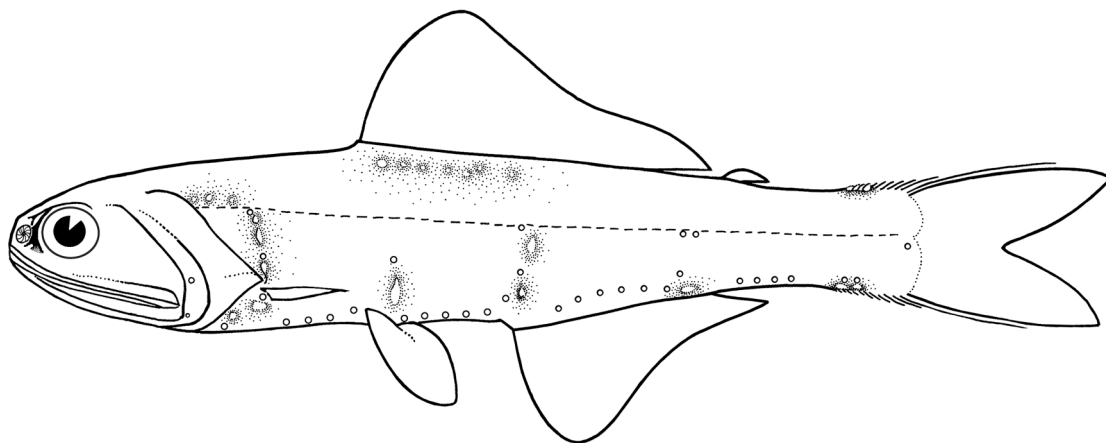
- 26 AOa₁ elevated; 2 Pol between last AOa and lateral line in vertical or subvertical line, never horizontal [8 species, [p. 52](#)] *Gymnoscopelus*



- AOa level; 2–3 Pol horizontal 27
- 27 D 17 (16–18); 3–7 primary cheek photophores present; PLO midway between lateral line and pectoral-fin base; adult males with large Suo; 3 Pol forming right angle, with upper 2 horizontal at lateral line; head, body, and fins covered with secondary photophores (all body photophores usually rubbed off) [monotypic, p. 76] *Lampichthys*



- D 23–27 (22, rarely 21); cheek photophores absent; PLO much closer to lateral line than pectoral-fin base; males without Suo; 2, rarely 3, Pol horizontal near lateral line; no secondary photophores present [2 species, p. 95] *Notoscopelus*



Key to the species of Australian Myctophidae

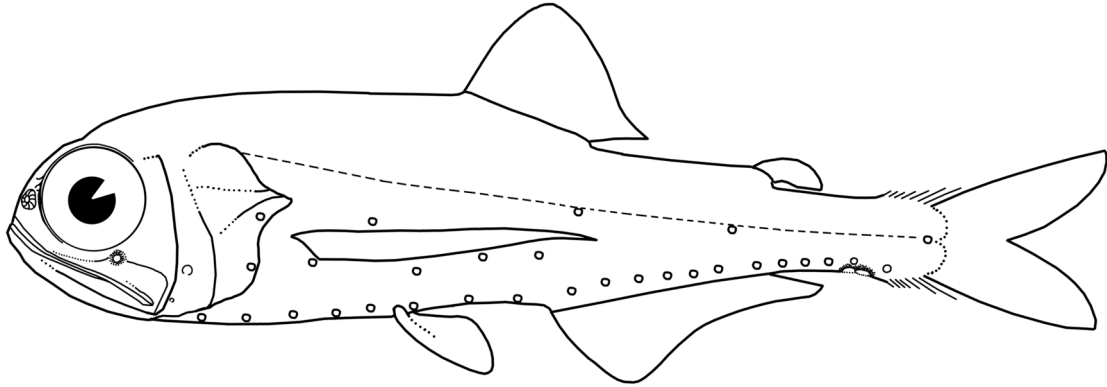
Benthosema Goode & Bean, 1896

One of only two myctophid genera with an elevated VO_2 in combination with two Prc and the PLO above level of dorsal margin of pectoral-fin base. The SCO and ICO are coalesced patches or separate organs surrounded by black pigment, and sexually dimorphic in number or position; these organs are usually absent in *B. pterotum*.

The genus is circumglobal in distribution with five world species, and three species in Australian waters; see Nafpaktitis and Nafpaktitis (1969); Gjøsæter (1981); Becker (1983); Hulley (1984, 1986a, 1990b); Paxton and Hulley (1999); Hoese *et al.* (2006); Zahuranec *et al.* (2012); Larson *et al.* (2013); Denton (2014); Roberts *et al.* (2015); Martin *et al.* (2018); Sutton *et al.* (2020); Mostarda *et al.* (2023); Koubbi *et al.* (2025). Data from non-Australian specimens in {} are from Nafpaktitis and Nafpaktitis (1969) (*B. suborbitale*, *B. fibulatum*), and Hulley (1986a) (*B. pterotum*).

Key to the genus *Benthosema*

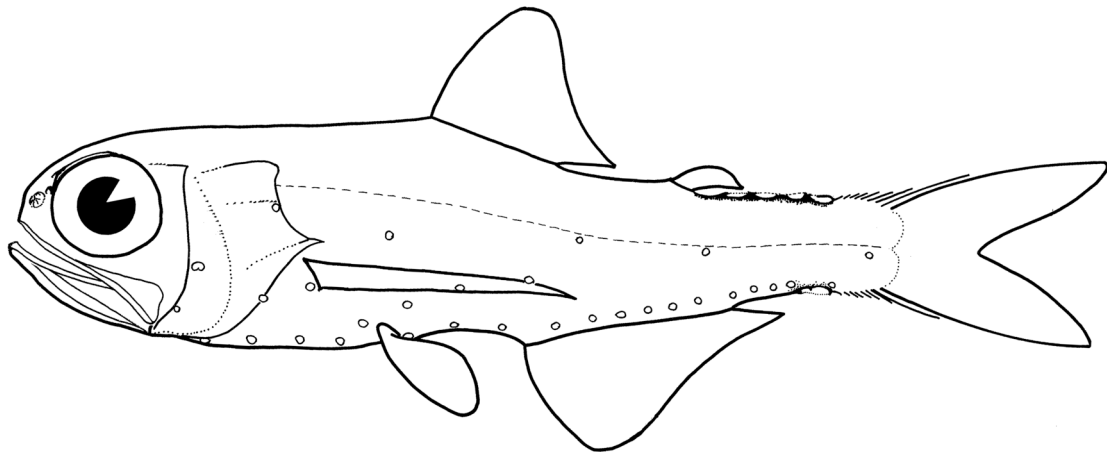
- 1 So present, below posterior one third of eye; GR 3 (rarely 4) + 11 (10, rarely 12), total 14 (13, rarely 15) {3 + 10 (11), total 13–14}; [AO 6 (rarely 5) + 5 (rarely 6) total 11 (rarely 10, 12) {6 (5–7) + 5 (4–6), total 11 (10–12)}; SCO 1 (♂ > 23 mm SL); ICO 1–3 (♀ > 21 mm SL); D 13 (rarely 12–14) {13 (12)}; A 17 (rarely 16–18) {17 (16–18)}; P 13–14 {14}; max. size 39 mm SL; n = 38; Qld, LHI, NI, NSW, Vic, Tas, WA, Col*Benthosema suborbitale* (Gilbert, 1913)



37122024 Dimple Lanternfish (♀, Nafpaktitis & Nafpaktitis, 1969)

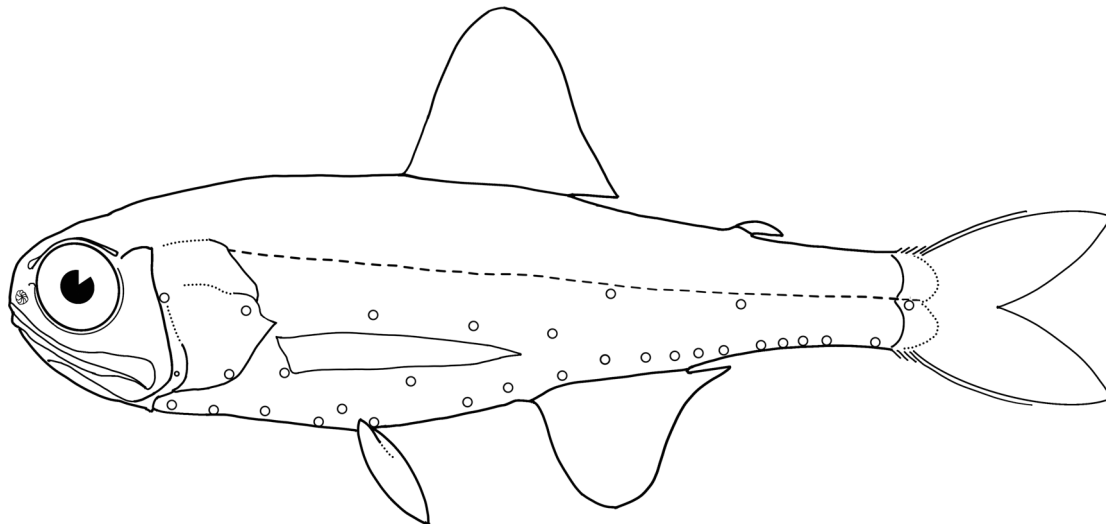
- No So below eye; GR 6–8 + 16–18, total >21..... 2

- 2 SAO₁ below VLO–SAO₂ line; PLO much nearer lateral line than pectoral-fin base; Op₂ on level of ventral margin of orbit; [AO 6 (rarely 5) + 4 (rarely 5), total 10 {6 (5–7) + 4 (3–5), total 10 (11)}; SCO 1 (♀ > 50 mm SL) or 4–5 (♂ > 50 mm SL), ICO 1, rarely 2 (♂, some ♀); GR 7 (6–8) + 16–17 (rarely 18), total 23–24 (22, rarely 25–26) {6–7 + 15–16 (rarely 13), total 21–23 (rarely 20)}; D 13 (rarely 14) {13}; A 19 (rarely 17–18) {19 (18)}; P 15–16 (rarely 17) {15 (14)}; max. size 90 mm SL; n = 23; Qld, NI, NSW, WA, NT*Benthosema fibulatum* (Gilbert & Cramer, 1897)



37122078 Spinycheek Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

- SAO₁ on VLO–SAO₂ line; PLO at or below midway point between lateral line and pectoral-fin base; Op₂ well above ventral margin of orbit, level with mid-orbit; [AO 6 + 4 (rarely 3–5) {6 + 4–5}; SCO & ICO 0 (rarely 1 or 2 small); GR 7 (6) + 15–16 (rarely 17), total 22–23 {6–9 + 15–20, total 21–27}); D 13 (rarely 12–14) {13–14}; A 18 (19, rarely 17) {17–22}; P 12–13 {14}; max. size 70 mm SL; n = 20; see remarks; WA, NT *Benthoosema pterotum* (Alcock, 1891)



37122079 Opaline Lanternfish (Hulley, 1986a)

Benthoosema remarks

The DNA studies of Poulsen *et al.* (2013), Denton (2014), and Martin *et al.* (2018) all included a subclade of *Benthoosema* and *Diogenichthys*, with the latter embedded in a paraphyletic *Benthoosema*. Denton (2014) sampled all five species in *Benthoosema* and remarked that his split into two species groups matched that of Zahuranec *et al.* (2012) based on single gene analyses. There are morphologic characters of caudal organ structure, larval anatomy, and photophore development that need to be considered together with adult dentition when taxonomic decisions of new subgenus or genus are made. The type species of *Benthoosema* is *Scopelus glacialis* (Reinhardt, 1837) that is in the group with *B. suborbitale*.

***B. pterotum*.** Analysis of DNA sequences of this species (Zahuranec *et al.*, 2012) demonstrates species level differences in populations from the Oman Sea and Japan. No direct comparisons of morphologic characters from the two populations are known. The Australian population should be included in any future study.

Specimens taken over the shelf in northern Australian waters have almost no dark pigment, except the borders of the photophores. This pseudoceanic species is the only myctophid collected in the relatively shallow waters of the Arafura Sea between Australia and West Papua. Large schools in the Gulf of Oman have long been considered a potential commercial resource (Gjøsæter, 1981), but no large aggregations have been found in Australian waters.

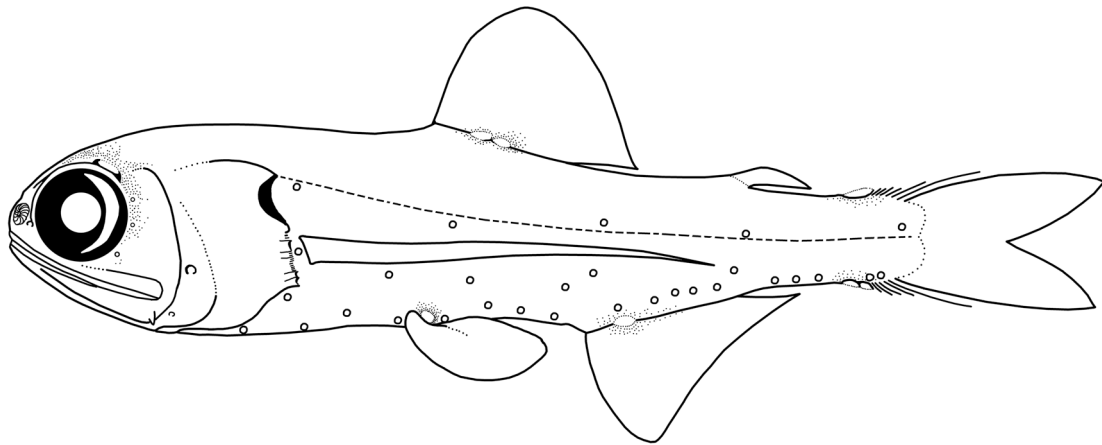
Bolinichthys Paxton, 1972

Bolinichthys species have a large eye and short to moderate jaws relative to other genera with three Pres (except some *Diaphus*). They possess a crescent of whitish tissue on the posterior half of the iris (sometimes difficult to see in damaged specimens) that is found in only one other genus, *Taaningichthys*, and in *Lampadena chavesi* (dorsal half of iris). *Bolinichthys* is distinguished from *Taaningichthys* by the SCO and ICO – composed of small, scale-like elements in *Bolinichthys* compared to single, large, translucent organs in *Taaningichthys*. Species of *Bolinichthys* have small luminous patches in various positions on the body, often associated with fin bases; the full extent and complement of ICO elements are not developed until ca. 25–30 mm SL. *Bolinichthys* species have one or two Pol, which are sometimes difficult to distinguish from the AOp series.

The genus has a circumglobal distribution with seven world species, all of which occur in Australian waters. Hulley and Duhamel's (2009) detailed revision of the genus includes Australian specimens and new records; and see Nafpaktitis and Nafpaktitis (1969); Becker (1983); Hulley (1984, 1986a, 1990b); Hoese *et al.* (2006); Hulley and Duhamel (2011); Denton (2014); Roberts *et al.* (2015); Hulley and Paxton (2016); Martin *et al.* (2018); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Hulley and Duhamel (2009).

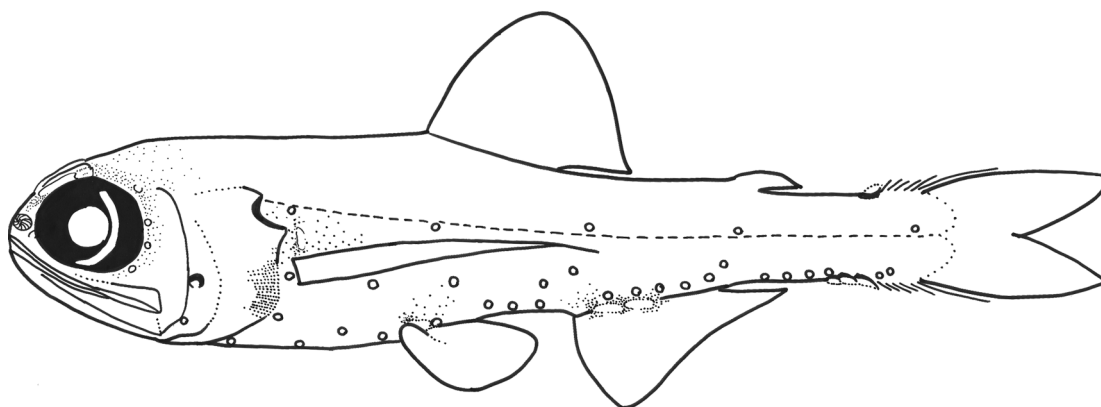
Key to the genus *Bolinichthys*

- 1 VLO about one diameter below lateral line; luminous patch present at pelvic-fin base; 3 small photophores present behind eye; minute secondary photophores present on body, often difficult to see ... 2
- VLO usually 2–5 diameters below lateral line, except some small *B. nikolayi*; no luminous patch at pelvic-fin base or associated with any other fin base except over anal-fin base; small photophores behind eye absent; secondary photophores on body absent ... 4
- 2 No luminous patch above pectoral-fin base; luminous patches below dorsal-fin base 1–2 {2–3}, above anal-fin base 0–1 (2) {1 (rarely 2); SCO 2 {1–2}, ICO 2 (3) {2–3}; anterior margin of preopercle with small ventral spine mostly attached to posterior wing of bone and slightly curved anteriorly; [AO 6 (5) + 4 (5), total 10 (rarely 11) {(4–6) + 4 (3–5), total 9 (7–10)}; GR 5 (rarely 4 in smallest specimens) + 12–13 (rarely 11 in smallest), total 17–18 (15–16 in smallest) {4 (3–5) + 11 (10–13), total 15–16 (13–18)}; D 13 (rarely 12–14) {13 (12–14)}; A 13–14 (rarely 15) {14 (13–15)}; P 13 (rarely 12–14) {12 (13)}; max. size 55 mm SL; n = 10; Qld, LHI, NI, NSW, Tas, WA, Col *Bolinichthys longipes* (Brauer, 1906)



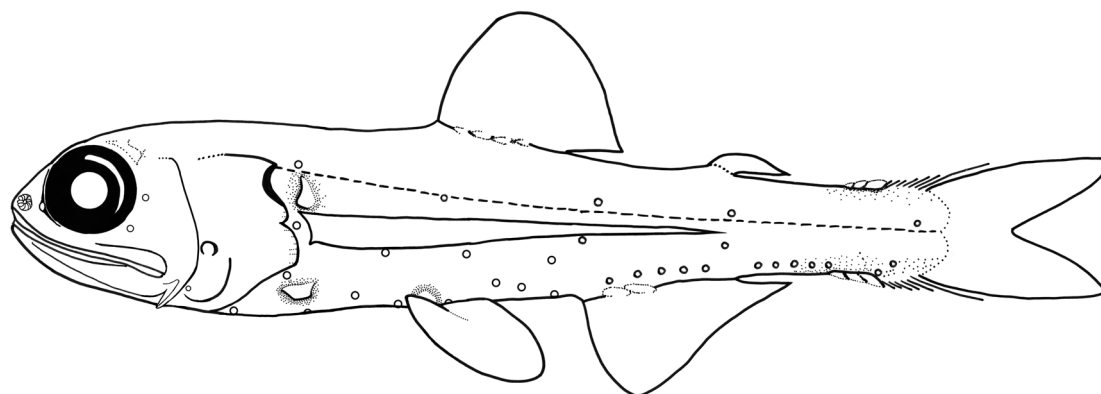
37122025 Popeye Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- Luminous patch present above pectoral-fin base.... 3
- 3 GR 4 (3) + 11 (12–13), total 15 (16–17) {4 (3–5) + 12 (10–13), total 16 (14–18)}; anterior margin of preopercle with small ventral spine mostly attached to posterior wing of bone and slightly curved anteriorly; no luminous patch below PVO₁; lowest photophore behind eye notably larger than upper 2, especially in specimens less than 25 mm SL; [AO 6 (7) + 4 (5) total 10 (11, rarely 12) {6 (4–7) + 4 (2–5), total 10 (8–12)}; luminous patches: below dorsal-fin base 0 {0–2}, above anal-fin base 2 (3, rarely 1) {2–3 (rarely 4)}, SCO 2 (rarely 1) {1–2}, ICO 3 (rarely 4–5) {2–4}; D 13 (12) {13 (12–14)}; A 13 (rarely 14) {13 (12–15)}; P 13 (14) {13 (12–14)}; max. size 47 mm SL; n = 12; WA ... *Bolinichthys indicus* (Nafpaktitis & Nafpaktitis, 1969)



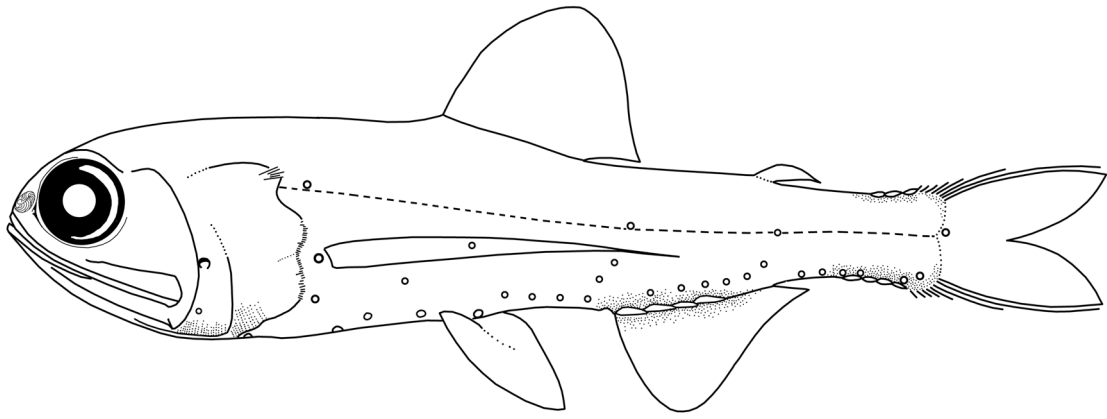
37122074 Smoothcheek Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- GR 6 (7) + 14–16, total 20–22 {6 (5–7) + 14–15 (12–17), total 20–21 (18–23)}; anterior margin of preopercle with distinct ventral spine free from posterior sheet of bone and curved anteriorly almost 45° from vertical; luminous patch usually present below PVO₁; lowest photophore behind eye slightly larger than upper 2 or same size; [AO 6–7 + 4–5, total 10–11 {7 (5–8) + 4 (3–6), total 11 (9–12)}; luminous patches: below dorsal-fin base 3–4 {2–4}, above anal-fin base 3 {2–4}; SCO 3 {3}, ICO 3 {2–3 (4)}; D 13 (12) {13 (12–14)}; A 13–14 {14 (13–15)}; P 14 (13) {14 (12–13)}; max. size 73 mm SL]; n = 5; Qld, LHI, NSW, CoI ... *Bolinichthys photothorax* (Parr, 1928)

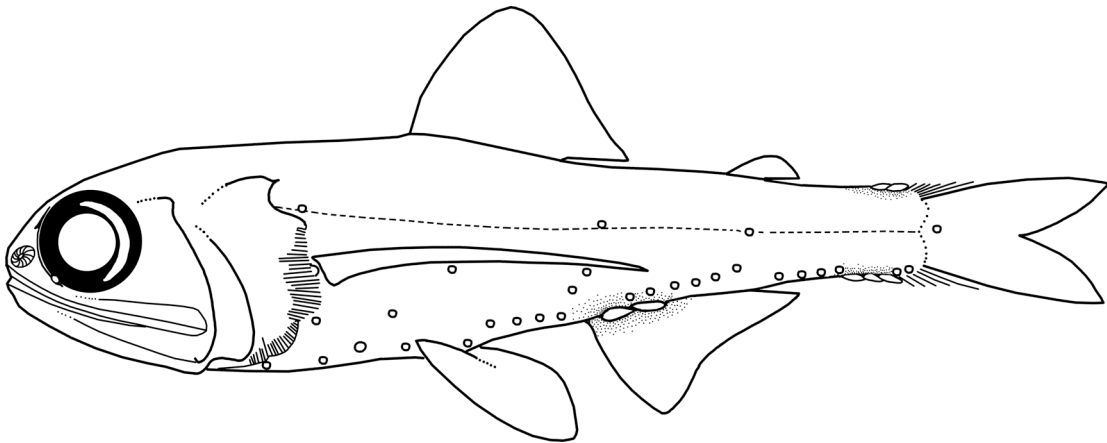


37122027 Spurcheek Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- 4 VO_{2–5} in straight line, VO₂ distinctly below SAO₁–PO₄ line; posterior and ventral edges of subopercle and interopercle strongly serrate in specimens over 35 mm SL ... 5
- VO_{2–4/5} line angulate, VO₂ elevated above VO_{3–4/5} line, to or almost to SAO₁–PO₄ line; posterior and ventral edges of subopercle and interopercle smooth ... 6
- 5 GR 6 (5) + 13–14 (15), total 19–20 (18–21) {6 (5–7) + 1 + 13–14 (12–16), total 19–20 (18–22)}; Pol₁ usually elevated above tangent to dorsal edges of last 2 AOa; Vn usually below vertical of anterior margin of orbit at level of ventrolateral edge of nasal rosette; [AO 6 + 4 (rarely 3, 5), total 10 (rarely 9, 11) {6 (4–7) + 4 (3–5), total 10 (8–11)}; luminous patches: below dorsal-fin base 0, above anal-fin base 3 (rarely 2) {3–5}, SCO 3 (2), ICO 3 (rarely 4); ICO usually extending anteriorly beyond last AOp; D 13 {13 (12–14)}; A 14 (rarely 13–15) {14 (12–15)}; P 14 (13) {13 (12–14)}; max. size 117 mm SL]; n = 20; Qld, LHI, NI, NSW, Vic, Tas ... *Bolinichthys supralateralis* (Parr, 1928)

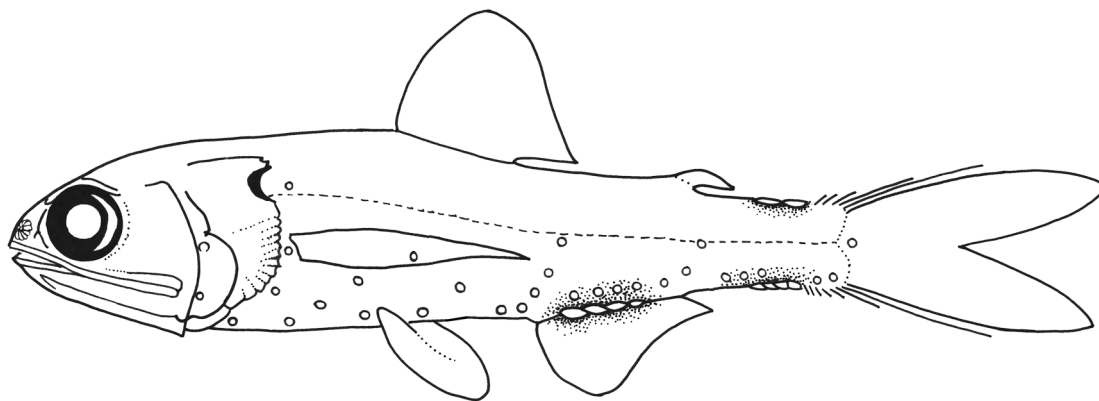

 37122028 Stubby Lanternfish (Nafpaktitis *et al.*, 1977)

- GR 5 + 12, total 17 {5 (4–6) + 12 (11–13), total 17 (15–18)}; Pol₁ only slightly raised, touching tangent to dorsal edges of last 2 AOa; Vn usually on or posterior to vertical of anterior margin of pupil, rarely between verticals of anterior margins of orbit and pupil; [AO 6 + 4 {5–6 + 4 (5), total 10 (8–11)}; luminous patches: below dorsal-fin base 0, above anal-fin base 3 {2 (1–3)}, SCO 2 {2 (1)}, ICO 3 {3 (2–4)}, extending anteriorly to last AOp; D 12 {13 (12–14)}; A 13 {14 (13–15)}; P 12 {12 (11–13)}; max. size 90 mm SL; n = 1; Qld ... *Bolinichthys distofax* Johnson, 1975



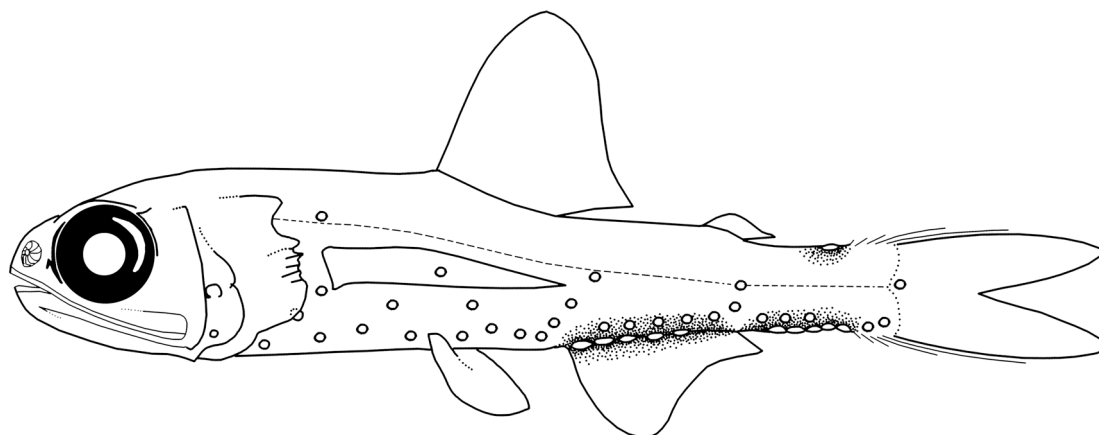
37122108 Barenose Lanternfish (Johnson, 1975)

- 6 GR 6 (4–6) + 13 (12–13) total 19 (17–19), {5–6 (4) + 13 (11–14), total 19 (17–20)}; luminous patches: below dorsal-fin base 0, above anal-fin base 4 (5) {3–5}; SCO 3 {2–3}, ICO 4 (3) {3–4} extending anteriorly beyond last AOp, but not as far as AOp₁; VLO midway between lateral line and pelvic-fin base or slightly closer to lateral line; VO 4 (rarely 5); [AO 6 (5) + 3, total 9 (8), {5 (4–6) + 3 (4), total 8 (7–10)}; D 13 (12) {13 (11–12)}; A 13 (12) {13 (12–15)}; P 12 (13) {11–12 (13–15)}; max. size 93 mm SL; n = 5; Qld, WA, ... *Bolinichthys pyrsobolus* (Alcock, 1891)



37122080 Firey Lanternfish (Hulley & Duhamel, 2009)

- GR 4 (rarely 3) + 9–10 (11), total 14 (13–15) {4 (3) + 9 (7–11), total 13 (11–14)}; luminous patches: below dorsal-fin base 0, above anal-fin base 5–6 (rarely 7) {6–7}; ICO extending anteriorly to AOp_i (only in specimens over c 30 mm SL); VLO much closer to lateral line than pelvic-fin base, in specimens less than 25 mm SL distance between upper edge of VLO and centre of lateral line 1.33–1.75 photophore-diameters; VO 5; [AO 6 (5, rarely 7) + 3 (rarely 4), total 9 (rarely 8, 10) {6 (4–7) + 3 (2–4), total 9 (6–10)}; D 13 (12) {13 (10–12)}; A 14 (13–15) {14 (10–13)}; P 10–11 (rarely 9) {11 (9–10)}; max. size 41 mm SL; n = 45; Qld, NI, NSW, Vic, Tas ... *Bolinichthys nikolayi* Becker, 1978



37122026 Nikolay's Lanternfish (Hulley & Duhamel, 2009)

Bolinichthys remarks

DNA studies of Denton (2014) and Martin *et al.* (2018) recovered this genus in a strongly supported clade with the Atlantic endemic genus *Lepidophanes*, and *Ceratoscopelus*. The studies included five and three species respectively in their phylogenetic studies. Each recovered their species in a monophyletic clade, with the former recovering two subclades with included species the same as the two groups in the key above divided by morphologic characters in couplet 1.

***B. longipes*.** Nafpaktitis and Nafpaktitis (1969) used two other characters in addition to the absence of a luminous 'scale' above the pectoral-fin base to distinguish this species from the other two species in the species group: the presence of only 0–1 luminous patches over the anal-fin base and the origin of the infracaudal organ behind the last AOp. Our unpublished data (PAH) show the latter character is unreliable because it is highly variable. The largest of 2,772 specimens studied by Hulley and Duhamel (2009) was 43 mm SL; size-frequency distributions suggested a one-year life cycle.

Centrobranchus Fowler, 1904

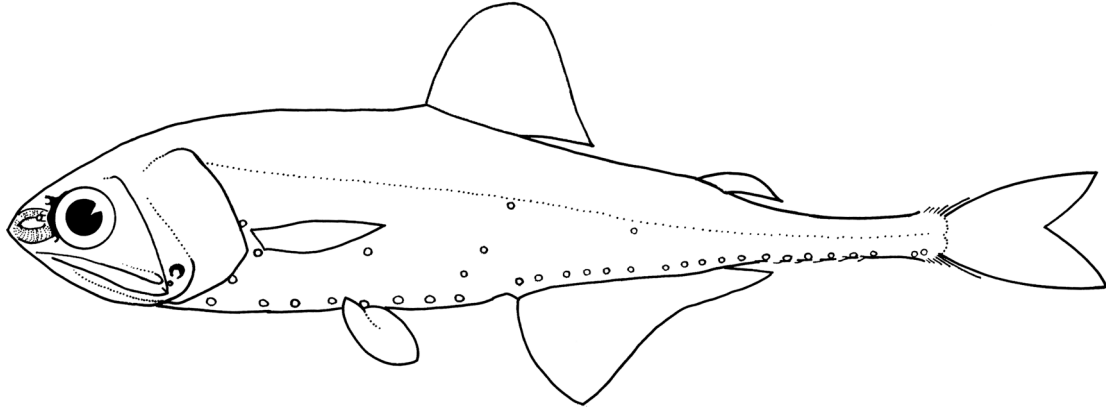
Centrobranchus is one of four slender-tailed lanternfish genera (Becker, 1964); the others in Australian waters are *Loweina* and *Gonichthys*. Among them, *Centrobranchus* is the only genus in which gill rakers are reduced to low spinous protuberances, teeth of the third pharyngobranchial are plates (Paxton, 1972), and subterminal mouth with enlarged snout.

Male *Centrobranchus* have an SCO of 4–8 well-defined, overlapping plates, and ICO absent; females with ICO of 3–7 non-overlapping patches, and SCO absent; body firm, usually scaled, body sides blue–silver, darkening dorsally (Sutton *et al.*, 2020).

The genus has a circumglobal tropical and subtropical distribution and two world species (see **remarks**), both occurring in Australian waters, see Nafpaktitis and Nafpaktitis (1969); Wisner (1976); Becker (1983), Hulley (1981, 1984, 1986a, 1990b); Rivaton and Bourret (1999); Hoese *et al.* (2006); Gago and Lavenberg (1992); Denton (2014); Roberts *et al.* (2015); Hulley and Paxton (2016), Martin *et al.* (2018); Mostarda *et al.* (2023). Non-Australian data in {} from Wisner (1976).

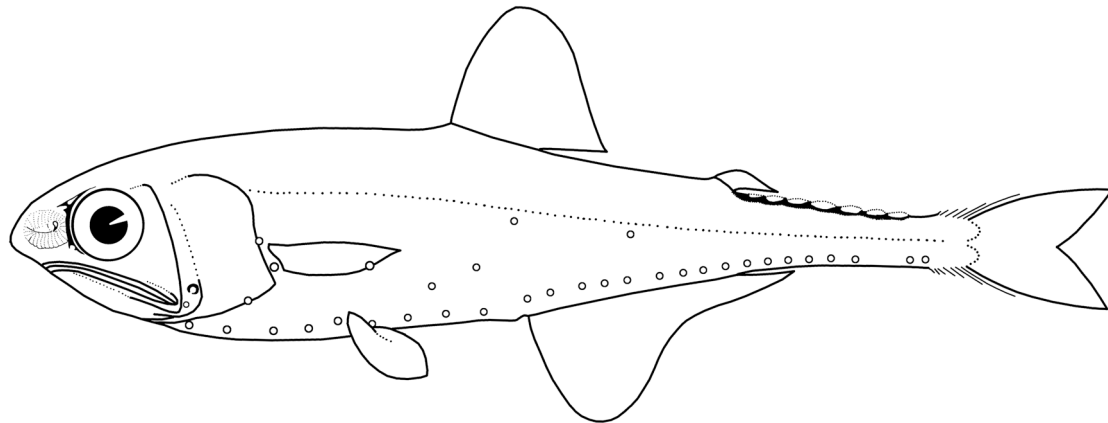
Key to the genus *Centrobranchus*

- 1 SAO₁ over VO₄ or slightly anterior or posterior; vomer with 2 lateral elongate, ovoid tooth patches in specimens > 50 mm SL, joining anteriorly in largest; [AO 7 (6, rarely 8) + 10 (11, rarely 9) total 17 (16–18) {6–7 (5–8) + 10 (9–11, rarely 7 or 12, total 17 (15–18, rarely 19))}; SCO 6–7 {5–8}, ICO 5 {4–7}; D 11 (12–13) {11 (10–12)}; A 19 (18) {18–19 (17–20)}; P 13 (11–12) {12–13 (11–14)}; max. size 65 mm SL]; n = 7; Qld *Centrobranchus andreae* (Lütken, 1892)



37122081 Andreae's Lanternfish (♀, after Nafpaktitis & Nafpaktitis, 1969)

- SAO₁ over VO₂₋₃ space; vomer with 2 lateral, round tooth patches in specimens > 35 mm SL, touching in largest; [AO 5–6 (rarely 4) + 9–11 (rarely 8), total 14–16 (rarely 17) {5 (4–7) + 9 (8–11), total 15 (13–17)}; SCO 6 (5–7) {5–7}; ICO 5 (rarely 4, 6) {3–6}; D 10 (11, rarely 9) {10 (9–11)}; A 17 (18, rarely 16) {18 (17–19)}; P 12–13 (rarely 14, 15) {15 (14–17)}; max. size 40 mm SL]; n = 20; Qld, LHI, NI, NSW, WA *Centrobranchus nigroocellatus* (Günther, 1873)



37122029 Roundnose Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

Centrobranchus remarks

The “slendertail” lanternfish genera (sensu Gonichthyini Paxton, 1972) were not recovered as a monophyletic group in the DNA analyses by Denton (2014). Similar results, based on nuclear, protein-coded, and morphological analyses were obtained by Martin *et al.* (2018).

Becker's (1964) revision recognised four valid species (*C. andreae*, *C. brevirostris*, *C. choerocephalus*, *C. nigroocellatus*). This was followed by most authors until the review of Gago and Lavenberg (1992), who recognised only the two species included here. A number of authors in the last decade have considered *Centrobranchus*

choerocephalus (Fowler, 1904) a valid species without mention of the problems described in Gago and Lavenberg (1992). Denton (2014) considered all four species valid, based on DNA analyses of one specimen each of the three questionable species. Further work is required.

The record of *C. choerocephalus* from Lord Howe Island, based on one juvenile specimen, inadvertently omitted from the first Zoological Catalogue of Australia, Pisces (Paxton *et al.*, 1989) and subsequent editions, is now considered to be *C. nigroocellatus*.

Ceratoscopelus Günther, 1864

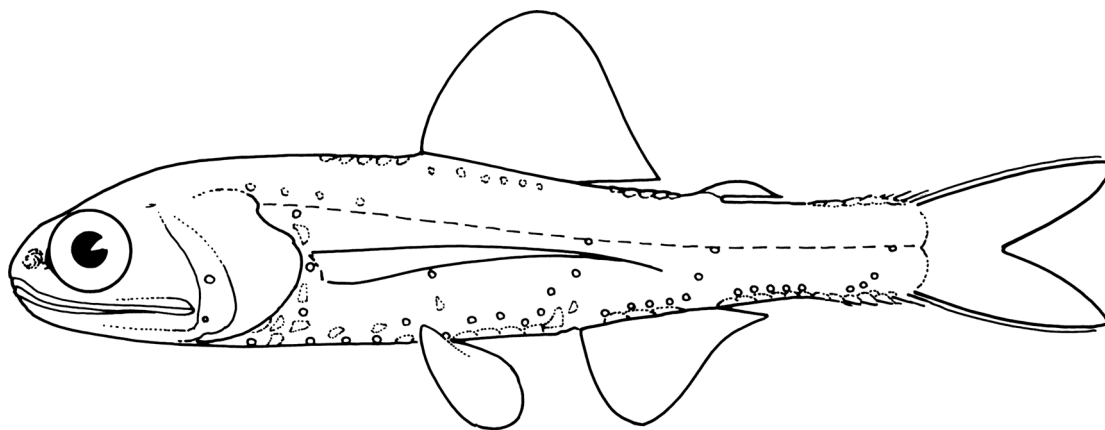
Ceratoscopelus species, uniquely, have mid-ventral luminous tissue between the pelvic-fin bases or between the pelvic-fin bases and anus, and over the entire anal-fin base. There are other luminous tissue patches on head and body, 4 Prc, and jaws extending far behind the eye.

The genus has a circumglobal distribution with three world species (see **remarks**), one recorded from Australia,

see Becker and Borodulina (1968); Nafpaktitis and Nafpaktitis (1969); Wisner (1976); Hulley (1981, 1984, 1986a, 1990b); Becker (1983); Badcock and Araújo (1988); Linkowski (1997); Hoese *et al.* (2006); Denton (2014); Roberts *et al.* (2015); Hulley and Paxton (2016); Sutton *et al.* (2020); Mostarda *et al.* (2023); and Koubbi *et al.* (2025). Non-Australian data in {} below from Atlantic (n= 1561) (Hulley, 1981).

Key to the genus *Ceratoscopelus*

A median series of luminous patches between inner pelvic-fin bases and anus; AO 6 (5–7, rarely 8) + 5 (4–6), total 11 (12, rarely 13) {7 (6–8, rarely 9) + 5 (4–6, rarely 7), total 12 (11–13, rarely 10 or 14)}; GR 4 + 11 (10, rarely 12), total 15 (14, rarely 16) {4 (rarely 3 or 5) + 10 (9–11, rarely 12), total 14 (13–15, rarely 16)}; D 14 (15) {14 (13–15)}; A 14 (13–15) {14 (13–15)}; P 14–15 (13) {13–14 (12–15)}; max. size 81 mm SL; n= 40; Qld, LHI, NI, NSW, Vic, SA, WA, ChI, CoI, NT *Ceratoscopelus warmingii* (Lütken, 1892)



37122021 Warming's Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

Ceratoscopelus remarks

The DNA studies of Denton (2014) and Martin *et al.* (2018) recovered this genus in a strongly supported clade with the Atlantic endemic genera *Lepidophanes* and *Bolinichthys*. Badcock and Araújo (1988) recommended *C. warmingii* be placed in the synonymy of the older northeast Pacific endemic *C. townsendi*, based on the variation in luminous patches and other features of the former throughout its worldwide range. More recent works have not followed this recommendation. Linkowski (1997) illustrated great variation in the otoliths of both species, as well as in the distribution and extent of luminous tissue other than photophores. He defined 26 different forms (Atlantic 5, Pacific 20, Indian Ocean one), including four sympatric forms in the Coral and Solomon Seas NE of Papua New Guinea plus an additional two, one off NSW and another off New Zealand. Unfortunately, the luminous tissue patches are easily damaged in trawls, and few individuals are complete. CO1 sequences indicate much variation (Pogonoski, pers. comm., 2026). The results of Denton (2014) supported unique geographic clades in Samoa and Hawaii. Further detailed genetic studies are needed.

C. warmingii. Oceanic, mesopelagic; recorded from tropical and subtropical Atlantic (42°N–45°S) with vagrants to 59°N in Gulf Stream; Indian (14°N–44°S west of 70°E) and off Western Australia; Pacific (35°N–38°S) and

in the Great Australian Bight (Hulley & Paxton, 2016). A single juvenile specimen reported from the Southern Ocean at 64.60°S, 108.87°W should be treated with reservation; also recorded from just outside boundary limits near Crozet and Kerguelen islands in Indian sector (41.05°S–43.98°S, 050.00°S–077.38°E).

Diaphus Eigenmann & Eigenmann, 1890

The genus is the largest in the family with more than 80 taxonomically valid extant species. Sub-groups of species and species complexes have been considered, e.g. based on arrangements of the Dn and Vn photophores (Nafpaktitis, 1978), but here we simply recognise two sub-genera: (1) *Diaphus* (*Diaphus*), restricted to species possessing an So photophore, short jaws, and a row of broad-based, strongly hooked teeth in the posterior portion of the premaxilla; and (2) *Diaphus* (*Aethoprora*), for all other species. Our rationale is detailed in **remarks** below.

Most species of *Diaphus* have distinctive light organs around the orbit (Ant, Dn, So, Suo, Vn); these are sexually dimorphic in some *Diaphus* species, where males usually have a larger Vn. Almost all *Diaphus* species have a luminous patch (termed 'scale' in previous works, due to its shape) near the PLO; no species of *Diaphus* has caudal luminous

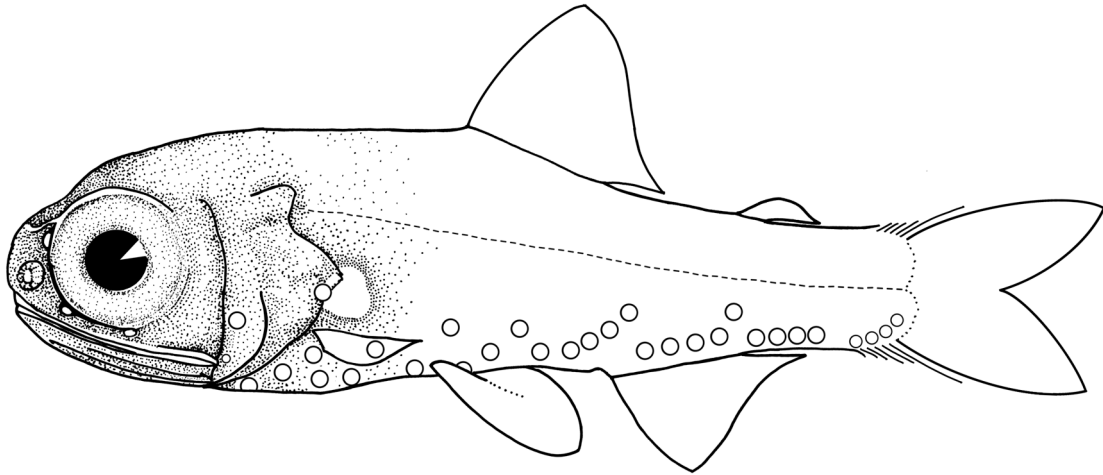
organs. As the orientation of the Dn is at times difficult to discern, particularly in damaged specimens, other features are utilised in the key.

The genus is circumglobal in distribution; 39 species are recorded from Australian waters, and one further species (included in key) which is likely to occur here based on records from adjacent waters (within a few 100 n.m. of EZ); see; Nafpaktitis (1968, 1973, 1974, 1978); Nafpaktitis *et al.*

(1977, 1995); Kawaguchi and Shimizu (1978); Hulley (1981, 1984, 1986a, 1990a, 1990b); Becker (1983); Bourret (1985); Hoese *et al.* (2006); Hulley and Paxton (2016); Sutton *et al.* (2020); and Roberts *et al.* (2015). Data from non-Australian specimens in {} are from several of the above sources, but predominantly Kawaguchi and Shimizu (1978), Nafpaktitis (1978), and Roberts *et al.* (2015).

Key to the genus *Diaphus*

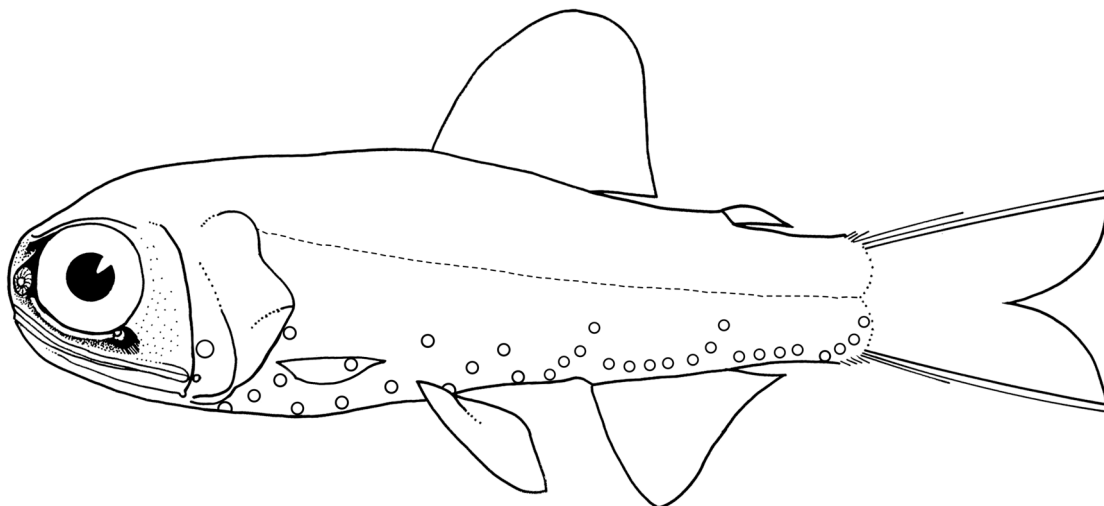
- 1 Vn and So present; jaws short, extending 1/2 eye diameter or less behind eye; posterior upper jaw with inner row of broad-based, strongly hooked teeth; vomer toothless or with few, scattered, tiny teeth; [Ant absent] ... ***Diaphus (Diaphus)*** 2
- So absent, Vn present (absent in juvenile *D. drachmanni*); jaws usually extending 3/4 eye diameter or more behind eye; no broad-based, strongly hooked teeth in posterior upper jaw; vomer with small, bilateral patches of teeth; [Ant present or absent] ... ***Diaphus (Aethoprora)*** 11
- 2 Vn small and round, equal in size to and far forward of So, both smaller than photophores; body photophores very large; [PLO luminous patch very large, anteroventrally striated, extending far above PLO; AO 5 + 4–5, total 9–10 {4–5 + 4–5}; GR 5–6 (4) + 12–13, total 17 (19) {4–5 + 11–12, total 15–17}; D 12–13 (14) {12–13}; A 12–13 {11–13}; P 10–11 {10–11}; max. size 40 mm SL]; n = 7; Qld, LHI, NI, NSW, WA ***Diaphus (D.) anderseni* Tåning, 1932**



37122030 Andersen's Lanternfish (Nafpaktitis, 1973)

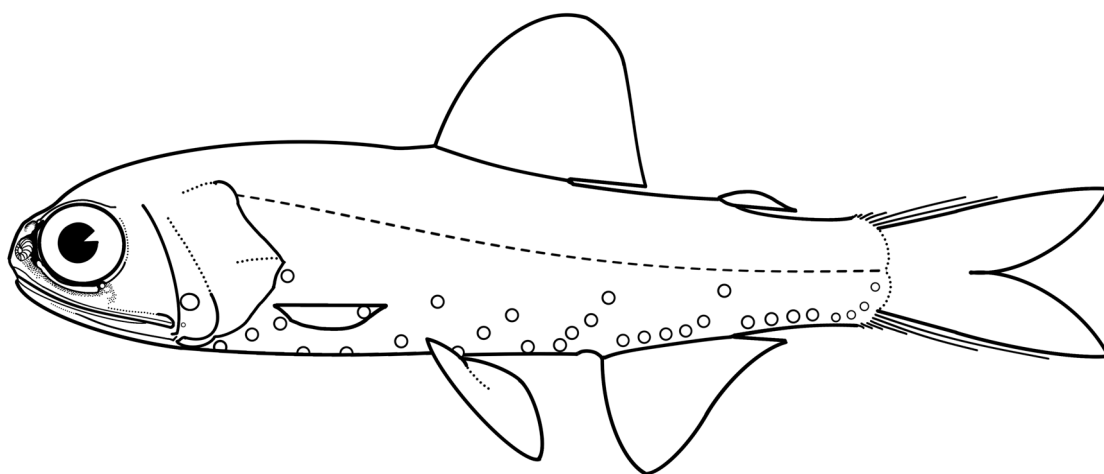
- Vn elongate, larger than So 3
- 3 Vn very elongate, contiguous with So behind posterior margin of pupil (sometimes obscure); no luminous patch at PLO 4
- Vn separate from So before posterior margin of pupil; PLO luminous patch present 5

- 4 Body markedly truncate, photophores large, snout broadly rounded, eye large, with body depth 1.6–1.8 in predorsal length, head depth 1.5–1.9 in predorsal length; caudal peduncle depth 3.3–3.8 in predorsal length; eye diameter 3.5–4.1 in predorsal length; postorbital length of upper jaw 3.0–4.6 in eye diameter; distance Op_2 –PLO 1.3–1.7 in eye diameter; [AO 5 (4–6) + 4 (5), total 9 (10) {5–6 + 4 (rarely 5)}; GR 5 (6) + 12 (13), total 17 (18, 20) {5 (rarely 6) + 12–13, total 17–19}; D 12–13 {12–13}; A 13 (14) {12–13}; P 11–12 {11–12}; max. size 60 mm SL]; n = 10; Qld, LHI, NI, NSW, WA, ColI *Diaphus (D.) brachycephalus* Tåning, 1928



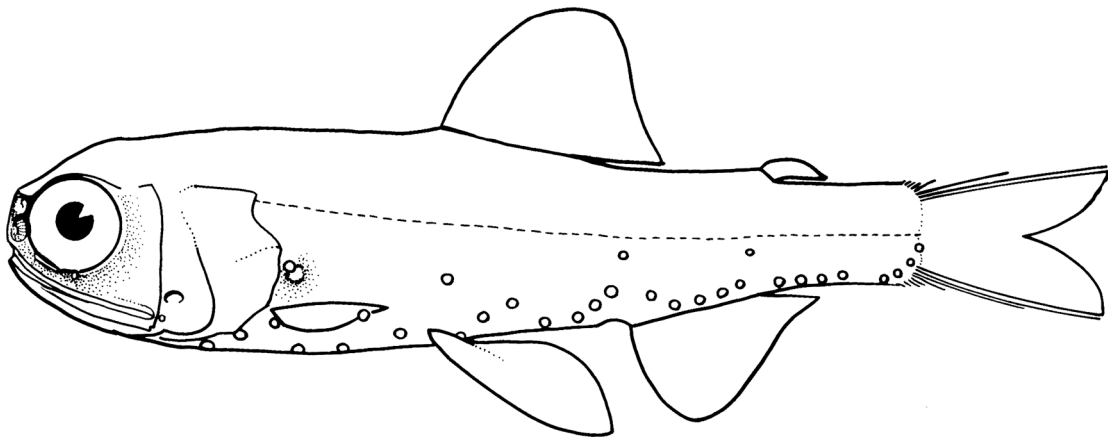
37122032 Shorthead Lanternfish (Nafpaktitis, 1973)

- Body truncate, snout somewhat pointed, eye normal, with body depth 1.9–2.3 in predorsal length, head depth 2.0–2.4 in predorsal length, caudal peduncle depth 3.9–4.4 in predorsal length eye diameter 4.2–5.3 in predorsal length; postorbital length of upper jaw 2.0–2.6 in eye diameter; distance Op_2 –PLO 0.9–1.3 in eye diameter; [AO 5 + 4, total 9 {5 (4–6) + 3–4 (2), total 8–9}; GR -- {6–7 + 14–15 (13), total 20–22 (19)}; D 12–13 {13 (12–14)}; A 12–13 (12–14); P 12 {11 (10–12)}; max. size 60 mm SL]; {n = 2}; Qld *Diaphus (D.) richardsoni* Tåning, 1932



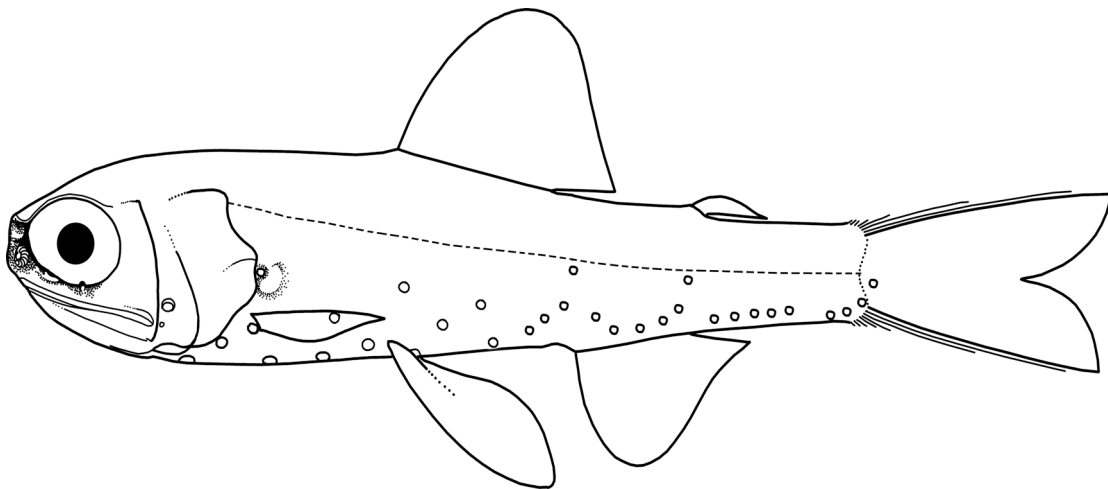
37122122 Richardson's Lanternfish (Hulley, 1986a)

- 5 AOA₁ raised above level of AOA₂ and AOA₃ (rare aberrant forms exist) 6
- AOA₁ level with AOA₂ and AOA₃ (rare aberrant forms exist) 9
- 6 Operculum with horizontal dorsal margin and pronounced, slender posterodorsal lobe; Vn–So interspace 2–3 times So diameter, shorter than Vn in females; PLO luminous patch small, mottled; GR on lower limb of 1st arch broad, leaf-like; [AO 5 (4–6) + 4 (3–5), total 9 (8–10) {5 (rarely 4) + 4 (rarely 3)}; GR 5 (6) + 13 (14), total 18 (19) {5 + 12–13 (rarely 14), total 17–19}; D 13 (14) {13–14}; A 13 (14) {13}; P 10–11 (12) {9–11}; max. size 70 mm SL]; n = 20; Qld, LHI, NI, NSW, Vic, Tas, WA *Diaphus (D.) mollis* Tåning, 1928



37122038 Soft Lanternfish (Nafpaktitis, 1978)

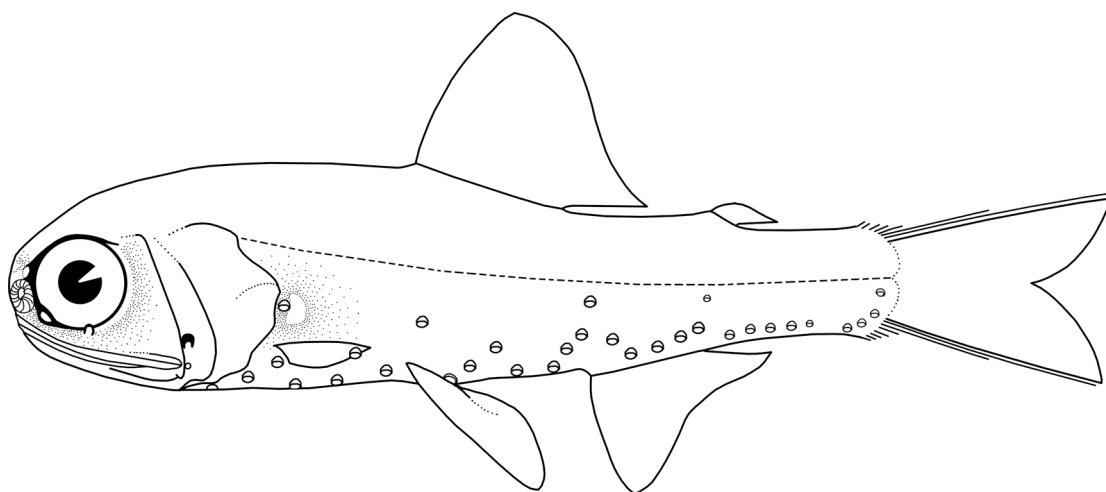
- Operculum with sloped dorsal margin, rounded or angled posterodorsally, without slender lobe; Vn–So interspace 4–5 times So diameter, longer than Vn in females; GR on lower limb of 1st arch slender, not leaf-like 7
- 7 SAO₃ and Pol one photophore-diameter or less below lateral line; body photophores small and widely spaced, from at least 1.5 (AOa and AOp series) to at least 2.5 (VO series) photophore-diameters apart; [AO 5 (4–6) + 5 (4–6), total 10 (9–11); GR 5–6 + 12–14, total 17–20; D 14 (13); A 13 (12); P 10 (9); max. size 45 mm SL]; n = 0; Qld *Diaphus (D.) fulgens* (Brauer, 1904)



37122119 Lightning Lanternfish (Nafpaktitis, 1978)

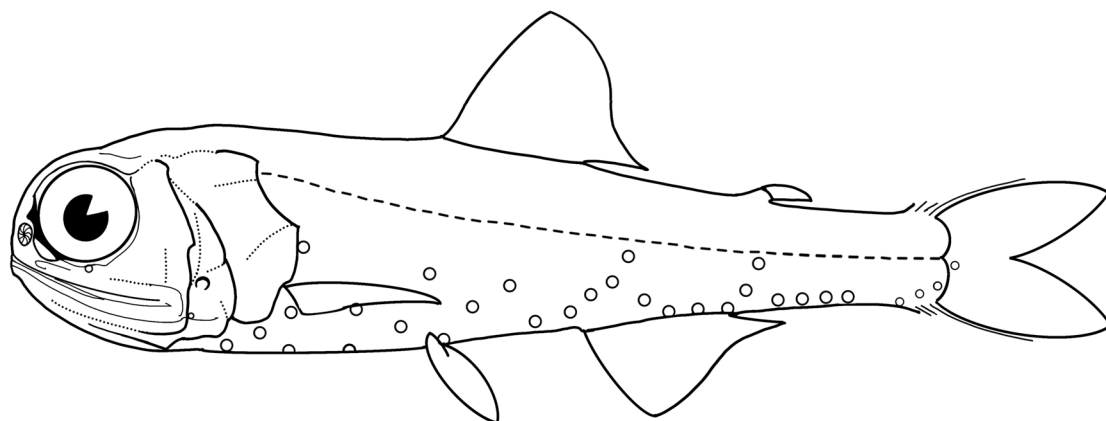
— SAO₃ and Pol more than one photophore-diameter below lateral line; body photophores moderate and not widely spaced, from about 1 (AOa and AOp series) to 2 (VO series) photophore-diameters apart or less 8

- 8 GR 5 (rarely 4–6) + 12–13, total 17–18 (rarely 19); sexually mature ca. 27 mm SL; Vn of mature males filling most of space between eye, nasal rosette, and anterior upper jaw; SAO distinctly angular; PLO luminous patch small, striations indistinct [AO 5 + 4–5, total 9–10 {5 (4) + 4 (5), total 9 (8–10)}; D 14 {13–14}; A 12–13 {13 (12)}; P 11 {10 (11)}; max. size 40 mm SL; n = 2; WA *Diaphus (D.) impostor*
Nafpaktitis, Robertson & Paxton, 1995



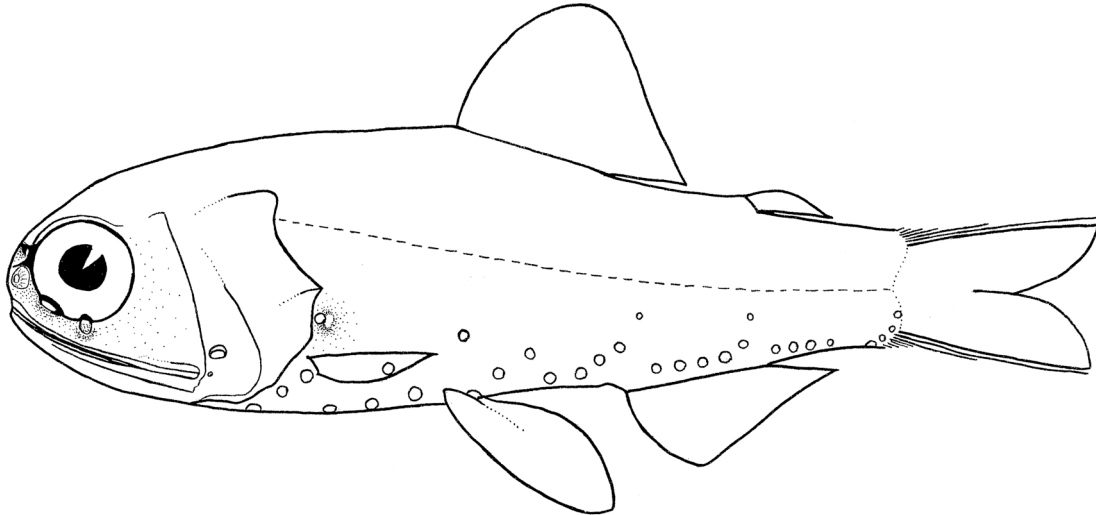
37122082 Impostor Lanternfish (Nafpaktitis *et al.*, 1995)

- GR 6 (5) + 13–14, total 19–20 (rarely 18); sexually mature ca. 45–48 mm SL; Vn of mature males variable, but never filling space between eye, nasal rosette, and anterior upper jaw; SAO gently curved; PLO luminous patch 1.5–3 times photophore-diameter, postero-ventrally striated [AO 5–6 + 4–5, total 9–11 {5–6 + 4, total 9–10}; GR 6 (5) + 13–14, total 19–20 (rarely 18) {6–7 + 13–14, total 19–20}; D 14–15 {14}; A 11–13 {12–13}; P 11 (10) {10}; max. size = ca. 68 mm SL; n = 5; Qld, Tas *Diaphus (D.) aliciae* Fowler, 1934



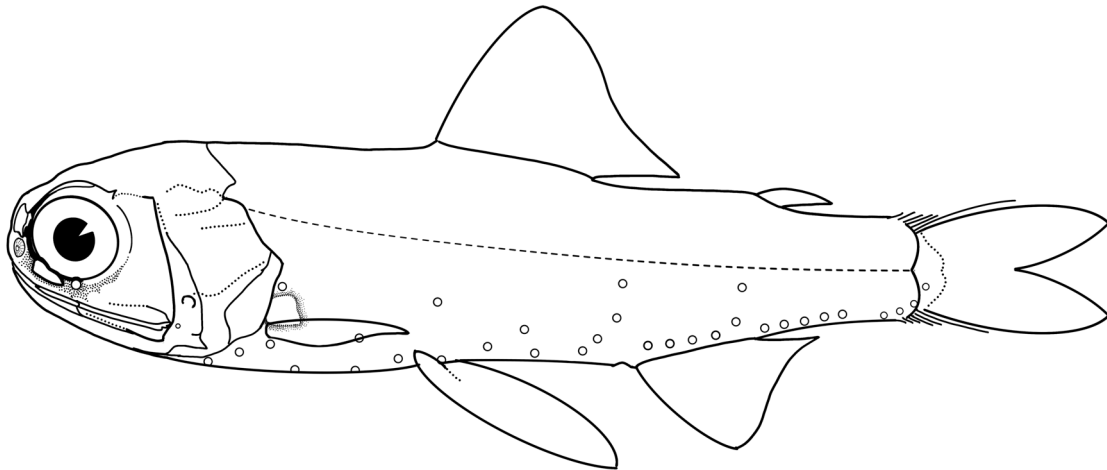
37122118 Alice's Lanternfish (Hulley, 1986a)

- 9 Posterodorsal operculum distinctly lobate; body deep, depth 3.0–3.7 in SL; Vn–So interspace 1.5–3.0 times So diameter; Vn of females and immature males equal to or shorter than Vn–So interspace; [PLO luminous patch small, 1 or less times PLO diameter (variable with size, and in specimens from other areas), horizontally striated; GR 5–6 + 13–14 (12), total 18–20 (17) {6 (5) + 13–14 (12–15), total 19–20 (17–21)}; AO 5 + 4, total 9 {4–6 + 3–5, total 8–10}; D 13 {13–14}; A 13 {13 (11–14)}; P 10–11 {10–11}; max size 65 mm SL]; n = 10; Qld, LHI, NI, NSW, Vic, WA, CoI .. *Diaphus (D.) parri* Tåning, 1932



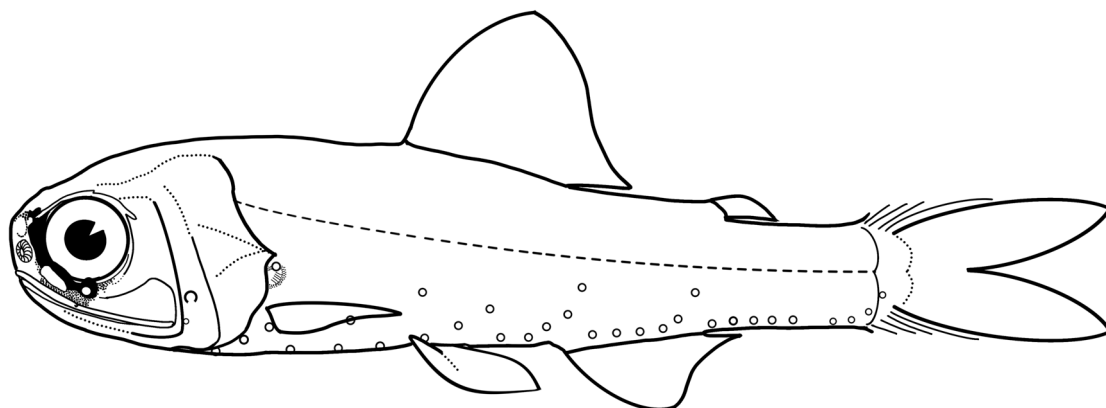
37122039 Parr's Lanternfish (Nafpaktitis, 1978)

- Posterodorsal operculum not distinctly lobate; body depth moderate, depth 4.0–4.5 in SL; Vn–So interspace 0.5–1.5 times So diameter; Vn longer than Vn–So interspace 10
- 10 GR 6–7 + 15–16, total 22–23 {7 (6–8) + 16 (14–17), total 23 (20–25)}; PLO luminous patch moderate to large, mottled; pelvic fin reaching slightly beyond anal-fin origin; fresh colour metallic green; [AO 5 (6) + 5, total 10 (11) {5–6 (rarely 4, 7) + 5–6 (4), total 10–11, rarely 9, 12)}; D 13–14 {14 (rarely 13, 15)}; A 13 (12) {13 (14)}; P 10–11 {11 (rarely 10, 12)}; max. size 84 mm SL]; n = 5; NSW, Vic, Tas, MqI, SA, WA *Diaphus (D.) hudsoni* Zurbrigg & Scott, 1976



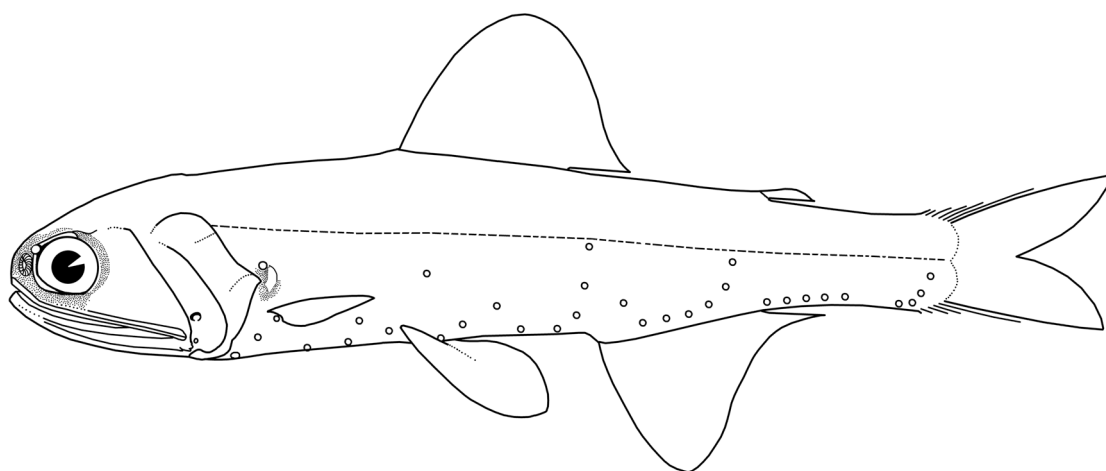
37122061 Hudson's Lanternfish (LM)

- GR 5 + 12–13 (11), total 17–18 (16) {5 (4) + 12–13 (11), total 17–18 (16, 15 in juveniles less than 20 mm SL)}; PLO luminous patch small, posteroventrally striated; pelvic fin not quite reaching anal-fin origin; fresh colour metallic blue; [AO 5 + 5 (4), total 10 (9) {5 (4–6) + 5 (4–6), total 10 (11)}; D 14 (13) {14 (13)}; A 12–13 (14) {12–13}; P 11–12 (10) {11 (12)}; max. size 54 mm SL]; n = 5; LHI, NI, NSW, Vic, Tas, WA *Diaphus (D.) meadi* Nafpaktitis, 1978



37122036 Mead's Lanternfish (Nafpaktitis, 1978)

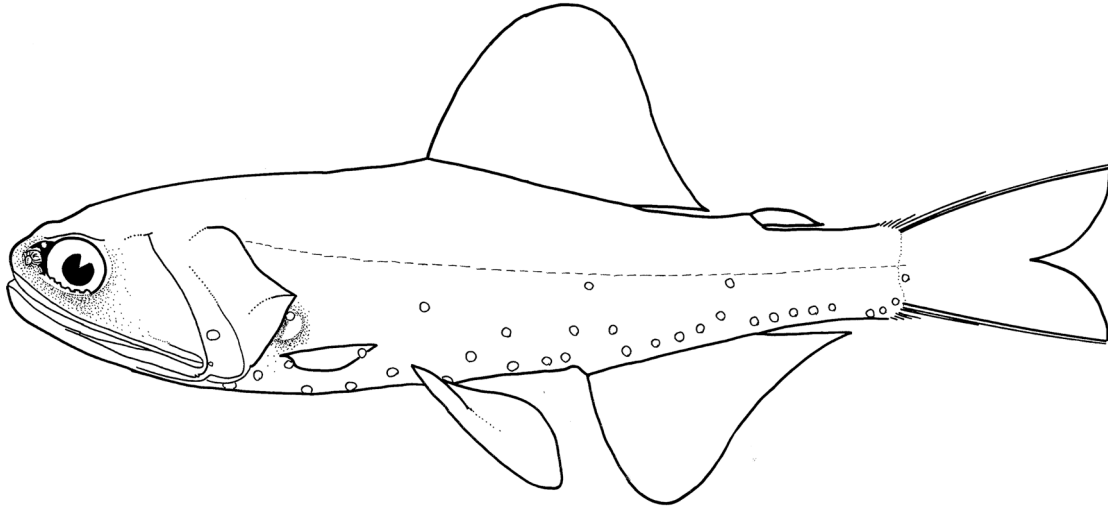
- 11 Vn elongate or Vn posteriorly located, with posterior margin under mid-orbit or beyond in adults (at least to anterior margin of pupil in juveniles) 12
- Vn short to moderate, not extending posteriorly under eye to mid-orbit 19
- 12 Suo present, length about 2/3 eye diameter, extending over orbit beyond level of posterior margin of pupil (to centre of eye in smaller specimens); [Vn similar to Suo in size, shape, and position along ventral margin of orbit, offset slightly anteriorly; Dn much smaller than nasal rosette, anterolateral and shallow; no Ant; PLO luminous patch moderate to large, somewhat elongated vertically; GR 5 (4) + 11 (12), total 16 {4–5 + 11, total 15–16}; AO 6 + 5, total 11 {6 + 5 (6), total 11 (12)}; D 15 (16) {14–15}; A 14–15 {14–15}; P 12–13 {12 (10)}; max. size 207 mm SL; n = 4; Qld, NI *Diaphus (A.) adenomus* Gilbert, 1905



37122112 Firebrow Lanternfish (Nafpaktitis et al., 1977)

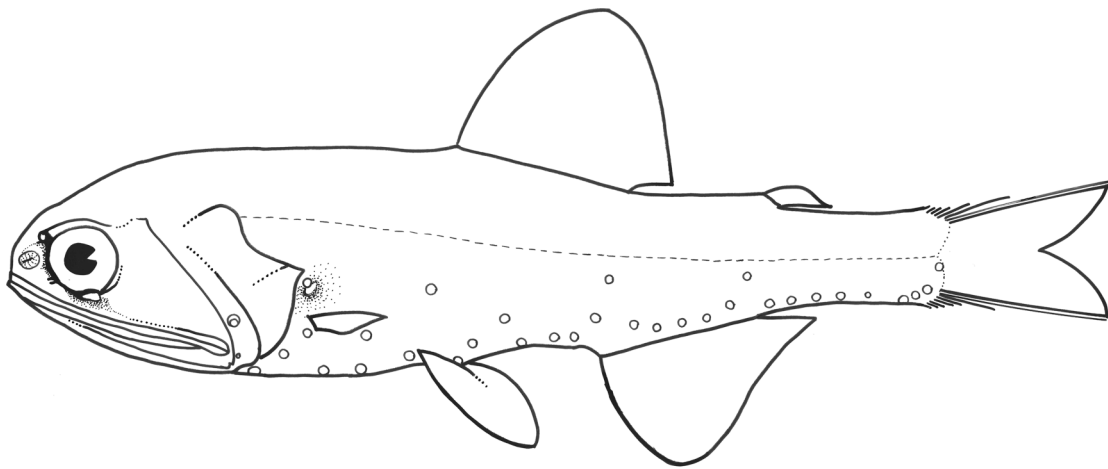
- Suo absent 13

- 13** Vn elongate with 3–5 small, dorsal projections into orbit; SAO_1 at level of, or slightly higher than, VO_5 ; [$AO\ 6 + 5$, total 11 {6 (5–7) + 4–5 (6), total 10–12}; $GR\ 6 + 14–15$, total 20–21 {6–7 + 14–16, total 20–22}; $D\ 16–17$ {16–17}; $A\ 15$ (16) {15}; $P11$ (12) {12}; max. size 60 mm SL]; $n = 10$; Qld, LHI, NI, NSW, Vic, WA, Col *Diaphus (A.) luetkeni* (Brauer, 1904)



37122035 Lütken's Lanternfish (Nafpaktitis, 1978)

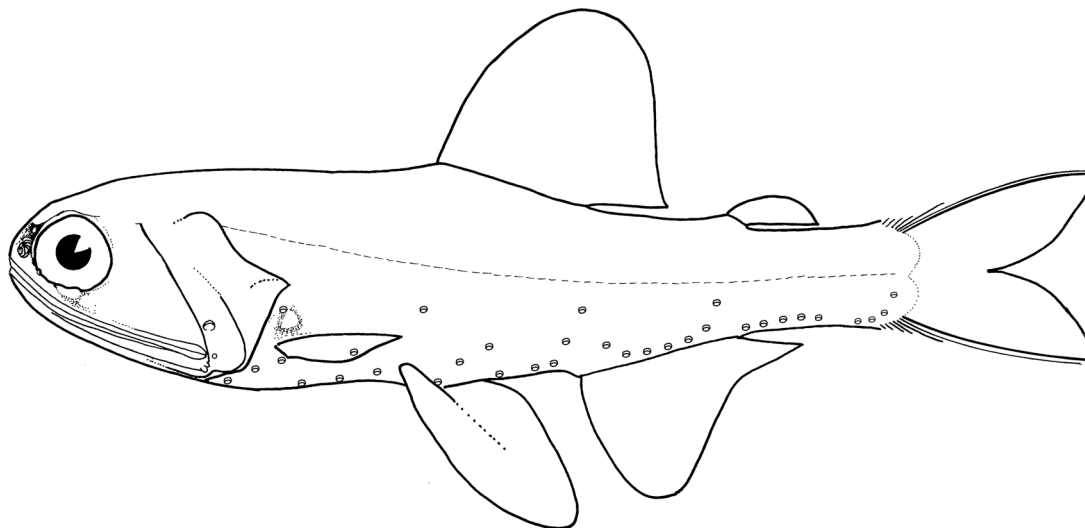
- Vn without dorsal projections into orbit **14**
- 14** Vn isolated under posterior half of eye; tiny luminous organs in black pigment between Vn and nasal organ **15**
- Vn extending from nasal organ to under posterior half of eye; no tiny luminous organs between Vn and nasal organ **17**
- 15** $GR\ 5 + 11–13$, total 16–18 {5 (4–6) + 11–12, total 16–17 (15–18)}; $AO\ 5 + 4–6$, total 9–11 {5 (4) + 4–5, total 9–10}; pelvic fin not reaching anal-fin origin; [Vn sexually dimorphic, very much larger in mature males than in females; PLO luminous patch minute; $D\ 14–15$ {14 (13)}; $A\ 14–15$ {14 (13–15)}; $P\ 11$ (10) {10–11 (12)}; max size 42 mm SL]; $n = 7$; Qld, NSW, WA, Col *Diaphus (A.) diadematus* Tåning, 1932



37122072 Crown Lanternfish (Nafpaktitis, 1978)

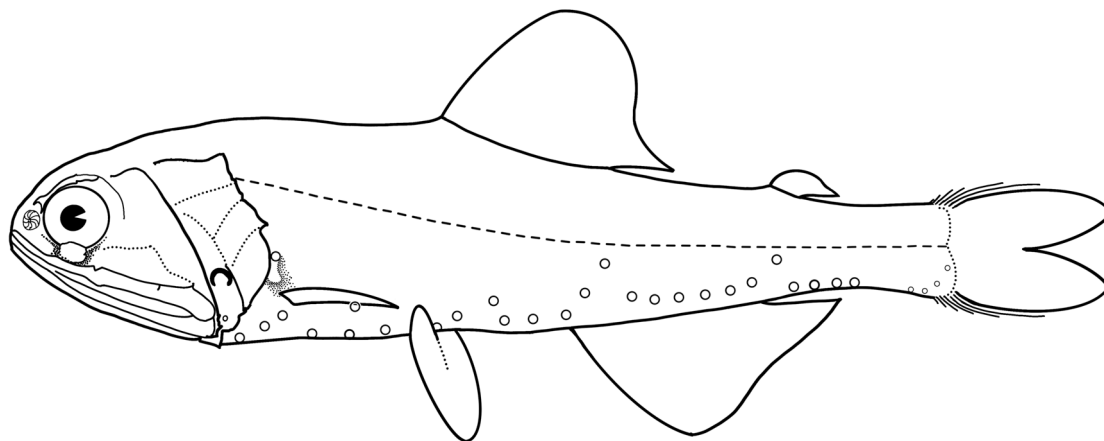
- $GR\ 6–9 + 13–16$ (12–17), $T\ 19–25$; $AOa\ 6$ (5–7); pelvic fin reaching base of anal-fin ray 2–5; max. size 50–80 mm SL ... **16**

- 16 GR 8–9 (7) + 15–16, total 24–25 (23–26) {7–9 + 14–17 (rarely 18), total 21–26}); AO 6 (5) + 5 (4–6), total 11 (10–12) {5–6 + 4–5}; pelvic fin just reaching anal-fin origin or to ray 4–5; D 13–14 {14–15 (rarely 13)}; A 15 {15 (rarely 14)}; P 12 {10–12}; max. size 80 mm SL, but largest benthopelagic 117 mm SL (see **remarks**); n = 13; Qld, LHI, NI, NSW, Vic, Tas, WA, Col *Diaphus (A.) termophilus* Tåning, 1928



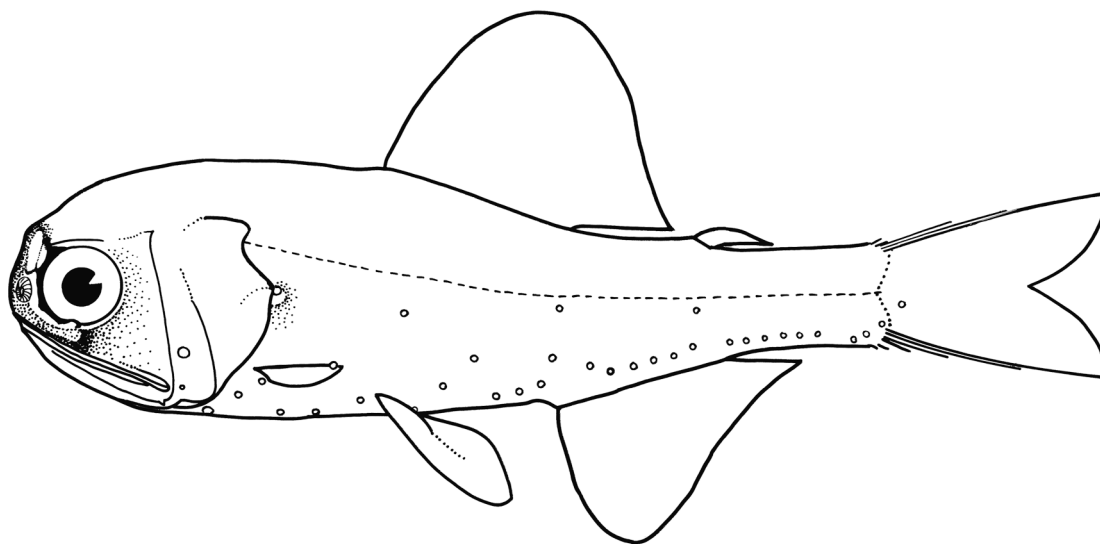
37122041 Warmwater Lanternfish (Nafpaktitis, 1973)

- GR {6–7 + 12–14, total 18–21; AO 6 (5) + 4 (3–5), total 10 (9–11)}; pelvic fin reaching base of anal-fin ray 2; max size 50 mm SL}; [{D 14 (15); A 15 (14–16); P 12 (11)}; max. size 49 mm SL]; n = 0 (see **remarks**); LHI *Diaphus (A.) diademophilus* Nafpaktitis, 1978



37122076 Coronet Lanternfish (Nafpaktitis, 1978)

- 17 Vn ending posteriorly in rounded knob, very rarely in slightly separated piece resembling So; head almost as deep as long, depth less than 4 in SL; PLO luminous patch small; last AOa photophore level with rest of series [Dn very large, reaching ethmoid crest on snout midline and extending above supraorbital ridge; Ant roughly triangular, in contact with Dn; photophores small; AO 6 + 6 (rarely 5), total 12 (rarely 11) {6 (5–7) + 6 (5–7), total 11–13}; Prc 3 + 1 in straight line; operculum with prominent posterodorsal lobe, weakly serrate in specimens over 50 mm SL; GR 8–9 (rarely 10) + 16–17 (rarely 15), total (23) 24–26 {7–9 + 14–16, total 21–25}; D 14–15 {15–16}; A 14–15 (16) {15 (14–16)}; P 11 {10–11}; max. size 89 mm SL]; n = 10, Qld, LHI, NI, NSW, Vic, Tas *Diaphus (A.) metopoclampus* (Cocco, 1829)

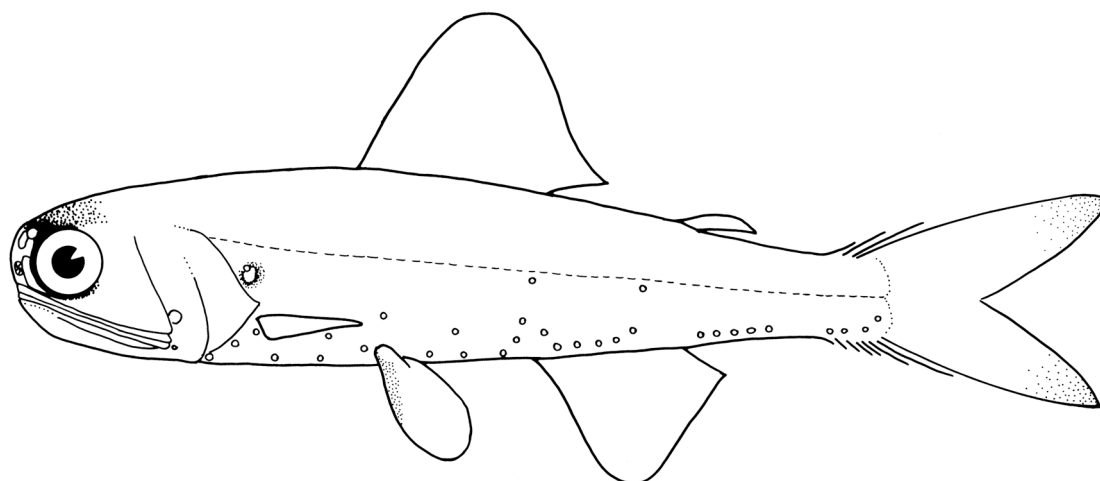


37122037 Bluntnose Lanternfish (Nafpaktitis, 1978)

— Vn not ending in rounded knob; head moderate, depth more than 4 in SL; PLO luminous patch large; last AOa photophore elevated above rest of series 18

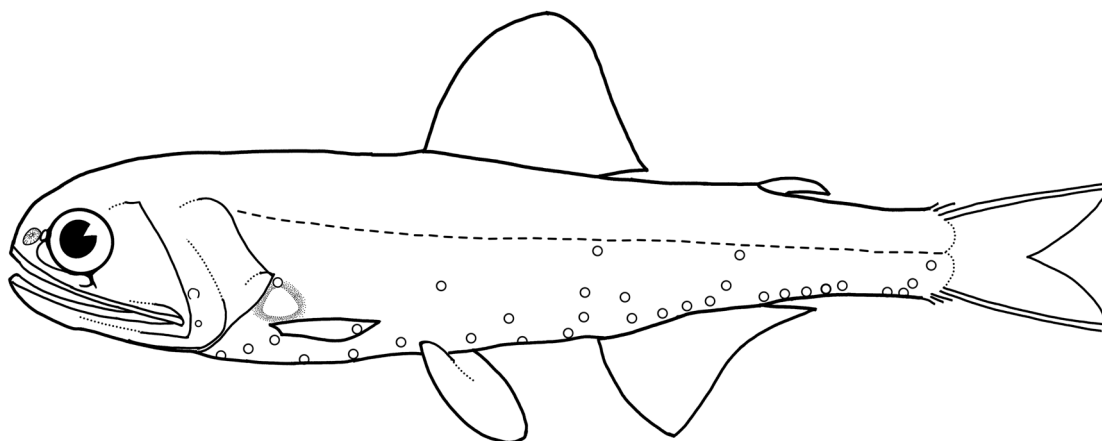
- 18** Ant present; PLO luminous patch small, not triangular; PLO usually closer to lateral line than upper pectoral-fin base; SAO_3 on or less than one photophore-diameter posterior to SAO_1 – SAO_2 line; Dn directed anteriorly, equal to or larger than nasal rosette; caudal-fin tips dark; usually dark pigment on pelvic fin, on basal half of outer rays and basal one tenth of inner rays; GR 8-9 + (16) 17, total 24–26 {7 + 15, total 22}; [in largest specimens, inner row of lower jaw teeth enlarged and widely spaced; AO 6 + 5 (6), total 11 (12) {6 (7) + 5 (4–6), total 11 (12)}; D 16–17 {16–17}; A 15–16 {16 (15–17)}; P 11–12 {12 (11)}; max. size 120 mm SL]; n = 10; Qld, WA ...

Diaphus (A.) chrysorhynchus
(Gilbert & Cramer, 1897)



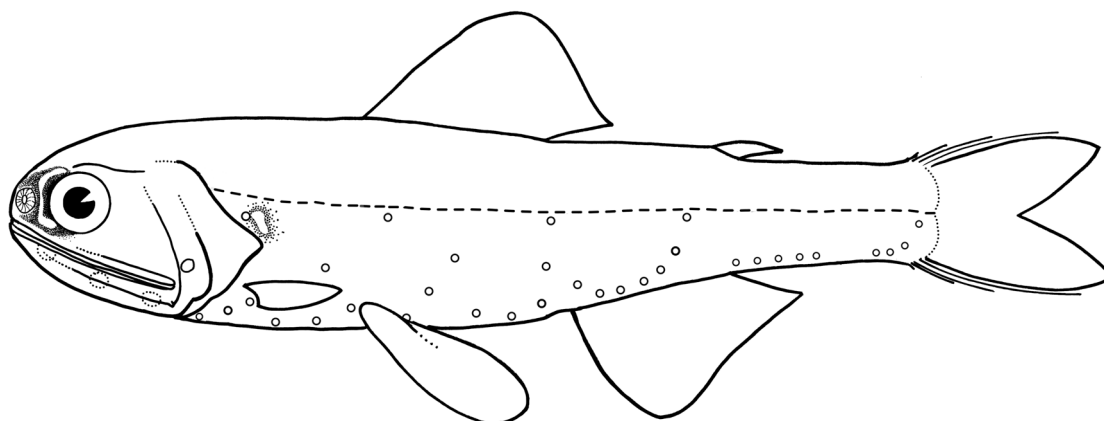
37122083 Goldnose Lanternfish (Gilbert & Cramer, 1897)

- Ant absent; PLO luminous patch very large, triangular, mottled; PLO usually closer to upper pectoral-fin base than lateral line; SAO_3 more than one photophore-diameter posterior to SAO_1 – SAO_2 line; Dn directed anterolaterally, smaller than nasal rosette; no dark pigment on caudal-fin tips or pelvic fins; GR 9–10 (8) + 19 (17–20), total 27–28 (26–29) {9 + 18–20}, total 27–29}); [AO 6 (7) + 5 (6), total 11 (12) {5 + 4–5 (rarely 6)}]; D 15 (14–16) {15 (rarely 14)}; A 15 (16) {15 (rarely 14)}; P 12 (11–13) {11–12}; max. size 126 mm SL]; n = 20; Qld, LHI, NSW, Vic, Tas, SA, WA *Diaphus (A.) danae* Tåning, 1932



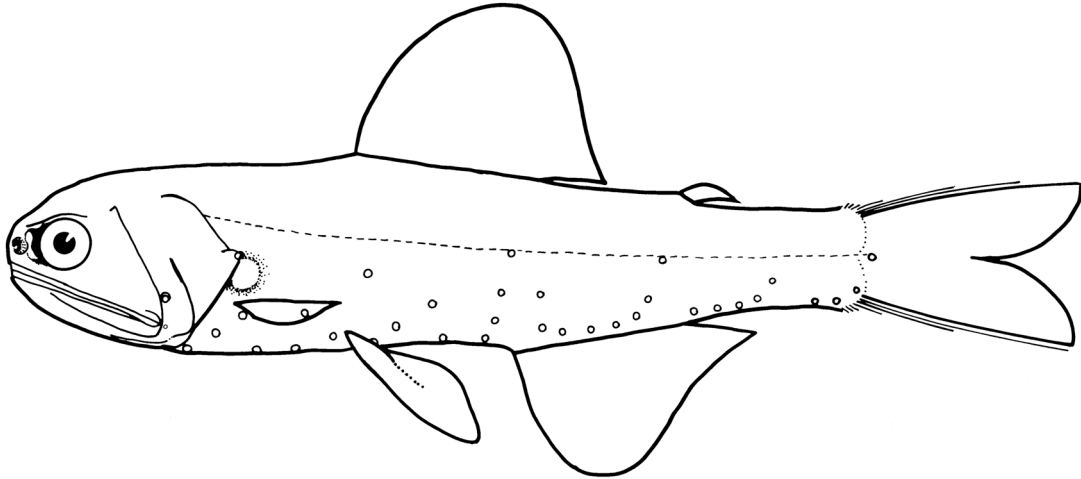
37122001 Dana Lanternfish (LM)

- 19 VLO at lateral line; PO_4 highly elevated above level of upper edge of P; VO_3 slightly below level of posterior point of operculum; [Ant present as dorsoposterior extension of Dn, almost reaching level of anterior margin of pupil; Dn slightly recessed, obscured in lateral view by Ant, larger than nasal rosette, not reaching midline of snout; Vn widest under nasal rosette, with narrow strip extending to Dn dorsally, orbital margin bordered by heavy black pigment; PLO about 3 diameters below lateral line, with narrow luminous patch behind and below; SAO_3 and Pol at lateral line; Prc 3 + 1; AO 6 + 5, total 11 {6 + 5–6, total 11–12}; GR 5 + 12–13, total 17–18 {6 + 14, total 20}; D 14–15; A 15–16; P 12–13 {13}; vert. 35; max. size 113 mm SL]; n = 5; WA *Diaphus (A.) lucifrons* Fowler, 1934



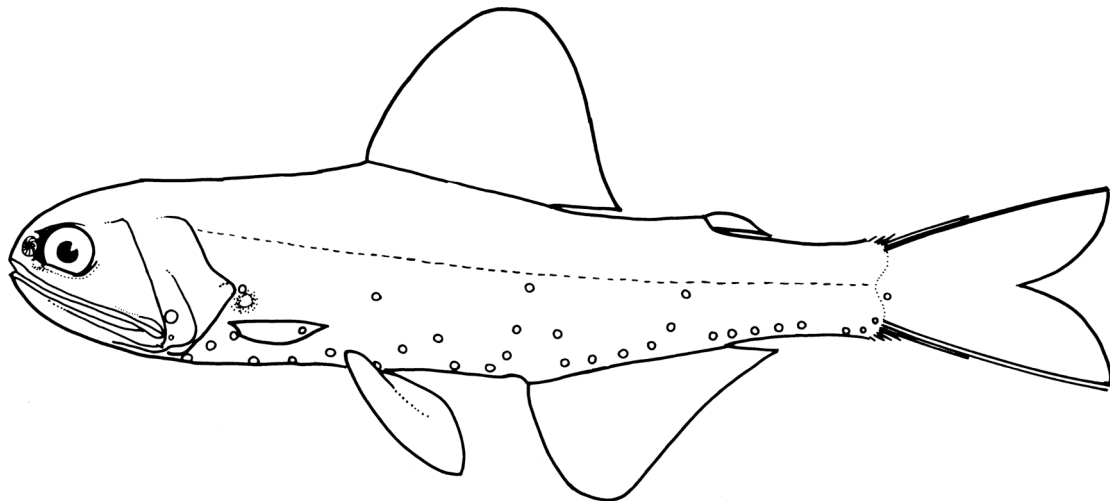
37122120 Frontlight Lanternfish (Fowler, 1934)

- VLO at least 3 photophore-diameters below lateral line; PO₄ below level of upper edge of P, rarely at same level; VO₃ distinctly below level of posterior point of operculum20
- 20 Posterior 1-3 AOp elevated; [Dn anterolateral, tapering medially above nasal rosette; Vn reaching and apparently fused with Dn, not reaching midline of snout; Ant absent; PLO luminous patch large; Pol, SAO₃, and Prc₄ in contact with lateral line; Prc widely spaced, especially Prc₄; AO 6-7 + 5-6, total 12 {6-7 + 5-6 (7), total 11-13}; GR 6-7 (8) + 13-14 (15), total 19-21 {6-7 (8) + 13-14 (15), total 19-21}; D 16 (15) {16 (15)}; A 17 (16) {17 (16)}; P 10-11 {10-11}; max. size 65 mm SL]; n = 7; Qld, WA, NT*Diaphus (A.) regani* Tåning, 1932



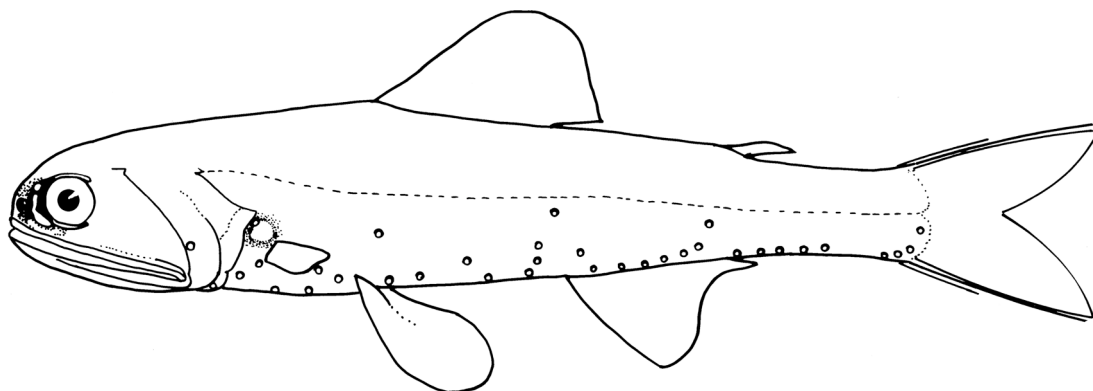
37122090 Regan's Lanternfish (Nafpaktitis, 1978)

- Posterior AOp level ... 21
- 21 GR total 13-16; (Prc₃₋₄ interspace larger than others) ... 22
- GR total 17-29 23
- 22 Ant absent; Dn directed anterolaterally, smaller than body photophore; Vn with posteroventral margin anterior to level of anterior border of pupil; PLO luminous patch small; SAO₁₋₂ line passing through or slightly posterior to SAO₃; AOp₁ over anal-fin base; anal-fin origin slightly before end of dorsal-fin base; [AO 6 + 5, total 11 {6 (7) + 5 (4-6), total 11 (10-13)}; GR 4 + 9-10, total 13-14 {4 + 10 (9-11), 14 (13-15)}; D 16 {16 (15-17)}; A 17-18 {17 (16-18)}; P 11 (10, 12) {11-12}; max. size 108 mm SL]; n = 11; Qld, WA *Diaphus (A.) problematicus* Parr, 1928



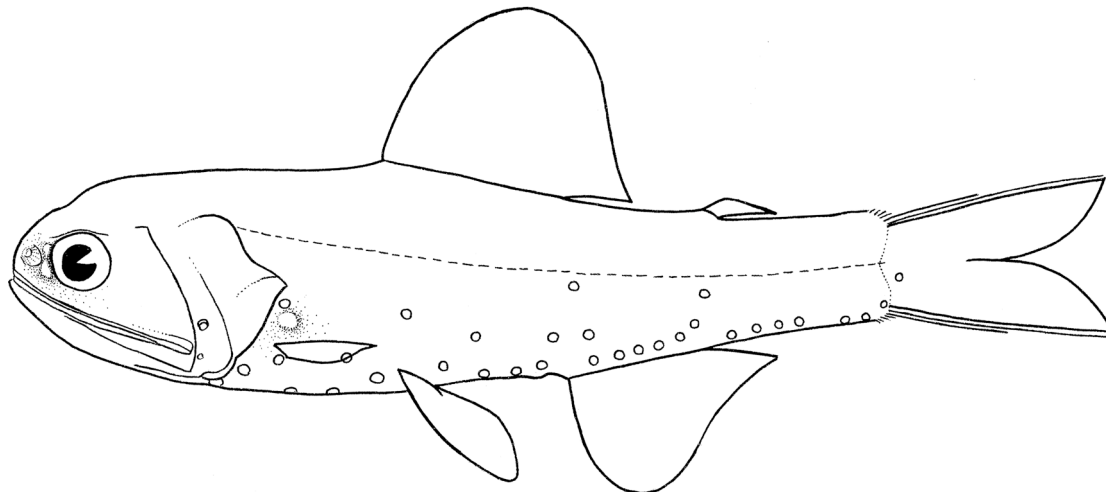
37122089 Problematic Lanternfish (Nafpaktitis, 1978)

- Ant present, round in males, more triangular in females; Dn recessed, directed anteriorly, not reaching midline, equal in size or larger than body photophores, smaller than nasal rosette, obscured in lateral view by Ant and Vn; Vn reaching Dn dorsally, with posteroventral margin almost at level of anterior border of pupil, teardrop-shaped and not reaching as far posteriorly in specimens less than 90 mm SL; PLO luminous patch large, triangular, almost reaching upper margin of pectoral-fin in large specimens; photophores small; SAO_{1-2} line clearly anterior to SAO_3 ; all AOp behind anal-fin base; anal-fin origin behind end of dorsal-fin base; [AO 6–7 + 5 (6), total 11–12 (13); GR 4–5 + 10–11, total 14–15 (16); D 14–15 (13, 16); A 16 (15, 17); P 11–13]; max. size 172 mm SL]; n = 6; Qld .. *Diaphus (A.) whitleyi* Fowler, 1934



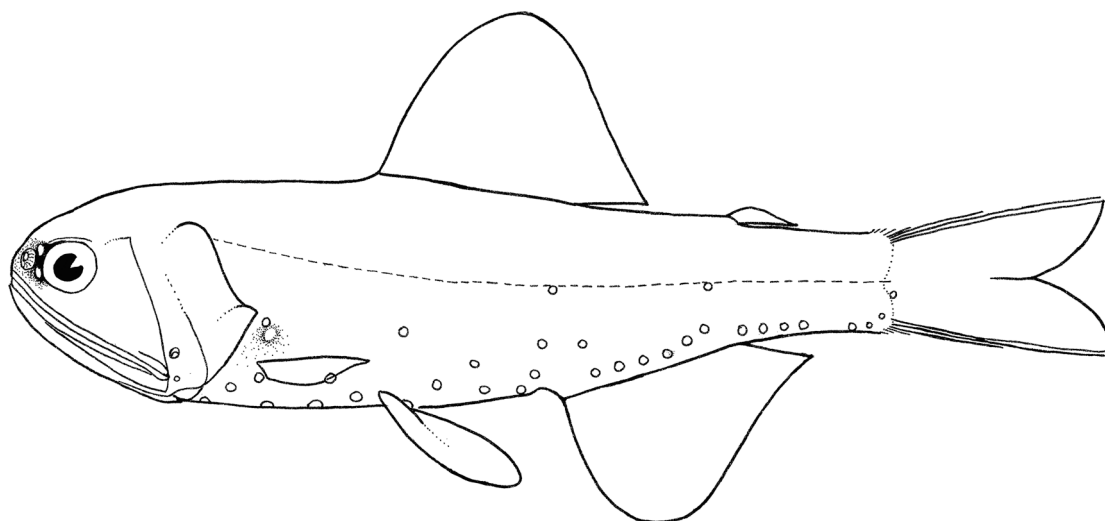
37122111 Whitley's Lanternfish (Bourret, 1985)

- 23 Dn directed anterolaterally, and smaller than nasal rosette (except in mature males of *D. malayanus* and *D. schmidtii*) 24
- Dn directed anteriorly and usually recessed in depression (best seen from head on), size smaller than a body photophore to massive, sometimes covering whole rostral region [most subjective couplet in key for some species; if in doubt, try both 24 & 28] 28
- 24 SAO_1 very low, almost in line with VO_{4-5} ; SAO_3 and Pol 1–1.5 times diameter below lateral line; adult males with well-developed Ant; [PLO luminous patch moderate in females, larger and thicker in males; AO 5–6 + 5 (4), total 10 (11) {6 (5–7) + 5 (4–6), total 11 (10, rarely 12)}; GR 6 + (13–15), total 19–21 {6 + 14 (13–15), total 20 (19–21)}; D 13–15 {15 (14)}; A 13–14 {14 (13–15)}; P 9–10 {10 (9)}; max. size 50 mm SL]; n = 5; Qld *Diaphus (A.) jenseni* Tåning, 1932



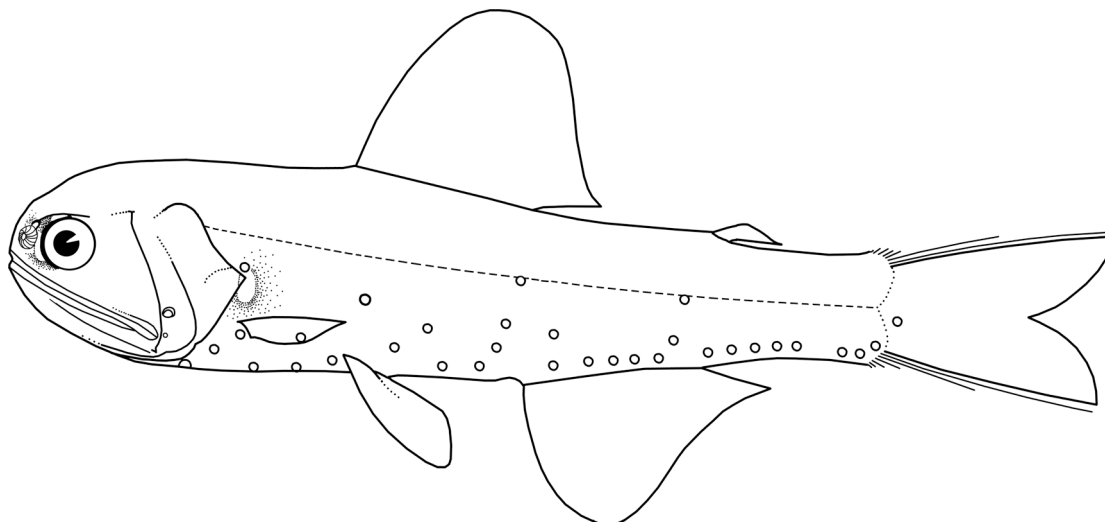
37122085 Jensen's Lanternfish (Nafpaktitis, 1978)

- SAO_1 more than one photophore-diameter above VO_4 – VO_5 line; SAO_3 and Pol in contact with or immediately below lateral line; Ant absent **25**
- 25** Body moderately deep, 4 or less times in SL; PLO luminous patch small; AOa_{2-3} space similar to remainder; [Dn and Vn greatly enlarged in mature males, with Dn larger than nasal rosette; PLO distinctly closer to pectoral-fin base than lateral line; AO 6 + 5 (4), total 11 (10) {6–7 + 4–5 (6), total 11 (10–12)}; GR 6 + 13 (14), total 19 (20) {6–7 + 13–14 (15), total 19–21 (22)}; D 15 (14) {15 (16)}; A 16 {16 (15)}; P 12 {12 (11)}; max. size 45 mm SL; n = 4; Qld, Col *Diaphus (A.) malayanus* Weber, 1913



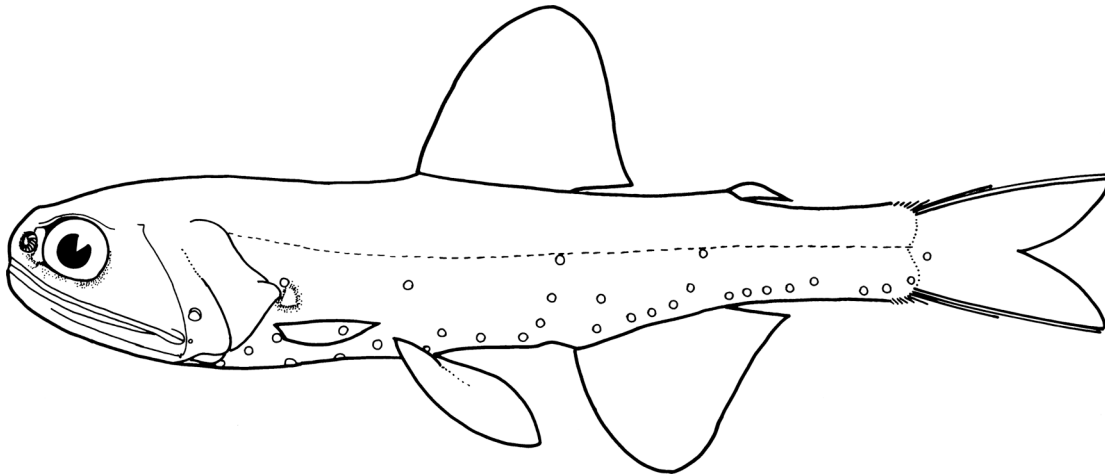
37122087 Malayan Lanternfish (Nafpaktitis, 1978)

- Body slender, depth more than 4 times in SL; PLO luminous patch moderate to large; AOa_{2-3} space slightly but distinctly wider than those more posterior **26**
- 26** PLO luminous patch elongate and rectangular, small to moderate sized; PLO closer to lateral line than pectoral-fin base (midway in some juveniles); Prc_{1-3} closely spaced with Prc_4 significantly further away; [Dn always smaller than nasal rosette; AO 7 + 5–6, total 12–13 {7 (6–8) + 5 (4–6), total 12 (11–13)}; GR 7 + 14–15, total 21–22 {7 (rarely 6, 8) + 14–15 (rarely 13, 16), total 21–22 (rarely 20, 23)}; D 14–15 {15 (14–16)}; A 15–16 {16 (15–17)}; P 11–12 {12 (11)}; max. size 60 mm SL; n = 9; Qld, LHI, NSW, WA *Diaphus (A.) garmani* Gilbert, 1906



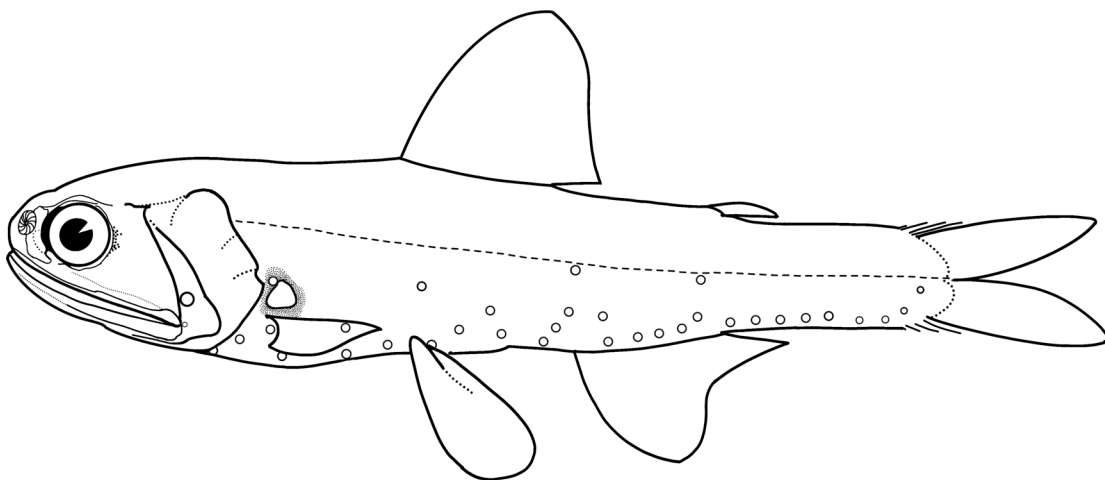
37122084 Garman's Lanternfish (Nafpaktitis, 1978)

- PLO luminous patch triangular, moderate or large sized; PLO closer to pectoral-fin base than lateral line or midway; Prc₁₋₃ widely spaced with Prc₄ only slightly further away..... 27
- 27 VLO clearly closer to lateral line than pelvic-fin base; PLO midway between pectoral-fin base and lateral line or slightly lower; PLO luminous patch striated; AOa₁ directly over or usually behind vertical through AOa₂; Vn about equal in size to Dn, slightly larger in mature males; SAO₃ about under end of dorsal-fin base; body more elongate; [GR 6–7 + 14–16, total 20–22 {6 (5–7) + 15 (14–16), total 21 (20–22)}; AO 6–7 + 5, total 11–12 {6 (5–7) + 5–6, total 11–12}; D 15 {15 (16)}; A 15–16 {15}; P 11 {11 (12)}; max. size 60 mm SL; n = 4; Qld, WA *Diaphus (A.) signatus* Gilbert, 1908



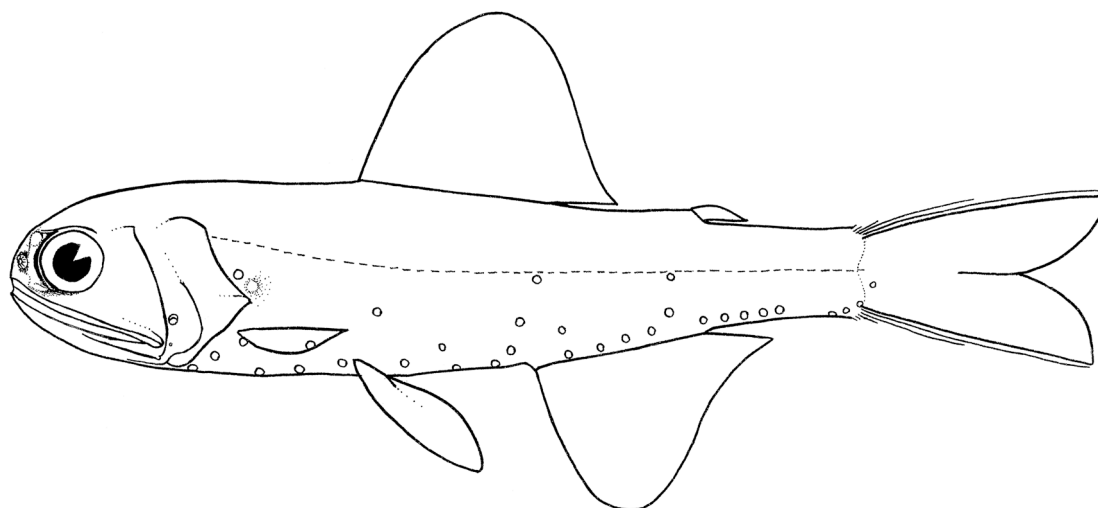
37122123 Arrowmark Lanternfish (Nafpaktitis, 1978)

- VLO midway between lateral line and pelvic-fin base or slightly higher; PLO clearly closer to pectoral-fin base than lateral line; PLO luminous patch mottled; AOa₁ directly over or slightly in front of vertical through AOa₂; Vn larger than Dn, especially in mature males; SAO₃ clearly behind end of dorsal-fin base; head more rounded; [{GR 6–7 + 14–16, total 20–23; AO 6 (5–7) + 5 (4–6), total 11 (10–12); D 13–14; A 14–15; P 9–10}; max size 40 mm SL]; not yet recorded from Australian waters, Coral Sea NE of EZ *Diaphus (A.) nielseni* Nafpaktitis, 1978



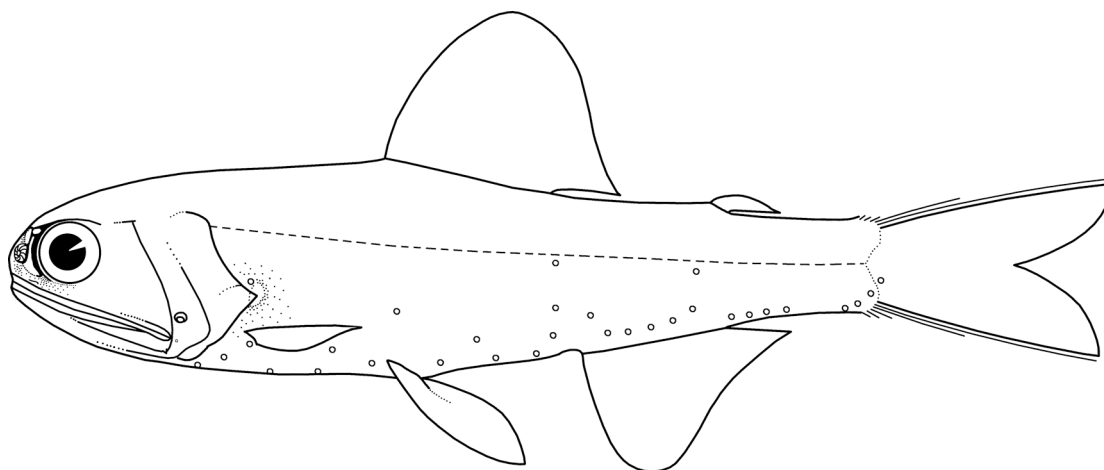
37122121 Nielsen's Lanternfish (LM)

- 28 Inner row of lower jaw teeth greatly enlarged; [Ant present; Dn equal in size to, or little larger than nasal rosette; PLO luminous patch small] 29
- Inner row of lower jaw teeth small or slightly enlarged 30
- 29 PLO 1.5–2.0 times closer to lateral line than pectoral-fin base; GR 5–6 + 12–13, total 17–19 {5 (6) + 12 (11–13), total 17 (16, 19)}; D 16–17 {18 (17–19)}; A 15–16 {16 (17–18)}; [AO 6 + 5, total 11 {6 (5–7) + 5 (4–6), total 11 (10–12)}; P 11–12 {11–12}; max. size 123 mm SL]; n = 11; Qld, LHI, NI, NSW, Vic, WA, Col ***Diaphus (A.) fragilis* Tåning, 1928**



37122034 Fragile Lanternfish (Nafpaktitis, 1978)

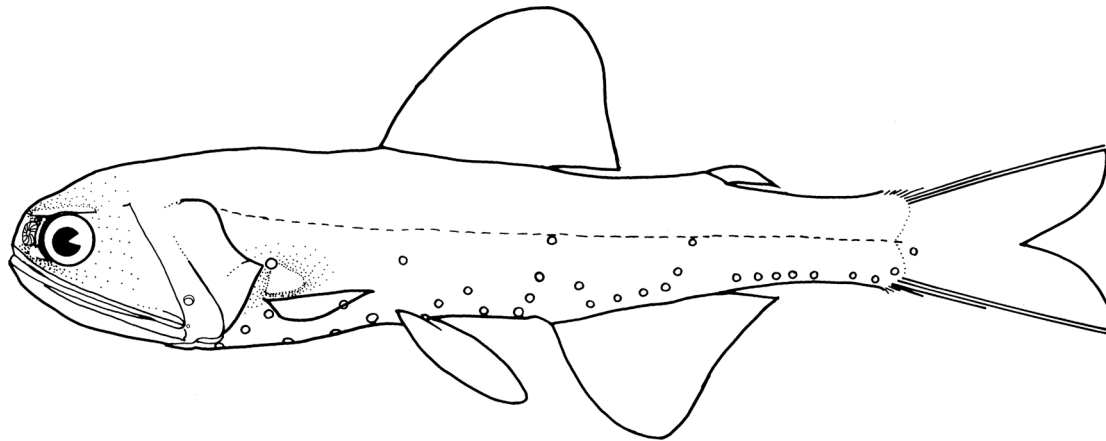
- PLO midway between lateral line and base of pectoral-fin, or slightly lower; GR 5–6 + 13 (12, 14), total 18–20 (17) {7 (6–8) + 15 (14–16), total 22 (20–24)}; D 15–16 (17) {16 (15–17)}; A 15–16 {15 (14–16)}; [AO 6 + 5, total 11 {6 (5–7) + 4 (3–5), total 10–11}; P 11 (13) {11}; max. size 129 mm SL]; n = 4; NSW, WA, Col ***Diaphus (A.) thiollierei* Fowler, 1934**



37122091 Thiollière's Lanternfish (Nafpaktitis, 1978)

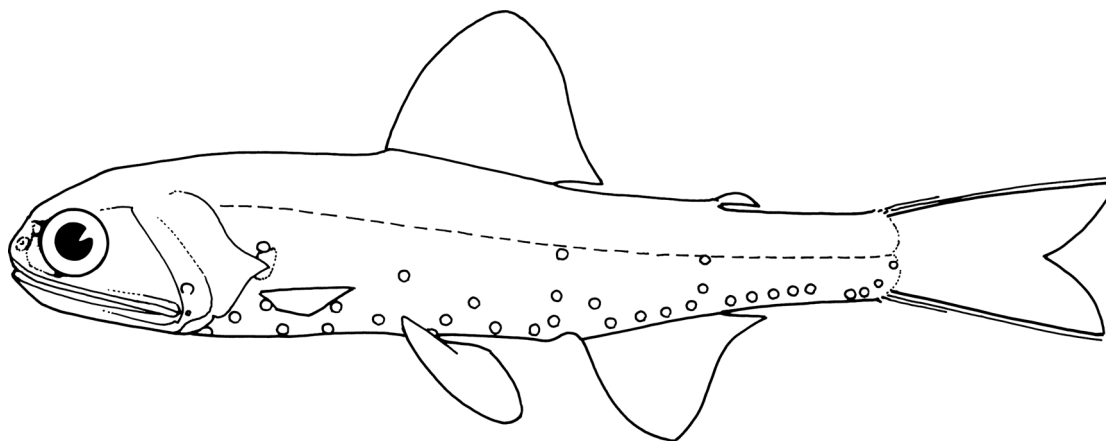
- 30 SAO3 and Pol touching lateral line or less than one photophore-diameter below lateral line 31
- SAO3 and Pol 1.5 photophore-diameters or more below lateral line 34
- 31 Dn smaller than nasal rosette 32
- Dn larger than nasal rosette 33

- 32 VLO 1.5–2 times closer to lateral line than pelvic-fin base; Prc all widely, nearly evenly spaced; GR 5 + 12 (13), total 17 (18) {5 + 12–13 (14), total 17–18 (19)}; supraorbital spine present (easily broken); Ant absent; PLO luminous patch large, semi-triangular and mottled; inner row of dentary teeth not enlarged; [AO 6 + 6, total 12 {6 (5–7) + 6 (5–7), total 12 (11–13)}; D 15 {15 (14)}; A 16–17 {16 (17)}; P 12 {12 (11)}; max. size 90 mm SL] n = 5; Qld, NSW, Vic, CoI *Diaphus (A.) splendidus* (Brauer, 1904)



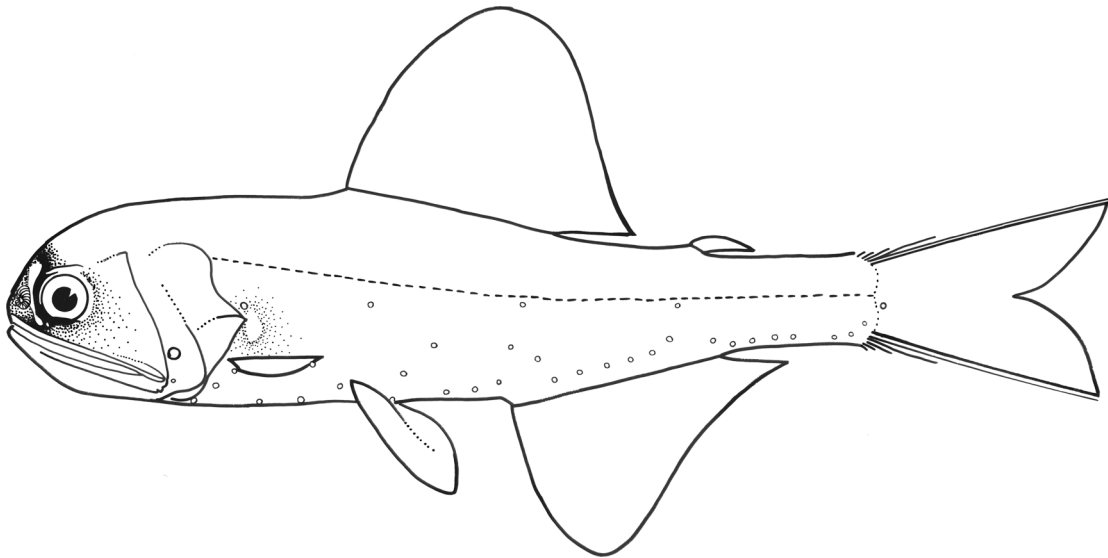
37122040 Horned Lanternfish (Nafpaktitis, 1978)

- VLO closer to pelvic-fin base than lateral line; Prc₁₋₂ interspace much shorter than Prc₃₋₄ interspace; GR 8 (7–9) + 16–17 (18), total 24–26 (23); supraorbital spine absent; Ant present in mature ♂s over 50 mm SL, absent in juveniles, easily lost in ♀s; PLO luminous patch moderate to large, somewhat elongate; inner row of dentary teeth slightly enlarged; [AO 6 + 5 (4–6), total 11 (10–12); D 15–16; A 15 (14); P 11 (12); max. size 80 mm SL]; n = 26; Qld, LHI, NI, NSW, Vic, Tas, WA *Diaphus (A.) kapalae* Nafpaktitis, Robertson & Paxton, 1995



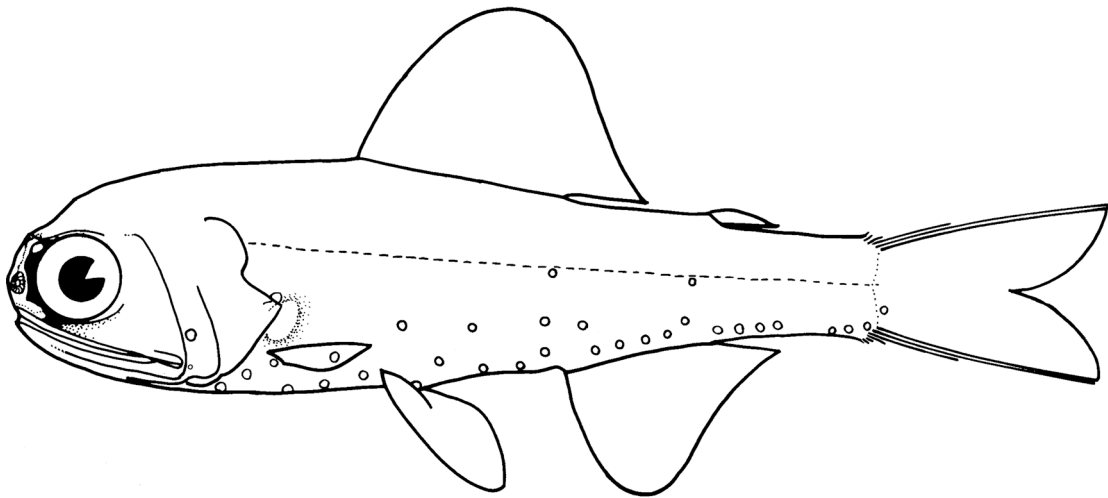
37122073 Kapala Lanternfish (Nafpatitis, Robertson & Paxton, 1995)

- 33 Dn as large as or larger than pupil, round; Ant absent; VLO much closer to lateral line than pelvic-fin base; PLO luminous patch moderate, vertically elongate; AOp₁ often raised; body photophores small; GR {5–6 + 12–13, total 17–19}; [operculum with rounded posterodorsal lobe, weakly serrate in specimens more than 65 mm SL; AO 7 (8) + 5–6 (4), total 12–13 {7 (8) + 4–5 (6), total 12 (11–13)}; D 17–18 {17 (18)}; A 17–18 {17–18 (19)}; P 11–12 {11–12}; max. size 118 mm SL]; n = 5; Qld, LHI, NI, NSW, WA *Diaphus (A.) lucidus* (Goode & Bean, 1896)



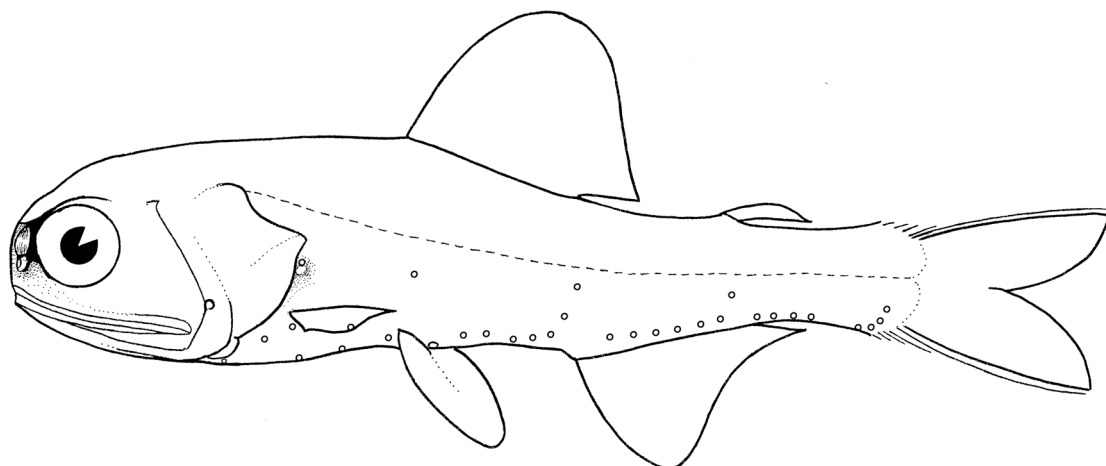
37122086 Spotlight Lanternfish (Nafpaktitis, 1978)

- Dn smaller than pupil, roughly rectangular; Ant present; VLO closer to pelvic-fin base than lateral line; PLO luminous patch large, almost equal to pupil size; AOp level; body photophores not small; GR 9–10 + 18 (17), total 27–28 {9–10 + 17–18 (19), total 26–28 (29)}; [dorsal area of operculum feebly serrate in specimens over 50 mm SL; inner row of premaxillary teeth weakly curved forward; AO 6 + 5, total 11 {6 (5–7) + 5 (4–6), total 11 (10–12); D 15–16 {16 (15–17)}; A 15 (14–16) {15 (14–16)}; P 11–12 {11 (10–12)}; max. size 71 mm SL]; n = 5; Qld, LHI, NI NSW, Vic, Tas, WA, Col *Diaphus* (A.) *perspicillatus* (Ogilby, 1898)



37122008 Flatface Lanternfish (Nafpaktitis, 1978)

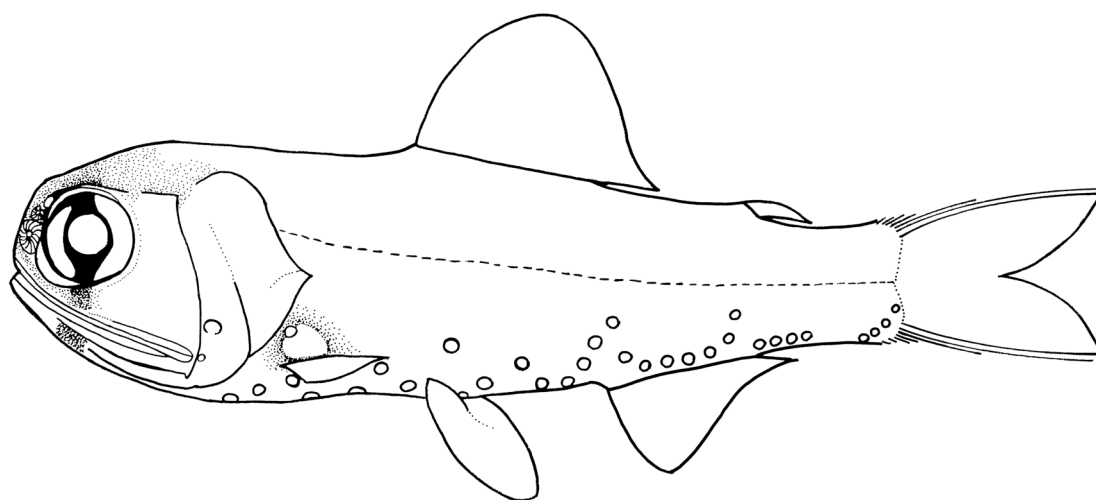
- 34 Vn limited to area between anterior margin of orbit and anterior margin of pupil, much smaller than Dn in largest ♂, absent in juveniles as large as 34 mm SL; Dn slightly smaller than nasal rosette, roughly crescent-shaped, very large in juveniles; VO₂ and VO₃ markedly low, almost in line with VO₁ and VO₅; SAO₁ low, from one half to one and a half diameters above level of VO₅; [body photophores unusually small; {AO 6 + 4, total 10}; GR 7 + 14–15, total 21–22 {6 + 13–14, total 19–20}; D 16 {15–16}; A 16 {15}; P 11 {11}; {n = 2; Nafpaktitis, 1978}; max. size 87 mm SL]; n = 2; NSW, WA *Diaphus* (A.) *drachmanni* Tåning, 1932



37122015 Drachmann's Lanternfish (Nafpaktitis, 1978)

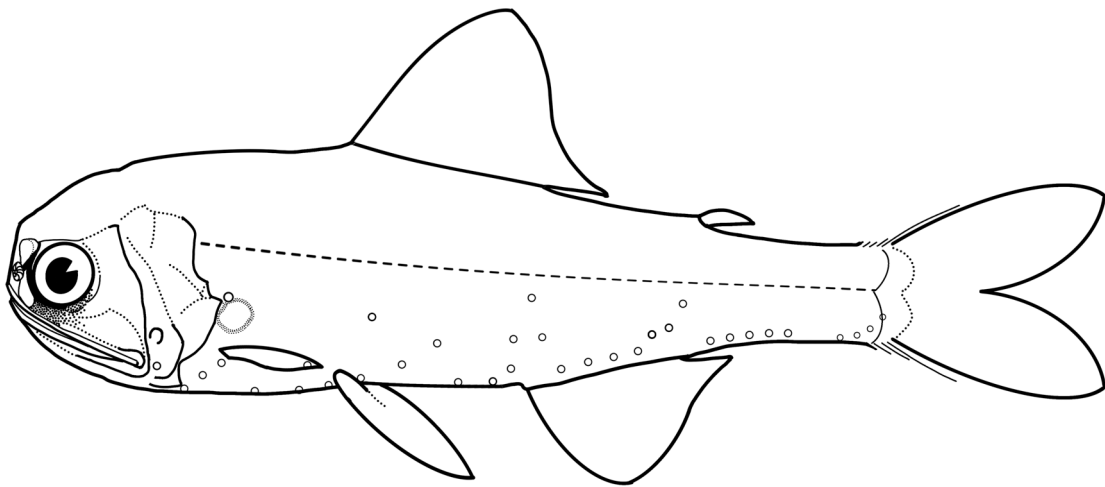
— Vn extending from anteroventral area of orbit dorsally to or above nasal rosette; Dn much larger or much smaller than nasal rosette; SAO₁ 2 or more photophore-diameters above level of VO₅ 35

- 35** Body photophores large; AOp photophores one half diameter or less apart in specimens less than 70 mm SL, photophores relatively smaller in specimens more than 100 mm SL with AOp photophores 1 diameter or more apart; SAO₁ at level of VO₃; Ant absent; Dn about one third nasal rosette; Vn moderate, not reaching ethmoid crest; iris gold anteriorly and posteriorly with black midsection and black pigment above and below eye in specimens greater than 60 mm SL, black not obvious in smaller specimens; inner row of dentary teeth slightly elongated; PLO luminous patch large, extending 90% of distance to upper pectoral-fin base; [Vn not extending dorsally above nasal rosette, extending posteriorly to point about half way between anterior margin of orbit and anterior margin of pupil, beyond margin of pupil but not to midline in largest specimens; AO 6 + 4–5, total 10–11 {6 + 4 (5), total 10 (11)}; GR 5–6 + 13 (14), total 18–19 (20) {5 (6) + 13–14, total 18–19 (rarely 20)}; D 14–15 {14–15}; A 14–15 {15–16 (14)}; P 11 (12) {11}; max. size 157 mm SL; n = 6; Qld, NSW *Diaphus (A.) bertelseni* Nafpaktitis, 1966



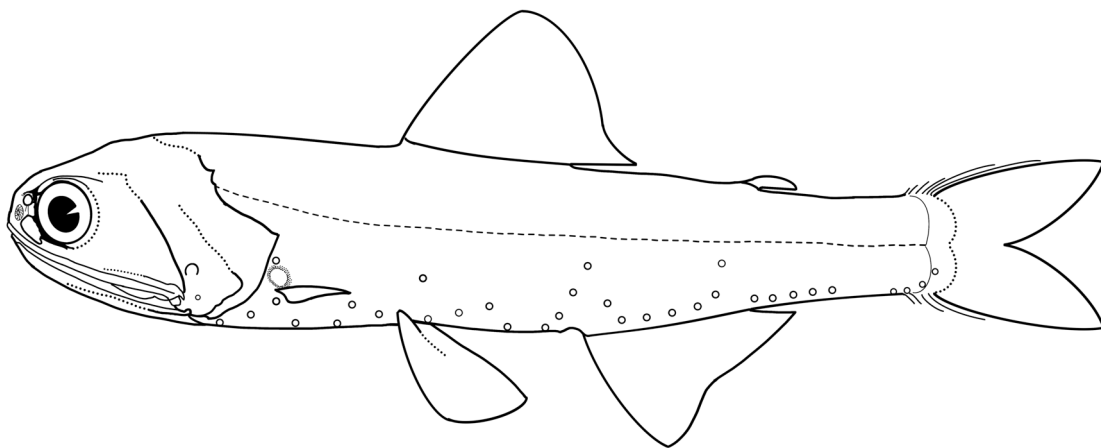
37122031 Bertelsen's Lanternfish (Nafpaktitis et al., 1977)

- Body photophores of small to moderate size, those of AOp series larger than one half AOp photophore-diameter; SAOp₁ below level of VO₃ (except *D. coeruelus*): Ant present or absent; iris without pigment above and below eye 36
- 36 HL about equal to HD, or less than 1.1 times as long as deep; Dn large, roundish, but not extending above level of dorsal margin of orbit; Vn reaching Dn and Ant, but not midline of snout; penultimate AOa highly elevated, dorsal to line formed by preceding AOa photophores; PLO luminous patch large, extending more than one half the distance to upper pectoral-fin base; posterodorsal lobe of operculum weakly serrate in specimens > 65 mm SL; [AO 7 (6) + 5 (6), total 12 {7 (6) + 5 (6, rarely 4, 7), total 12 (13, rarely 11)}; GR 8–9 + 16–17 (15), total 24–26 {8–9 (rarely 10) + 17 (16–18, rarely 15), total 25–26 (24–27, rarely 23)}; D 16 {16 (rarely 15, 17)}; A 15 (16) {15 (rarely 14, 16)}; P 10–11 {11 (10–12)}; max. size 120+ mm SL; n = 5; NSW, Vic, Tas, SA, WA *Diaphus (A.) ostenfeldi* Tåning, 1932



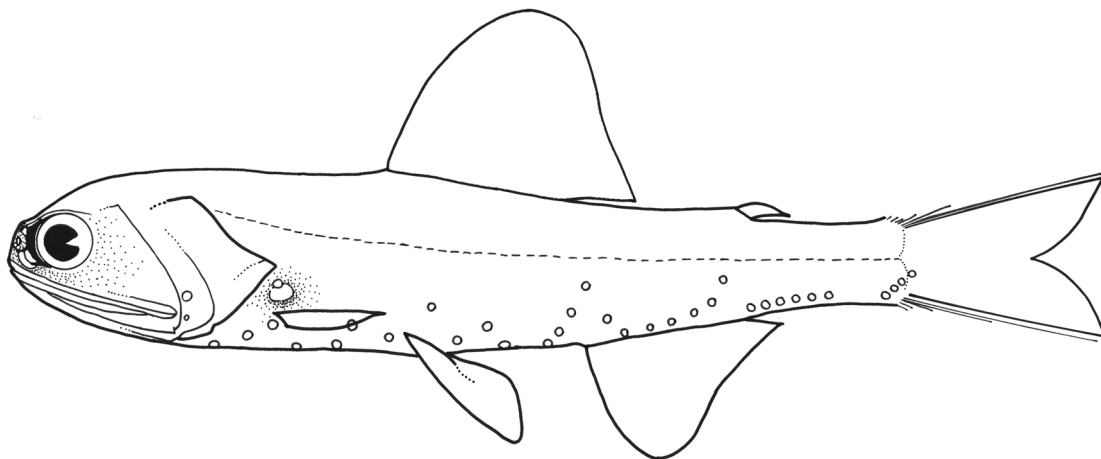
37122012 Ostenfeld's Lanternfish (Nafpaktitis, 1978)

- Head more than 1.2 times as long as deep 37
- 37 Dn smaller than a body photophore, its horizontal diameter about 3 times in diameter of nasal rosette 38
- Dn massive, reaching ethmoid crest at midline of snout and extending above level of dorsal margin of orbit; Vn reaching Dn and ethmoid crest, but not Ant (in undamaged specimens); head distinctly longer than deep; penultimate AOa level with, or tangential to, preceding AOa photophores; PLO luminous patch small or moderate, extending less than one half distance to upper pectoral-fin base; upper lobe of operculum not serrate 39
- 38 Ant present; Dn round, equal in size to body photophore or somewhat smaller; Vn large, extending posteriorly under eye to anterior margin of pupil; operculum rounded posterodorsally, posterior point not reaching PLO; least depth of caudal peduncle < 10 times in SL; head length equal to or less than distance from posterior end of upper jaw to dorsal-fin origin; [AO 6 + 5, total 11 {6 (7) + 5 (6), total 11 (12)}; GR 6 + 14 (13), total 20 (19) {5 (4–7) + 13–14 (15), total 18–19 (20–22)}; D 15 {15 (14)}; A 15 {15 (14)}; P 10–11 {11}; max. size 170 mm SL; n = 6; Qld, NI, NSW, Vic, SA, WA *Diaphus (A.) watasei* Jordan & Starks, 1904



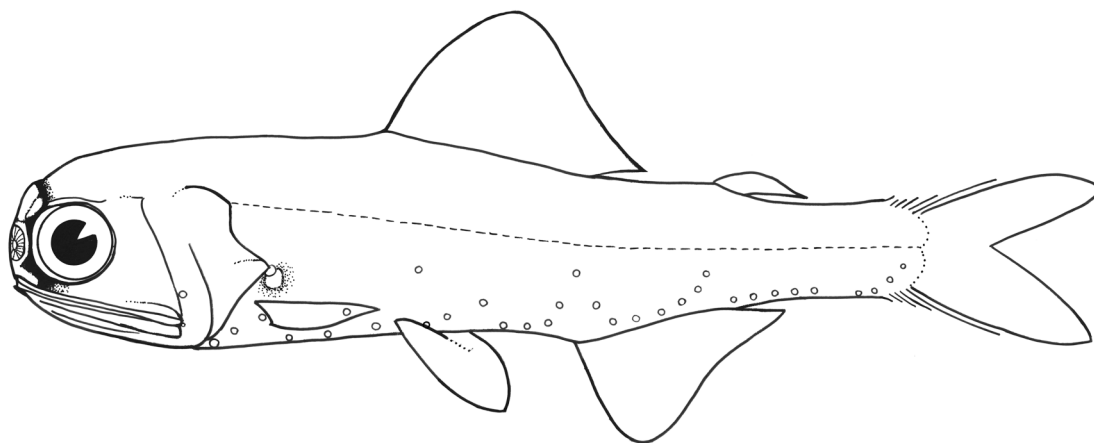
37122013 Watase's Lanternfish (Nafpaktitis, 1978)

- Ant absent; Dn bean-shaped, smaller than body photophore; Vn large, extending less than halfway to anterior margin of pupil; operculum somewhat angular posterodorsally, posteriorly ending in sharp point above PLO; least depth of caudal peduncle greater than 10 in SL; head length greater than distance from posterior end of upper jaw to dorsal-fin origin; [AO 6 + 5, total 11 {6 (5) + 5 (6), total 11 (10–12)}; GR 7 + 15 (16), total 22 (23) {6 (5–7) + 14 (13–16), total 20 (18–21)}; D 14–15 {15 (14)}; A 14–15 {15 (14)}; P 10–11 {10–11}; max. size 117 mm SL; n = 8; Qld, Tas, SA, WA, Col *Diaphus* (A.) *coeruleus* (Klunzinger, 1871)

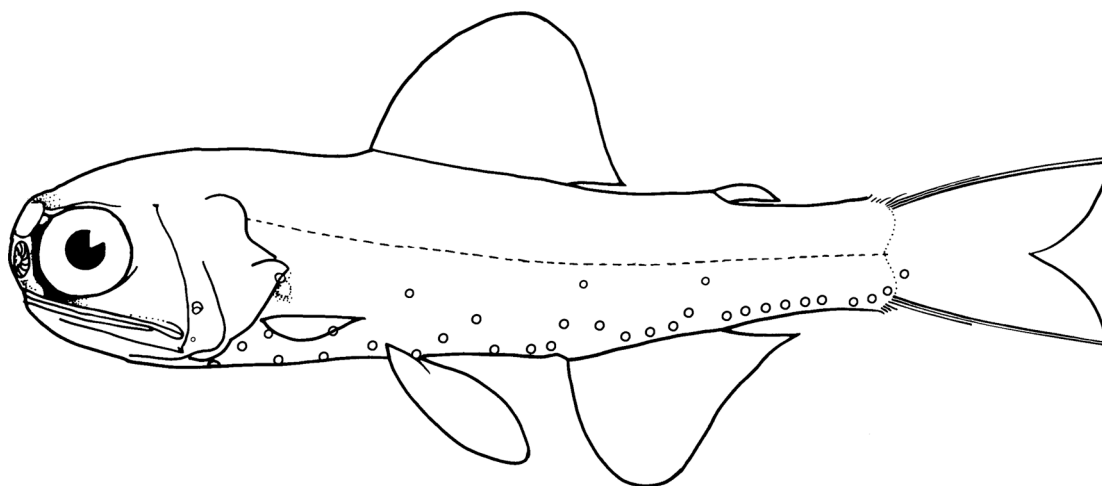


37122006 Blue Lanternfish (Nafpaktitis, 1978)

- 39** GR 6 (7) + 14 (13–15), total 20 (21) {5–6 + 12–14, total 17–20}; [AO 6 + 5, total 11 {6 (5–7) + 5 (6), total 11 (12)}; D 15–16 (17) {16 (15)}; A 14–15 {15 (14–16)}; P 12 (13) {11–12}; max. size 150+ mm SL; n = 9; LHI, NI, NSW, Vic, Tas, WA *Diaphus* (A.) *effulgens* (Goode and Bean, 1896)

37122033 Headlight Lanternfish (Nafpaktitis *et al.*, 1977)

— GR 8 (9) + 17–18, total 25–26 {8–9 + 16 (15–17), total 25–26 (24–27)}; [AO 5–6 + 5, total 10–11 {6 (5–7) + 5 (6), total 11 (10–12)}; D 15 {15 (16)}; A 14–15 {14–15}; P 11–12 {11–12}; max. size 77 mm SL]; n = 5; Qld, LHI, Col *Diaphus (A.) phillipsi* Fowler, 1934



37122088 Phillips' Lanternfish (Nafpaktitis, 1978)

Diaphus remarks

Diaphus is the largest genus in the family, with at least 80 valid extant species (Nafpaktitis, 1978; Paxton, 1979; Hulley & Paxton, 2016: 1885). Two sub-groups within the genus have long been recognised: (1) short-jawed species (jaw length extending significantly less than one orbit diameter behind vertical from posterior margin of orbit) and with an So light organ below the eye, and (2) long-jawed species (jaw length extending one or more orbit diameters behind vertical from posterior margin of orbit) that lack an So. All the short-jawed species have a row of broad-based, moderately hooked teeth on the posterior portion of the premaxilla; a small number of the long-jawed species have slightly hooked teeth, with one exception. Short-jawed species include *D. theta*, type species of the genus; there are about 20 valid short-jawed species in what Bolin termed *Diaphus (sensu stricto)*.

There are, however, few consistent patterns between groups of species which each show considerable variation in osteological features (Paxton, 1972; Martin & Davis, 2016), light organs (Nafpaktitis, 1966, 1977, 1978), otolith features (Schwarzahns, 2013) and DNA sequences (Denton, 2014; Martin *et al.*, 2018). Even sub-genus *Diaphus*, the

largest group, has one exception: *D. vanhoeffeni*, an Atlantic endemic, has an So and broad-based hooked teeth on the posterior premaxilla, but also a long jaw extending an orbit diameter or more behind the orbit. This species also has other differences within the group, including: otolith structure; a sexually dimorphic Ant present only in males; and the small lateral Dn, which is shallow and fused with the Vn. All other species lack an Ant in males and females, and have a forwardly directed Dn in a cup-shaped recess, separate from the Vn.

Paxton (1972:71) stated, “Another problem is encountered if *Diaphus* is restricted to only those forms with short jaws. What generic name will all other species of the group take until a definitive study is accomplished? Additional generic taxa have been formulated in the past, and more problems were created than solved. Stability of nomenclature will surely not be achieved by a restriction of the genus *Diaphus*; recognition of additional genera in the group, which currently has five generic synonyms, should be reserved for the future, as emphasized by Nafpaktitis (1966: 420).”

More than 50 years have passed since that opinion, and we are still faced with a genus with 80+ species and no agreement on significant species groups, except one. With

the current changes in relationships and additions of genera, it seems a good time to recognise a restricted *Diaphus*, with the rest of the species allocated to *Aethoprora* (Goode and Bean, 1896: 86), the next available junior synonym. Future work is required to uncover other species groups. As is the case for all of the new genera proposed, *Aethoprora* is recognised in the key only as a subgenus.

***D. aliciae*.** New record for Australian waters based on 4 specimens from the Coral Sea.

***D. adenomus*.** New Australian and western South Pacific records are based on five specimens taken in bottom trawls, one from some 100 n miles due east of the north end of Fraser Is., Qld (24.26°S) at 440 m near the top of a seamount (QM), one from the northern Norfolk Ridge (26.4°S, 167.01°E) at 1019–1030 m some 200 n miles from the nearest land (AMS), and three at CSIRO / AMS from Fraser Seamount (24.41°S, 155.32°E) in 1023–1026 m. The species previously was taken from off Hawaii and Japan in the North Pacific and the eastern and western North Atlantic (Nafpaktitis, 1974), as well as on the Nascas and Sala y Gomez Ridges in the eastern South Pacific (Becker, 1992) and off Brazil in the southwestern Atlantic (Braga *et al.*, 2008). Most previous specimens were taken in bottom trawls down to 700 m close to continents or islands. Meristics of the present specimens match those of the North Pacific and Atlantic, rather than those in the eastern South Pacific with higher number of gill rakers recorded by Becker (1992).

***D. bertelseni*.** The largest previously recorded specimen was 100 mm SL taken from a whale stomach in the northwestern Pacific (Kawaguchi & Kawamura, 1981). They described a previously unrecorded colour pattern on the eye of their fish. The Australian specimen in the best condition is a 149 mm SL QM fish that displays a similar pattern, a distinctive dark band through the middle of the golden iris from top to bottom, about the width of the pupil dorsally and half the width ventrally, continuing as a narrower band immediately behind the end of the Vn and ventromedially across the membrane of the dentary. The frontal above the orbit is damaged but also has dense black pigment. The anterior and posterior thirds of the iris have a yellow sheen similar in colour to the Vn. The same basic colour pattern is present in 16 specimens 95 mm SL and larger. Although less developed, the pigment band is visible in 3 NSW specimens 55.5–63.5 mm SL, but not in the smallest 47.5 mm specimen. Some differences between the Australian specimens and that from the northwestern Pacific are notable. The aphakic space is below the pupil in Australian specimens, as figured by Nafpaktitis *et al.* (1977), and not above the pupil as described and figured by Kawaguchi and Kawamura (1981). The luminous tissue patch at the PLO does not extend above the photophore in any of the Australian specimens, nor are the bases of the adipose or caudal-fins densely pigmented, although the caudal-fin rays are lightly pigmented basally in the largest specimens.

***D. chrysorhynchus*.** There are notable differences in pigmentation between the shallowest caught specimens, at 298–320 m from the North West Shelf, and those from deeper water, 400–520 m. The shallow captures are exceptionally

light, lacking most dark pigment except that around the Dn and Vn. Small pigment spots are on the caudal-fin tips and middle section of the outer pelvic-fin rays in specimens over 80 mm SL. Bourret (1985) noted variation in different populations in the western Pacific as described by previous authors and concluded *D. sagamiensis* is a junior synonym. Kawaguchi and Shimizu (1978) recorded a maximum size of 120 mm SL in Japanese specimens.

***D. danae*.** A widespread species recorded from Qld by Flynn and Paxton (2012) from specimens taken from tuna stomachs off Port Douglas (16.43–16.33°S, 146.63–146.8°E) (McPherson, 1988), not previously identified as this species due to their poor condition.

***D. diademophilus*.** New record for Australia based on a single specimen; data and specimen missing.

***D. lucifrons*.** New record for Australia based on 3 specimens (NMV, AMS, CSIRO) 102–113 mm SL from WNW of Broome, WA (17.05°S, 119.67°E) caught in a beam trawl at 450 m. Previously known only from the 104 mm holotype caught off the east coast of Luzon, Philippines (12.67°N) in a bottom trawl. All four specimens caught to date appear to be benthopelagic in habit.

***D. richardsoni*.** Newly recorded for Australia based on 4 larvae 4–5 mm SL from Coral Sea off Cairns, Qld, identified by DNA (CO1 barcode) by Flynn and Paxton (2012).

***D. termophilus*.** Two specimens from the Norfolk Island Ridge (26.43°S, 167.18°E) 112–117 mm SL exceed the previously recorded maximum size by more than 30 mm. They are both males with moderately developed gonads, and are in good condition despite being taken in an orange roughly bottom trawl at 750 m. They fall within the range of characters given for the species by Nafpaktitis (1978: Table 1, p 39), except the pelvic-fin rays barely reach the origin of the anal-fin rather than extending to the base of rays 4–5.

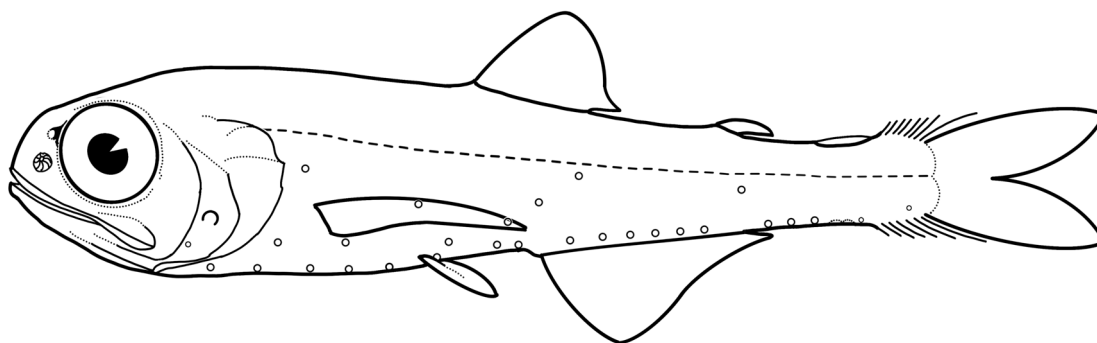
Diogenichthys Bolin, 1939

Diogenichthys species are small, with a maximum size of 29 mm SL. Characters include the VO₂ raised above the level of the VO series, but not as high nor as far anterior as those in *Benthosema* species, and the Vn is absent. The dentition is distinctive, with all species having at least some large, flattened, hooked teeth in a single row and small, flattened, tricuspid teeth somewhere in one or both jaws, unlike the closely related *Benthosema* with unmodified teeth (Paxton, 1972).

The genus has a circumglobal distribution with three world species, two are recorded from Australian waters, see Becker (1967, 1983); Nafpaktitis and Nafpaktitis (1969); Kotthaus (1972); Wisner (1976); Nafpaktitis *et al.* (1977); Parin *et al.* (1977); Hulley (1981, 1984, 1986a, 1990b); Hoese *et al.* (2006); Denton (2014); Roberts *et al.* (2015); Hulley and Paxton (2016); Martin *et al.* (2018); Wan and Bian (2018); Sutton *et al.* (2020); Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from several of the above sources.

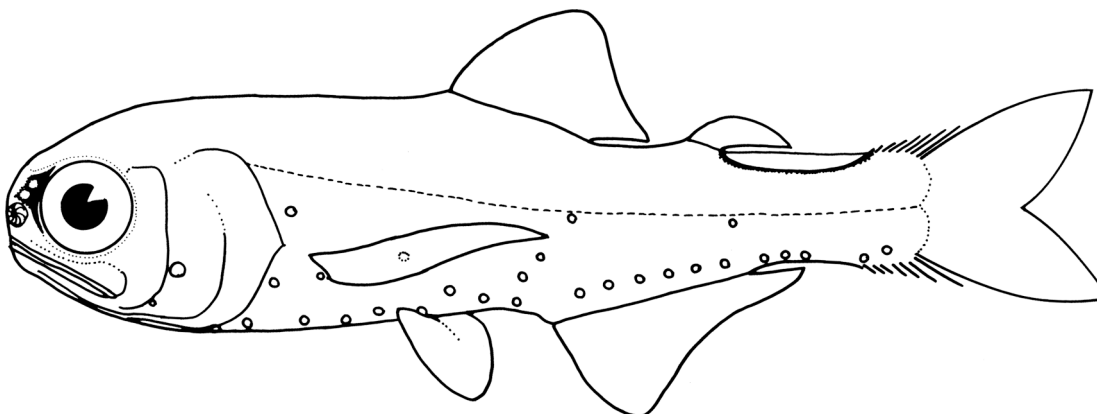
Key to the genus *Diogenichthys*

- 1 GR 2 + 11 (12), total 13 (14) {2 + 11–12 (10), total 13–14 (12)}; adult males with SCO covering about 50% {50–75%} of space between adipose-fin base and posterior margin of SCO; [Prc₁₋₂ interspace wide, equal to or more than distance between last AOp and Prc₁; adult males with small Dn; SAO₁ position variable, anterior to, over, or slightly posterior to VO₃; AO 6 (5, rarely 7) + 3 (2, 4), total 9–10 (8) {6–7 (8) + 3 (4), total 9–10 (11)}; D 10–11 {11–12 (10)}; A 15–16 {16–17 (15–18)}; P 12–13 {12–13 (14)}; max size 27 mm SL; n = 5; Qld, NSW, LHI, Vic, SA, WA .. *Diogenichthys atlanticus* (Tåning, 1928)



37122042 Atlantic Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- GR 2 + 9–10, total 11–12 {2 + 9–10, total 11–12}; adult males with SCO covering 75–100% of space between adipose-fin base and posterior margin of SCO; [Prc₁₋₂ interspace variable, typically ½ or less than distance between last AOp and Prc₁; Dn sexually dimorphic, well-developed in pigmented cup in adult males, smaller in females and juveniles; SAO₁ directly over or slightly posterior to VO₄; AO 6 + 2–4, total 8–10 {6 (5–7) + 3 (2)}; D 11; A 15–16; P13; max size 27 mm SL; n = 3; Qld, WA, ChI, CoI ... *Diogenichthys panurgus* Bolin, 1946



37122124 Rascal Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

Diogenichthys remarks

See **remarks** in the *Benthosema* key for the taxonomic problems caused by the DNA results of Denton (2014) and Martin *et al.* (2018) that embedded the species of *Diogenichthys* between clades of *Benthosema* species. The genus comprises three species, each with a distinct larval form (Wan & Bian, 2018).

***D. laternatus*.** The species is restricted to the eastern Pacific east of 158° W (Wisner, 1976: fig 41; Becker, 1983: 117, fig. 59), and does not occur in Australian waters. Upper jaw reaching well behind the vertical from the posterior margin of the orbit in this species is unique in the genus, while the short Prc₁₋₂ space is similar to specimens of *D. panurgus*.

***D. panurgus*.** Juvenile and immature specimens (n= 25, 10–20 mm SL) from the Coral Sea (MCZ 86564–69; MCZ 86571–75; MCZ 86949; AMS I–44483–001 to I–44485–001) identified as *D. panurgus* have some characters of all three species of *Diogenichthys*. The SCO in males is distinctive, covering 75% or more of the dorsal surface of the caudal peduncle between the adipose-fin base and the posterior margin of the SCO, but does not reach the adipose base as described for mature Indian Ocean specimens. In Indian Ocean specimens of *D. panurgus*, the Prc₁₋₂ space is

less than 50% of the space between the last AOp and Prc₁, and in *D. atlanticus* is more than 100% of that space; in the Coral Sea specimens the Prc₁₋₂ space varies from 70–115% of the AOp–Prc₁ space. The GR count for the Coral Sea specimens is consistently 2+10, which overlaps the count in the two Indian Ocean species. *D. laternatus* has a count of 3+11 (10). The position of the SAO₁ over the VO₄ is variable, and the Dn in our specimens is not enlarged.

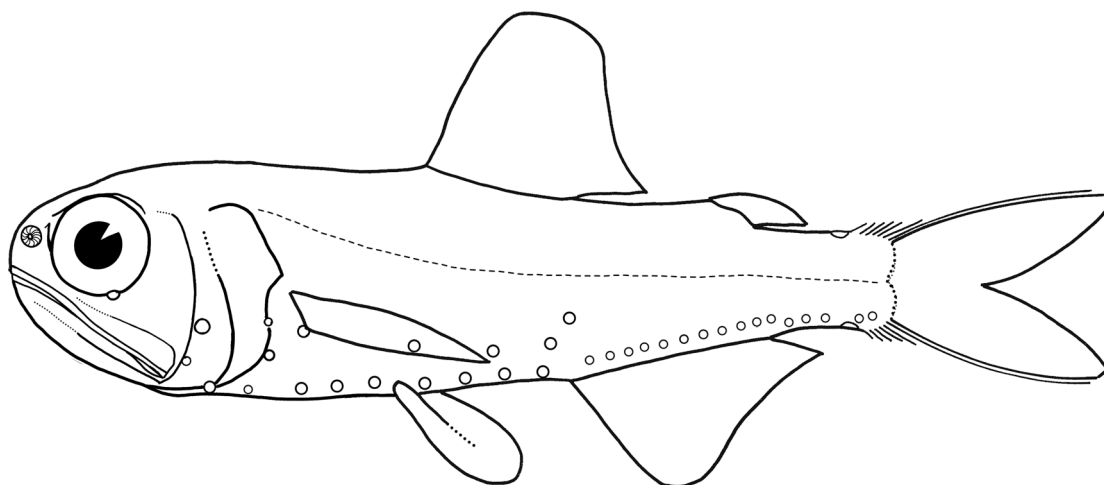
Electrona Goode & Bean, 1896

One of the four primarily Southern Ocean genera; possesses only 2 Prc's and no distinct Pol. One species with SCO of separate patches surrounded by black pigment in males; others with coalesced plates without pigment between.

The genus has a southern circumglobal distribution, with one species reaching the northern hemisphere; five world species, all of which occur in Australian waters, see: Nafpaktitis and Nafpaktitis (1969); Wisner (1976); Hulley (1981, 1984, 1986a, 1990a, 1990b, in prep.); McGinnis (1982); Becker (1983); Hoese *et al.* (2006); Duhamel *et al.* (2014); Roberts *et al.* (2015); Sutton *et al.* (2020); Mostarda *et al.* (2023); and Koubbi *et al.* (2025). Data from non-Australian specimens in {} are from the above sources.

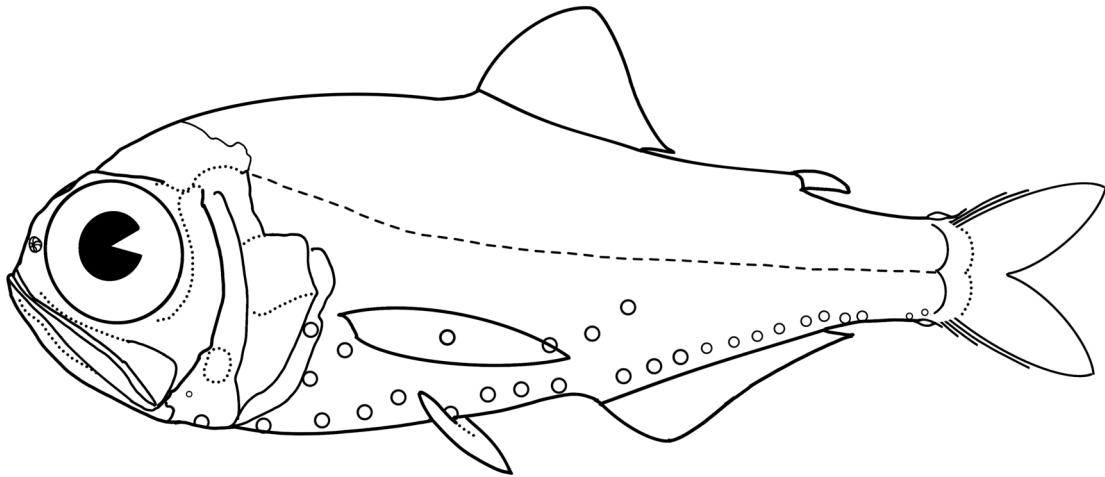
Key to the genus *Electrona*

- 1 So below or slightly behind vertical through middle of eye; Vn absent; [♂ and ♀ with SCO 1, ICO 1; AO total = 14 (15) {total = 14 (13–15)}; GR 9–10 + 20–21 (23), total = 29–32 {9 (8–10) + 22–23 (20–24, rarely 19, 25), total 31–32 (29–34, rarely 27, 28)}; D 13–14 {14 (13–15)}; A 19–20 {19 (18–20)}; P 12–13 {12–13}; max. size 95 mm SL]; n = 5; Tas, MqI, HIMI *Electrona carlsbergi* (Tåning, 1932)



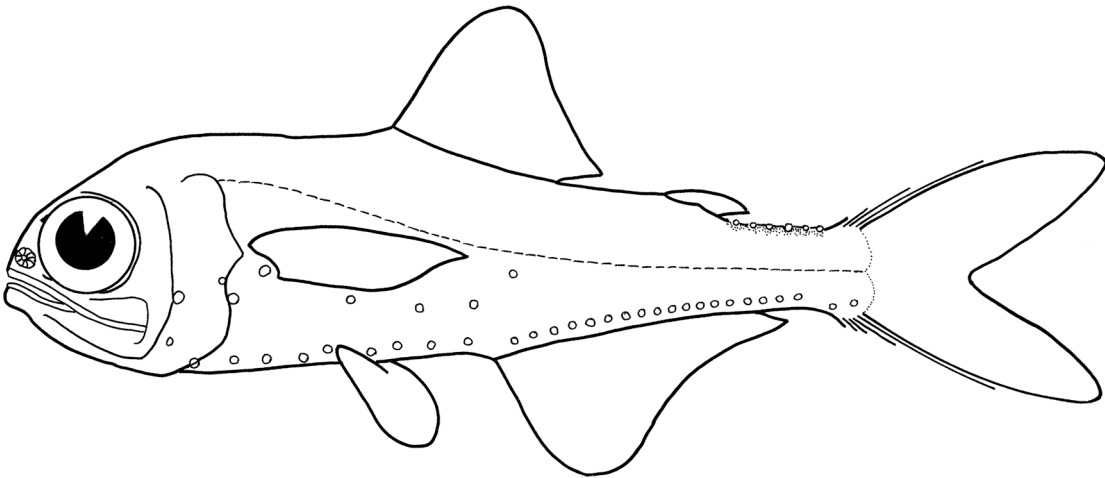
37122104 Carlsberg's Lanternfish (Hulley, 1981)

- No So below middle of eye; Vn present between nasal organ and anteroventral margin of eye 2
- 2 AO total = 10–13 {10–12}; body depth less than 3 in SL; [last 2 AO depressed; ♂ with SCO 0–1, ICO 0–1, ♀ with SCO 1 (rarely 0), ICO 1–2 (rarely 3); GR 9 (8) + 20 (19–21), total 29 (28–30, rarely 27) {8–9 + 19–21, total 27–30}; D 14 (13, rarely 15) {13–15}; A 19 (18–20) {18–20}; P 16 (15) {14–17}; max. size 82 mm SL]; n = 20; NI, NSW, Vic, Tas, WA *Electrona risso* (Cocco, 1829)



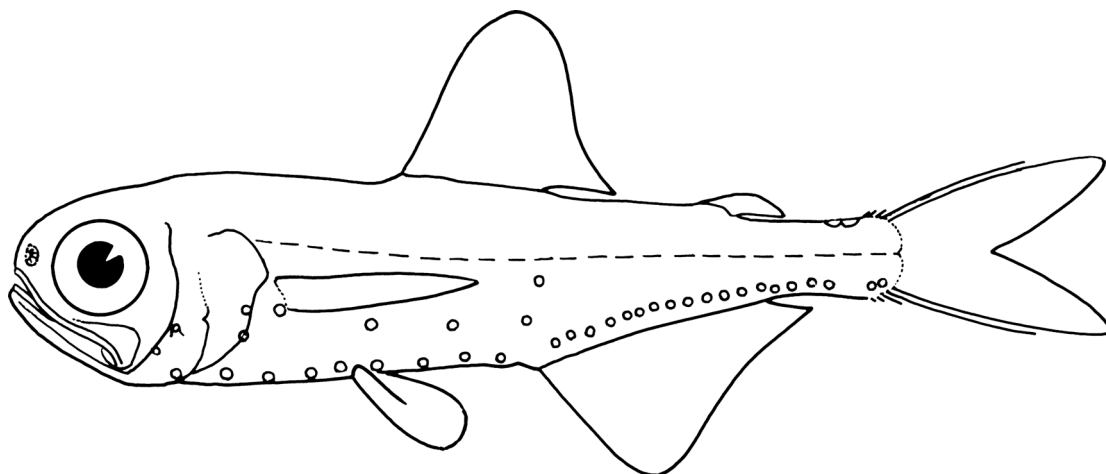
37122043 Risso's Lanternfish (♀, Nafpaktitis & Nafpaktitis, 1969)

- AO 13–19; body depth more than 3 in SL... 3
- 3** PLO much closer to PVO₁ than PVO₂; AO level; GR 4 (5, rarely 3) + 13–14 (rarely 15), total 17–18 (16–20); ♂ with SCO 6–7 (5) separate, with surrounding black pigment; ♀ with ICO 5 (4–6) separate; [AO total = 18–19 (16, 17) {total = 18 (17–19)}; D 13–14 {14–15 (16)}; A 20–21 {21 (20, rarely 19, 22)}; P 12–13 {12–13 (rarely 11)}; max size 82 mm SL; n = 5; MqI, HIMI *Electrona antarctica* (Günther, 1878)



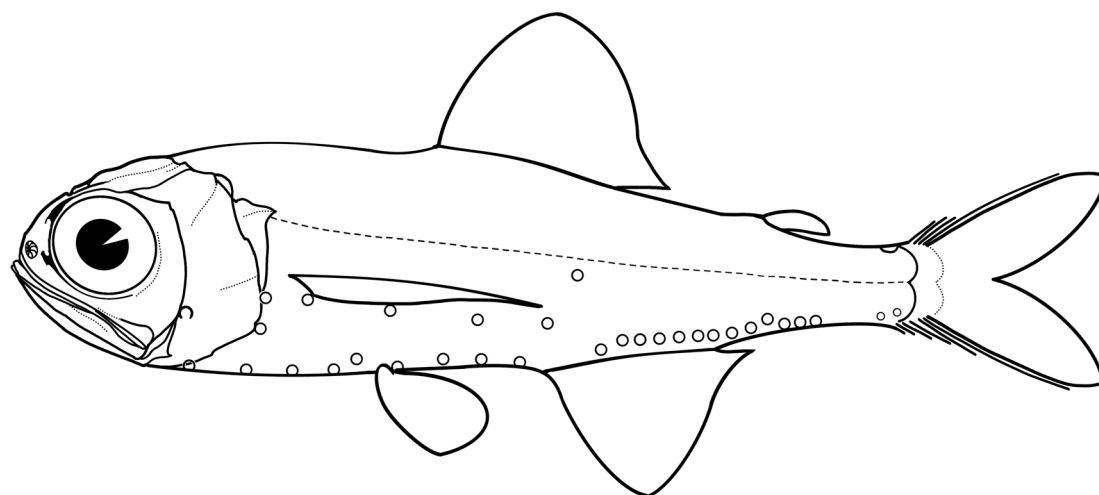
37122750 Antarctic Lanternfish (♂, Hulley, 1981)

- PLO equidistant between PVO₁ and PVO₂; last 4–5 AO slightly depressed; GR 6–8 (5–9) + 16–20 (15–22), total 22–28 (21–31); SCO of ♂ without black pigment separating plates if more than 1 ... 4
- 4** GR 8 (7) + 19–20 (18), total 27–28 (25) {8 (7–9) + 19–20 (18–22), total 27–28 (25–31)}; Prc_{1–2} interspace less than one photophore-diameter; [PO₅ on level with outer pelvic-fin base; AO total = 15–17 {17 (16, rarely 18)}; ♂ with SCO 2 {1–3} ICO 0; ♀ with SCO 0–2+, ICO 0–2+; D 13–14 {14 (13–15)}; A 21 (20–22); P 15 {14–15 (rarely 13, 16)}; max. size 127 mm SL; n = 5; Tas, MqI, HIMI *Electrona subaspera* (Günther, 1864)



37122014 Rough Lanternfish (♂, Hulley, 1981)

— GR 5–6 + 15–17, total 20–23 {6 (5) + 16 (15–18), total 22 (21–24)}; Prc_{1-2} interspace equal to or more than one photophore-diameter; [PO₅ elevated, slightly above level of outer pelvic-fin base; AO total = 14–16 (14–15) {15–16, rarely 14, 17}; SCO 1 ♂ and ♀, ICO 0 ♂, 3 ♀; D 13–14 (15) {14–15}; A 20 (20–21) {19–20}; P 13–15 {14–16}; max. size 75 mm SL]; n = 5; Tas, MqI, WA *Electrona paucirastra* Bolin, 1962



37122075 Belted Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

Electrona remarks

Distributional records for *Electrona* species occurring in the Southern Ocean have been recently summarised by Hulley (in preparation), as follows:

E. antarctica. Circumpolar distribution between Antarctic Slope Front and Antarctic Polar Front, with small specimens sometimes occurring as far north as Subtropical Front in deeper waters (2,000 m).

E. carlsbergi. Circumpolar distribution in Subantarctic Mode Water and Antarctic Intermediate Water between Southern Antarctic Circumpolar Current Front and Subtropical Front, but with isolated records north to 36°–34°S.

E. paucirastra. Generally distributed in the region of Subtropical Convergence, but records between Antarctic Polar Front and Subtropical Front, and north of Subtropical Front in Tasman Sea region, and in the Bounty Trough and Chatham Rise regions.

E. subaspera. Generally circumglobally distributed between Subtropical Front and Antarctic Polar Front, but

occurring north of Subtropical Front in Tasman Sea, and in Benguela and Falkland currents; several records south to Antarctic Circumpolar Current Front.

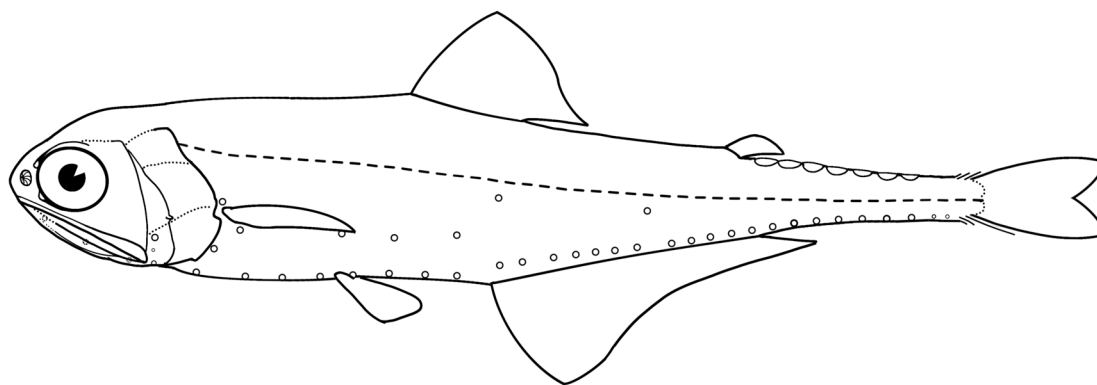
Gonichthys Gistel, 1850

Gonichthys is one of four slender-tailed lanternfish genera (Becker, 1964); the others in Australian waters are *Centrobranchus* and *Loweina*. Among them, *Gonichthys* is like *Centrobranchus* in having SCO (males) and ICO (females) as individual organs with black margins, distinctive in mature males; and subterminal mouth with enlarged snout.

The genus occurs in tropical, subtropical and temperate waters of the Atlantic, southern Indian, and eastern and central Pacific Oceans, with four world species, two in Australia; see Becker (1964, 1983); Wisner (1976); Nafpaktitis *et al.* (1977); Hulley (1981, 1984a, 1990b); Hoese *et al.* (2006); Roberts *et al.* (2015); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Hulley (1981).

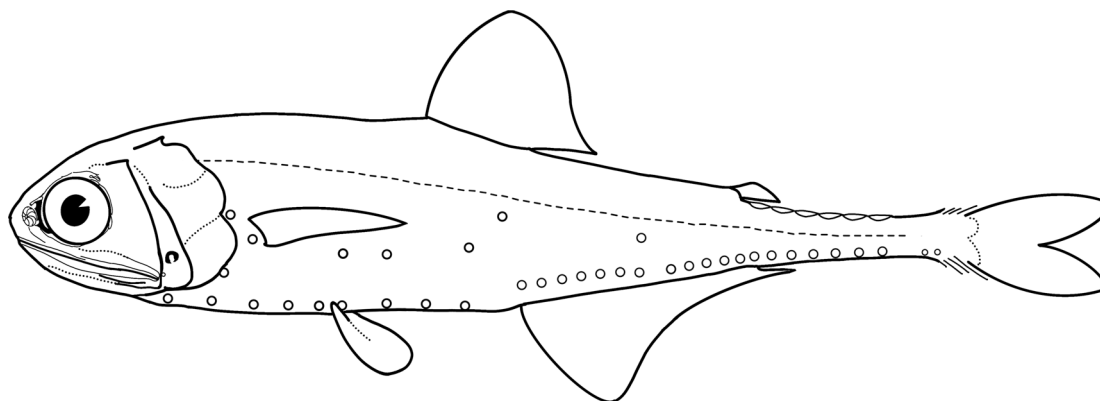
Key to the genus *Gonichthys*

- 1 Lateral line complete, all scales perforated; GR 4 (3) + 8–9 (6–7), total 9–13 {5 (4–6) + 9–10 (8–11), total 14–15 (12–16)}; [D 11–12 (rarely 13) {12 (11–13)}; A 20–22 (23) {22 (21–24)}; P 13–14 (rarely 12, 15) {14–15 (16–17)}; AO 6–7 (rarely 4, 5, 8) + 11–12 (13), total 18–19 (17, rarely 20) {6–7 (5–8) + 12–13 (10–14)}; SCO ♂ only, 7 (rarely 5, 6, 8) {8 (6–9)}; ICO ♀ only 5 (4, rarely 3, 6) {5 (4)}; max. size 50 mm SL; n = 28; LHL, NSW, Tas, SA, WA *Gonichthys barnesi* Whitley, 1943



37122044 Barnes' Lanternfish (♂, Becker, 1983)

- Lateral line semi-complete, last 3–6 scales unperforated; GR {4 (3–5) + 9 (7–10), total 13 (11–14)}; [D {11 (10–12)}; A {20 (19–21)}; P {14 (13–16)}; AO {5 (4–6) + 12–13 (11–14), total 17–18 (16–19)}; SCO ♂ only {6}; ICO ♀ only {6}; max. size 40 mm; n = 0 {11}; NI (type locality: 27.66°S, 171.93°E) *Gonichthys venetus* Becker, 1966



37122125 Bluegreen Lanternfish (♂, LM Hulley, unpublished)

***Gonichthys* remarks**

The “slendertail” lanternfish genera (sensu *Gonichthyini* Paxton, 1972) were not recovered as a monophyletic group in the DNA analyses by Denton (2014). Similar results, based on nuclear, protein-coded, and morphological analyses were obtained by Martin *et al.* (2018).

All four genera of slender-tailed lanternfishes were previously considered close relatives (Becker, 1964), but *Gonichthys* is now considered a sister genus of *Centrobranchus*, and not in the same clade as *Loweina* (Denton, 2014, Martin *et al.* 2018). Four nominal species are currently recognized, but the *alpha*-taxonomy of the genus has not yet been established with any certainty.

***G. barnesi*.** Nycto-epipelagic with circumglobal distribution in the region of the Subtropical Convergence; may extend 12–15° farther north into subtropical waters in some regions (Hulley 1981).

***G. cocco*.** Considered to be an Atlantic Ocean endemic, despite records in the Indian and Pacific oceans (Becker, 1964, 1983; Nafpaktitis *et al.*, 1977; Hulley, 1984, 1990b). Records exist off Christmas Island, and within the Western Australia EZ; the latter are probably referable to *G. barnesi*. The species has not been included in the key but may be distinguished from its congeners by having an incomplete lateral line, with last perforated scale below area of adipose fin origin; an anal-fin origin behind vertical through base of last dorsal-fin ray.

***G. venetus*.** Included here because its type locality is located off Norfolk Island. An equatorial population (between 140–155°W) of *G. venetus* may yet prove to be a cryptic species (Becker 1964; Wisner 1976) but requires

further investigation. This population has a complete lateral line with all scales perforated.

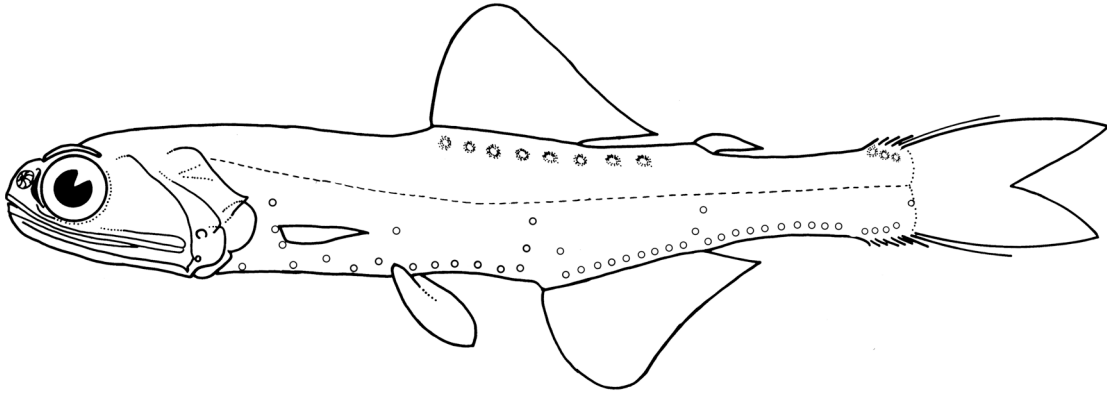
***Gymnoscopelus* Günther, 1873**

Gymnoscopelus species have the AO_a highly elevated (to about level of SAO₂ or higher), unlike all genera except *Idiolychnus* and some species of *Diaphus* (these two genera have fewer ventral procurent spines than the 10–15 of *Gymnoscopelus*); PO usually 5, but 6 (7) in 2 species; VO usually 5, but sometimes 6 in 1 species; Prc 4–8, with last separated posteriorly in all but 2 species. Dn well developed, Vn well developed in all but one species, completely fused with Dn (see **remarks**); variation within species not documented. SCO and ICO absent. Luminous-tissue patches in most species, probably all, but often lost; one specimen of *G. piabilis* with small luminous patch on every scale pocket; Wisner (1976) figured some exceptional specimens with luminous patches. Most meristic counts below are from the Hulley references. The largest known myctophid species is *Gymnoscopelus bolini* which attains 280 mm SL.

The genus is southern circumglobal in distribution; there are eight world species in two subgenera, all of which are recorded from Australian waters: see author’s (PAH) unpublished distribution data in **remarks**, and Nafpaktitis & Nafpaktitis (1969); Wisner (1976); Hulley (1981, 1986a, 1990a); McGinnis (1982); Becker (1983); Hoese *et al.* (2006); Flynn and Williams (2011); Duhamel *et al.* (2014); Roberts *et al.* (2015); Sutton *et al.* (2020); Mostarda *et al.* (2023); Koubbi *et al.* (2025). Data from non-Australian specimens in {} are from the above sources.

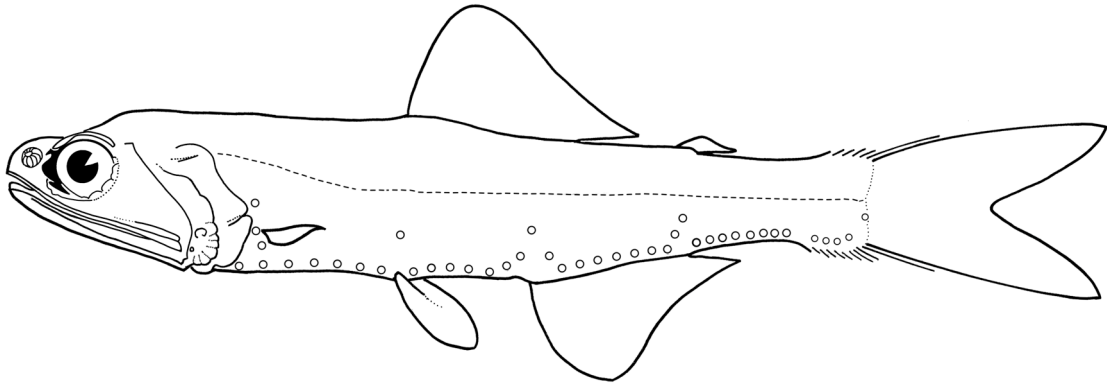
Key to the genus *Gymnoscopelus*

- 1 PVO₂ adjacent to pectoral-fin base; PLO closer to upper margin of pectoral-fin base than lateral line or midway between them subgenus ***Gymnoscopelus*** 2
- PVO₂ distinctly above level of upper end of pectoral-fin base; PLO much closer to lateral line than upper margin of pectoral-fin base subgenus ***Nasolychnus*** 5
- 2 Prc 4 (3, rarely 5) + 1, total 5 (4, rarely 6), last usually widely separated from rest; D 14–17 (rarely 18), its origin slightly behind vertical through outer pelvic-fin base 3
- Prc 5–7 (rarely 8), evenly spaced; D 18–21 (17–22), its origin on, or before, vertical through outer pelvic-fin base ... 4
- 3 GR 6 + 17 (16–18), total 23 (22–24) {6 (7) + 16–17 (18, rarely 15–19), total 22–23 (24, rarely 21–25)}; PO usually 5, with PO₃ and PO₅ slightly elevated; fresh eye colour pale blue; AO 9–10 + 9–10, total 19 {10 (9–11, rarely 8, 12) + 9 (8–10, rarely 11), total 19 (18–20, rarely 17, 21)}; fresh body colour smoky-grey; [VO 5 {5 (rarely 6)}; Prc 4 (3) + 1, {4 (3, rarely 5) + 1}; D 15–16 {16 (15–17, rarely 18)}; A 18 (16–17) {18 (17–19, rarely 16, 20)}; P 13–14 {13–14 (rarely 12, 15)}; max size 123 {162} mm SL; n = 5; MqI, HIMI ***Gymnoscopelus* (*G.*) *braueri* (Lönnberg, 1905)**



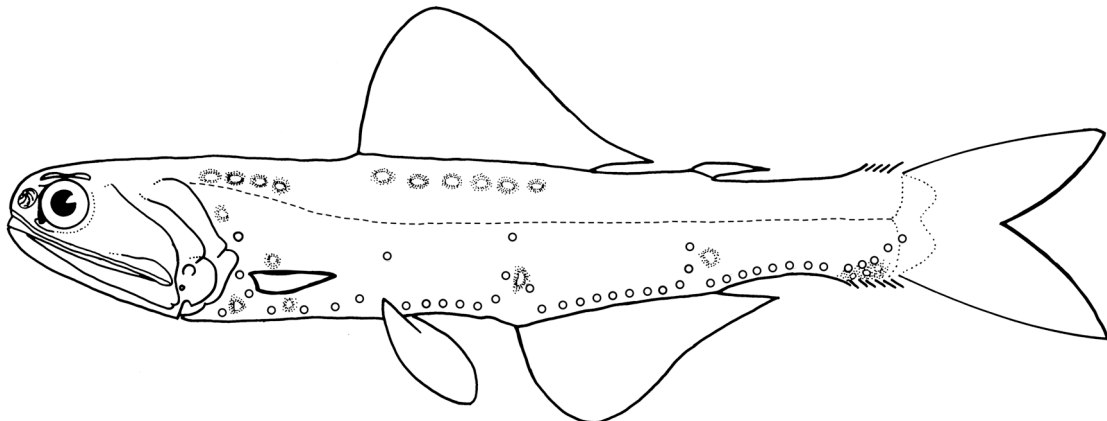
37122751 Brauer's Lanternfish (Hulley, 1986a)

- GR 8 + 19, total 27 {8 (7–9) + 18–19 (17–20, rarely 16), total 26–27 (25–28, rarely 23–29)}; PO 7 {6–7}, all level; fresh eye colour dark brown or black; AO 8 + 8, total 16 {9 (10) + 7–8, total 17 (16)}; blackish scales usually completely lost along with photophores and any luminous patches; [VO 5; Prc 4 + 1; D 16–18 (15) {16–17 (15, rarely 18)}; A 17 {17 (16–18)}; P 13–14 {13–14 (12)}; max. size 195 mm SL]; n = 5; MqI, HIMI *Gymnoscopelus* (*G.*) *opisthopterus* Fraser-Brunner, 1949



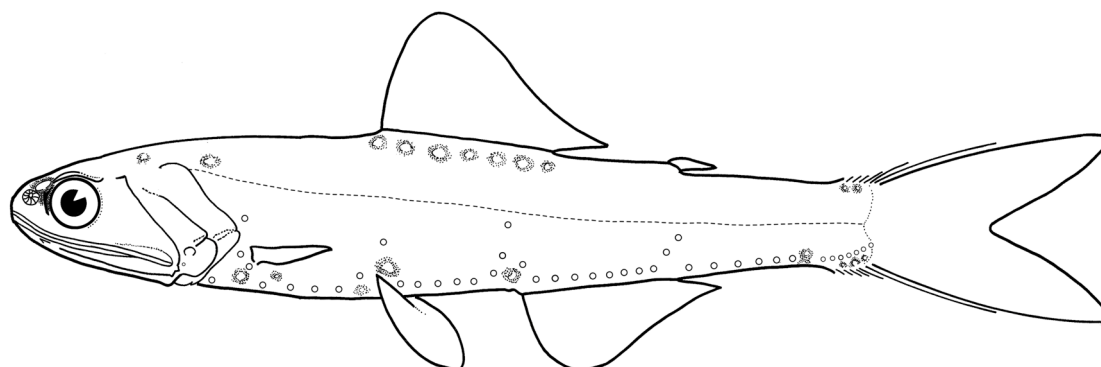
37122753 Ghost Lanternfish (Hulley, 1986a)

- 4 GR 6 + 16 (15), total 21–22 {6 (rarely 7) + 16 (15–17, rarely 14), total 22 (21–23, rarely 20)}; PO {usually 5}; D 19–22 {21 (19–22)}; [pelvic-fin rays pigmented, often entirely black; A 21–23 {21 (20–22, rarely 19)}; (AO 10 + 8, total 18 {11 (10, rarely 12) + 8–9 (7), total 19–20 (17–18)}; Prc 6 {5–6}; P 13–14 {12–13 (rarely 14)}; max. size 280 mm SL]; n = 5; SA, Tas, MqI, HIMI *Gymnoscopelus* (*G.*) *bolini* Andriashev, 1962



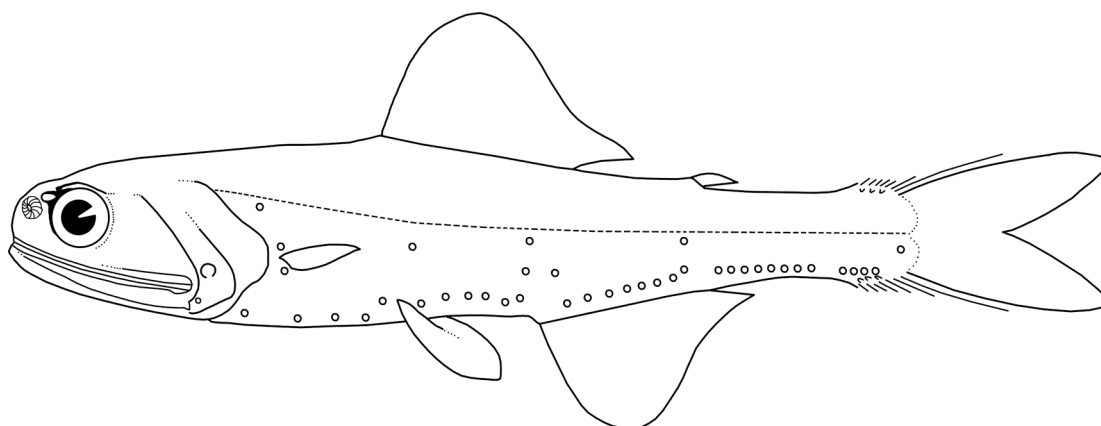
37122113 Grand Lanternfish (Hulley, 1986a)

- GR 10–11 + 21–22 (24), total 31–33 (35) {10–11 (rarely 9, 12) + 22–23 (21–24), total 32–33 (31–35, rarely 30, 36)}; PO 6 {usually 6}; D 18–19 {18 (17–19)}; [AO 9–10 + 6–7, total 16–17 (15) {10 (9–11, rarely 12) + 7 (6–8, rarely 9), total 17–18 (16–19, rarely 20)}; Prc 6–7 {7 (6, rarely 5, 8)}; A 18–19 {20 (19–21)}; P 13–14 {14 (13, rarely 15)}; max. size 185 mm SL; n = 5; MqI, HIMI *Gymnoscopelus (G.) nicholsi* (Gilbert, 1911)



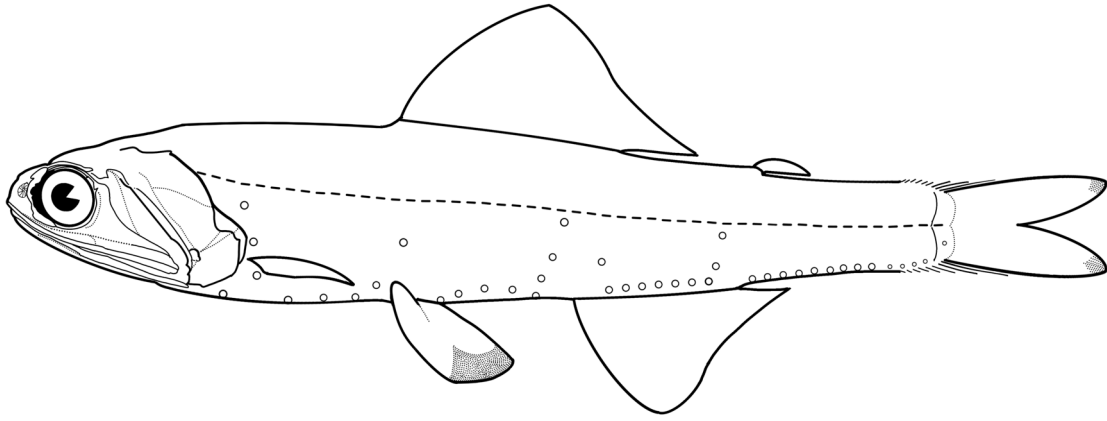
37122752 Nichols' Lanternfish (Hulley, 1986a)

- 5 Dn present, restricted to upper half of orbit, larger in males, iridescent yellow in life; Vn absent, although black skin may extend to anteroventral margin of eye; [AO 8–9 + 8–9, total 17–18 (16) {10 (9, rarely 11) + 9 (8, rarely 7, 10), total 18–19 (17, rarely 20, 21)}; Prc 3–4 (rarely 5) + 1, total 4–5 (rarely 6)}; GR 8–9 + 18–19, total 26–27 (25, 29) {8 (7–9) + 19 (18–20, rarely 17), total 27 (26–28, rarely 25, 29)}; D 18 (17) {17 (18, rarely 16)}; A 18–19 (17) {18 (19, rarely 17, 20)}; P 13–14 (12) {13–14 (rarely 12, 15)}; max. size 115 mm SL; n = 5; MqI, HIMI *Gymnoscopelus (N.) fraseri* Fraser-Brunner, 1931



37122114 Fraser's Lanternfish (Hulley, 1986a)

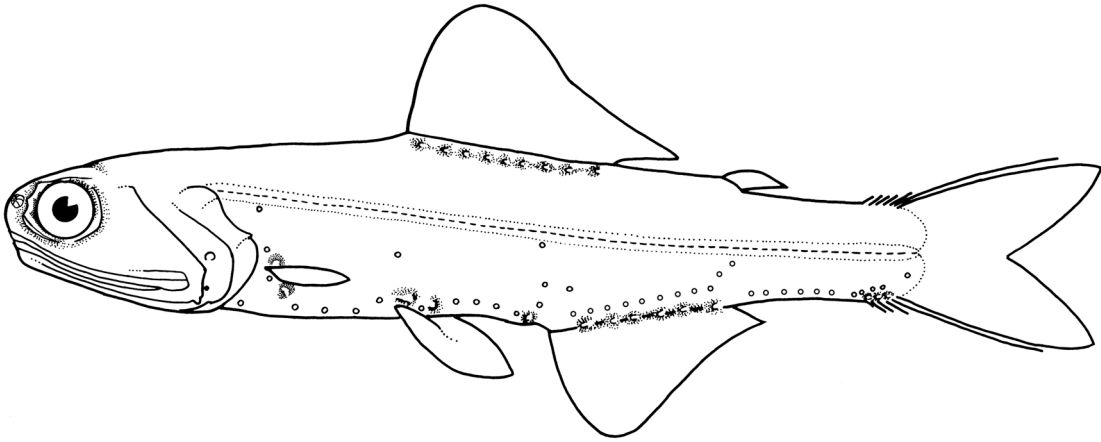
- Dn–Vn extending below upper half of orbit to at least anteroventral margin of eye 6
- 6 Pelvic-fin tips heavily pigmented, caudal-fin tips moderately pigmented, both with pigment on membranes and rays; [caudal-peduncle length greater than upper-jaw length; photophores normal in size, less than 2 diameters in adipose-fin base and lateral-line trough width; AO 8 (9) + 8 (9), total 16 (17) {8–9 (7–10) + 7–9 (10), total 15–17 (18–19)}; Prc 4 + 1, total 5 {4 (3–5) + 1, total 5 (4–6)}; GR 9–10 + 20–22 (23), total 29–32 (33) {10–11 (9–12) + 22–23 (20–25), total 32–33 (30–36)}; D 19–20 (18) {19 (18–20)}; A 18–19 (17, 20) {18 (17–19, rarely 16)}; P 13 (14) {13 (12–14)}; max. size 146 mm SL; n = 8; NSW, Vic, Tas, MqI, HIMI *Gymnoscopelus (N.) piabilis* (Whitley, 1931)



37122018 Southern Blacktip Lanternfish (Hulley, 1981)

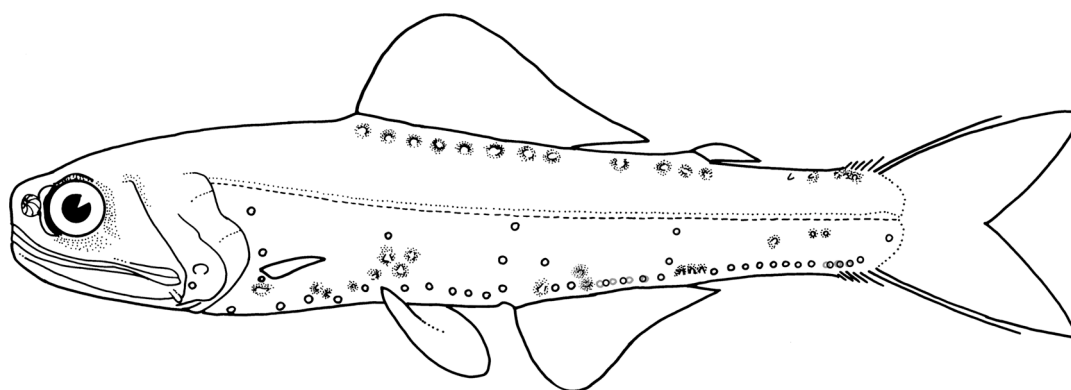
— Pelvic-fin and caudal-fin tips without pigment 7

- 7 Vn extending posteriorly under eye to level of mid-orbit; photophores small, about 2 diameters in adipose-fin base and lateral-line trough width; VO₅–SAO₁ space equal to SAO₁–SAO₂ space; ventral orbit margin to upper jaw distance equal to or less than pectoral-fin base length; GR 10–11 (9) + 20–22 (19, 23), total 30–31 (32, 34) {10 (9–11) + 21–23 (24), total 31–33 (30–35)}; [caudal-peduncle length equal to or less than upper-jaw length; AO 9 + 6 (7), total 15 (16) {9 (10) + 7–8 (6), total 16–17 (15–18)}; Prc 4 + 1 {3–4 + 1}; D 18–19 (17) {18–19 (20)}; A 19–20 (18, 21) {19 (18–20)}; P 13 (15) {13–14 (15)}; max. size 123 mm SL]; n = 5; Tas, MqI *Gymnoscopelus (N.) microlampas* Hulley, 1981



37122106 Minispotted Lanternfish (Hulley, 1981)

- Vn usually extending posteriorly only to level of anterior margin of pupil, rarely beyond; photophores larger, less than 2 diameters in adipose-fin base and lateral-line trough; VO₅–SAO₁ space about ½ SAO₁–SAO₂ space; ventral orbit margin to upper jaw distance 1.5 x pectoral-fin base length; GR 8–9 + 19, total 27–28 {9 (8–10, rarely 7) + 18–20 (21), total 26–29 (rarely 25–31)}; [AO 9–10 + 7–8, total 17 {8–9 (10, rarely 11) + 8 (7–9, rarely 6, 10), total 17 (15–19, rarely 20)}; Prc 4 + 1 {4 (3) + 1, total 5 (4)}; scale row above and below lateral line with small luminous patches on posterior edge of each scale pocket; D 18–19 {18 (17–19)}; A 18–20 {18–19 (rarely 17, 20)}; P 13–14 {13 (12–14, rarely 15)}; max. size 140 mm SL]; n = 3; Tas, MqI, HIMI *Gymnoscopelus (N.) hintonoides* Hulley, 1981



37122105 False-Midas Lanternfish (Hulley, 1981)

***Gymnoscopelus* remarks**

DNA studies by Denton (2014) and Martin *et al.* (2018) both recovered strong support for a sister relationship with this genus and *Lampichthys*, as well as good support for the monophyly of the genus. Denton (2014) sequenced DNA from 5 of the 8 species, but the two subgenera based on the positions of the PVO₂ and PLO described in couplet 1 were not corroborated. Further work, especially on the 3 unsampled species, is needed. The subgenera are provisionally retained here for convenience.

The luminous tissue around the anterior orbit is fused and separate Dn and Vn are not discernible. Paxton's (1972: 49) definition for all species of the tribe Gymnoscopelini incorrectly included character (26) "Dn and Vn present;" there is no luminous tissue in front of the eye ventral to the dorsal margin of the nasal organ in *G. fraseri*. Fusion of most tissue apparently prompted Nafpaktitis and Nafpaktitis (1969), Hulley (1981), Becker (1983) and Duhamel *et al.* (2005) not to use the terms Dn and Vn. With antorbital luminous tissue restricted to the Dn position in *G. fraseri* and extending posteroventrally to the level of the orbit midline in *G. microlampas*, use of Dn and Vn seems a valuable alternative even with fusion, as is the case in some species of *Diaphus*. Except for the distinctive features in the two species mentioned, detailed descriptions and variations within species are largely undescribed. Such a study will require ranges of specimen sizes with undamaged heads and eyes that have been unavailable for the current study.

***G. bolini*.** Oceanic, mesopelagic, but adults (> 100 mm SL) benthopelagic on slope regions in depths below 600 m (Marion Island) and 767–800 m (South Georgia) (Hulley, 1981); size stratification with depth (McGinnis 1982). In CCAMLR region, circumglobal between Antarctic Polar Front (APF) and Sub-Tropical Front (STF) but widely distributed south of the Sub-Antarctic Front (SAF) (Koubbi *et al.*, 2011), with northern extensions to about 38°S off Argentina, to 46°S off Chile, and to 34°S in eastern South Atlantic (Hulley, 1986a); distribution linked to AAIW.

***G. braueri*.** Oceanic, mesopelagic, showing size stratification with depth and seasonal variation in depth distribution. In CCAMLR region generally in AASW and AAIW between upper shelf-break of Antarctic continent and 33°S (south-western Atlantic sector), 46°S (mid Indian sector), and about 46°S (Pacific sector off Chile) in Polar Frontal, Subantarctic and Antarctic zones.

***G. fraseri*.** Oceanic, mesopelagic, possibly circumglobal between SAF and APF, but no records between 024°W–117°E except around Crozet and Kerguelen islands; and

with northern extensions to about STF in South-east Atlantic, Indian and Pacific sectors. Distribution associated with SAMW and AAIW (Duhamel *et al.*, 2014; Hulley, 1981). In CCAMLR region mainly between the northern boundary limits and APF in all three sectors, but extending south to SACCF in Atlantic and Pacific sectors. Species has been taken in bottom trawls.

***G. hintonoides*.** Oceanic, mesopelagic, generally circumglobal between STF and APF, but recorded between about 50°S–54°S along 040°W; and between the STF and APF at about 125°W. In CCAMLR region mainly between northern boundary limits and APF in all three sectors, but extending south to SACCF in western Pacific sector and into Ross Sea. Also taken in bottom trawls.

***G. microlampas*.** Oceanic, mesopelagic, generally circumglobal between SAF and STF, but south of Australia to SACCF. In CCAMLR region from 54.12°S, 30.98°W (Hulley, 1981) and in Indian sector at 45.91°S, 051.33°E, between about 47°S–51°S, 069°E–071°E, and between about 62°S–67°S, 139°E–145°E.

***G. nicholsi*.** Oceanic, mesopelagic / benthopelagic, generally distributed between Antarctic continent and 35°S (off Argentina); 47°S in Falkland Current region; and 47°–49°S (between 045°E and 071°E). Recorded in all CCAMLR regions, except Regions 485 (Weddell Sea) and 486 (South-Eastern Atlantic). Taken in bottom trawls on shelf and slope areas.

***G. opisthopectus*.** Oceanic, bathypelagic -- adults usually deeper than 400–500 m, with little evidence of vertical migration into mesopelagic zone (Donnelly & Torres, 2008; Koubbi *et al.*, 2011); probably benthopelagic over East Antarctic slope regions (Koubbi *et al.*, 2010, 2011, Hulley & Duhamel, 2011). Generally, circumglobal from SACCF to SAF, but occurring south of SACCF in Prydz Bay and Ross Sea to ice-edge (Donnelly *et al.*, 2006), and extending northwards to 40°S in Falkland Current region. In CCAMLR region mainly south of APF, but apparently only south of SACCF in spring and summer; associated with lower CDW at depths of 600–800 m (Hulley & Duhamel 2011).

***G. piabilis*.** Oceanic, mesopelagic / benthopelagic (adults), generally distributed between STF and APF (Atlantic Sector to South Australia/New Zealand), but with northern extensions in eastern boundary currents (to 40°S off Chile; to 25°S off Namibia); in western Atlantic sector off Uruguay; and north of Chatham Rise off New Zealand. Apparent absence in Subantarctic region of Pacific (McGinnis, 1982; Becker, 1983) may be due to sampling deficiency (Duhamel *et al.*, 2014). In CCAMLR region between northern boundary limits and APF in south-west Atlantic sector, southern Indian sector (46°–48°S, 051°–071°E), and south of Tasmania (57.68°S, 141.32°E).

Hintonia Fraser-Brunner, 1949

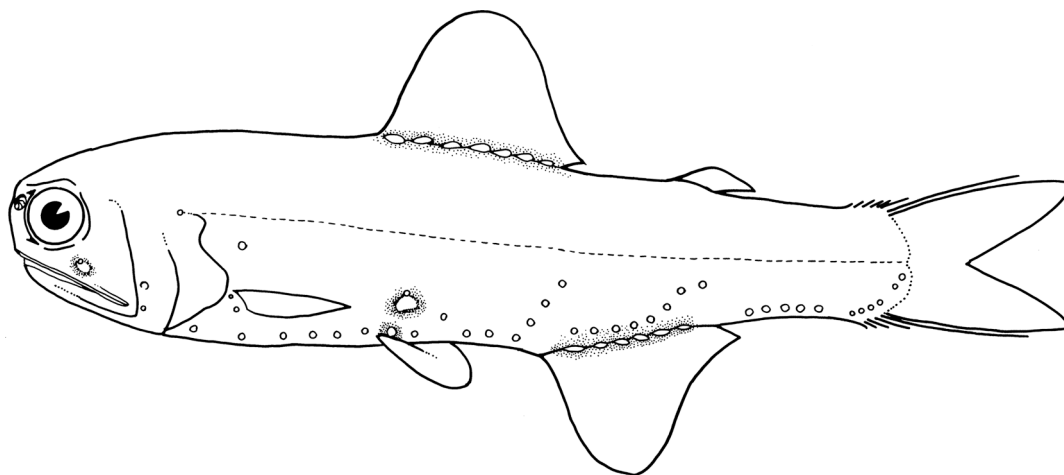
Distinctive genus with robust body, deep head and caudal peduncle, unique combination of photophores and luminous patches, Dn and Vn present (although often missing); SCO and ICO absent; small luminous patch on each scale pocket in best specimens.

This monotypic genus has a southern circumglobal distribution, see Wisner (1976); Hulley (1981, 1986a, 1990a, in preparation); McGinnis (1982); Becker (1983); Flynn and Williams (2011); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from the above sources.

Key to the genus *Hintonia*

AO 6 (5) + 5–6, total 11 (12) {6 (5–7) + 5 (6), total 11 (10–12, rarely 13)}; Prc 3 + 2 {3 (4) + 2, total 5 (6)}; large luminous tissue patch below cheek photophore (fresh colour golden), with other patches under VLO, under dorsal-fin base, over anal-fin base, and at pelvic-fin base; GR 6 + 13 (12) total 19 (18) {6 (7) + 12–13 (14), total 18–19 (20)}; D 14–15 {15 (14–16)}; A 13–14 {13 (12–14)}; P 14–15 {13 (14–15)}; max. size 130 mm SL;

n = 5; Tas, MqI, HIMI *Hintonia candens* Fraser-Brunner, 1949



37122115 Midas Lanternfish (Hulley, 1986a)

Hintonia remarks

No tissue was available for DNA sequencing when the studies of Denton (2014) and Martin *et al.* (2018) were completed, and the genus was placed in the tribe Gymnoscopelini or subfamily Gymnoscopelinae based on morphologic characters. The latter study recovered *Hintonia* as the sister group to the other five genera in the subfamily without further comment.

***H. candens*.** Oceanic, mesopelagic, with a circumglobal distribution between STF and SAF (ca. 38°S–55°S) in southwestern Atlantic sector of sub-Antarctic sector. Single record in CCAMLR region from 45.17°S, 069.20°E (Becker 1985).

Hygophum Bolin, 1939

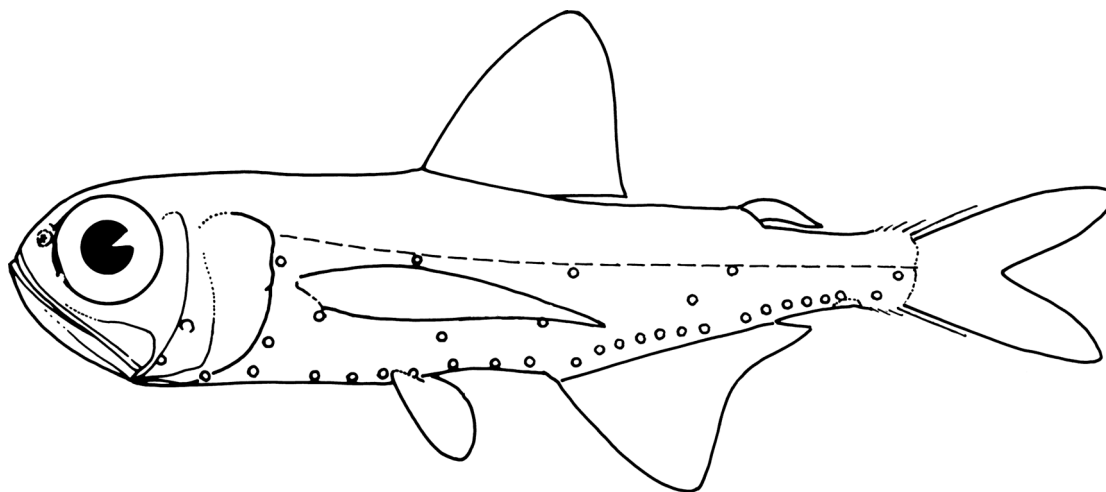
Species of this genus have the unique combination of 2 Pol

photophores, the PLO above the level of the pectoral-fin base, and 2 Prc photophores. There is a small Suo at the posterodorsal margin of orbit under 6th circumorbital, with black pigment dorsomedially. SCO in males only, as single plate in most species, developing as 4–6 distinct plates that fuse as adults in one species, or remain as distinct overlapping plates in one species; ICO in females only, usually as 1–4 plates that coalesce in adults of most species.

The genus is circumglobal in distribution with nine world species of which four occur in Australian waters, see Becker (1965, 1983); Nafpaktitis and Nafpaktitis (1969); Moser and Ahlstrom (1974); Wisner (1976); Nafpaktitis *et al.* (1977); McGinnis (1982); Hulley (1984, 1986a, 1990b); Paxton *et al.* (1989); Roberts *et al.* (2015); Yamaguchi (2000); Hoese *et al.* (2006); Hulley and Paxton (2016); Sutton *et al.* (2020); Mostarda *et al.* (2023); and Koubbi *et al.* (2025). Data from non-Australian specimens in {} are from Becker (1983).

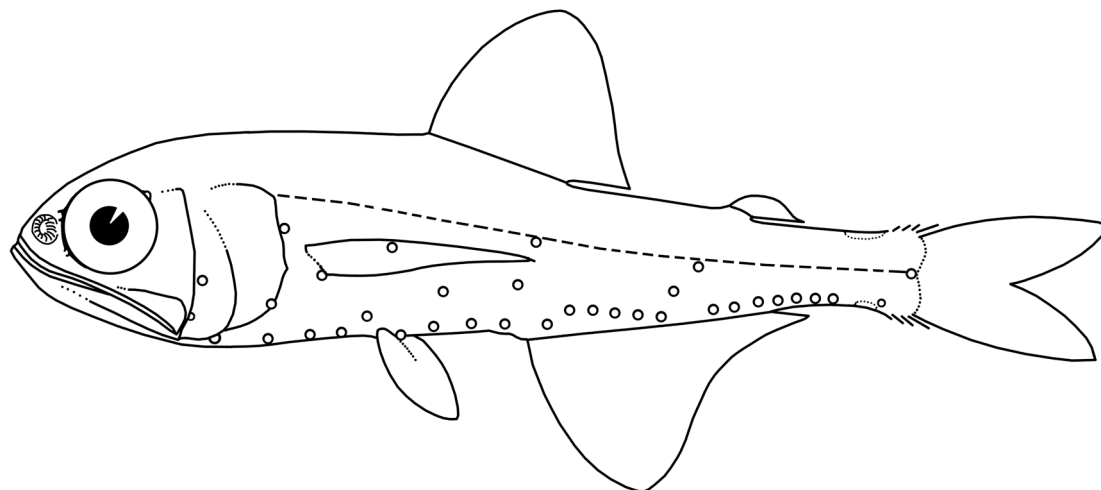
Key to the genus *Hygophum*

- 1 VLO at edge of lateral line; SAO₁ on or anterior to vertical through VO₂; GR 5 (6) + 15–16, total 20–21 (22) {5 + 15–16, total 20–21}; [AO 7 (rarely 6–8) + 6 (rarely 5–7), total 13 (rarely 12, 14) {7 (6–8) + 6 (5), total 13 (12)}]; SCO 1 (♂ usually > 45 mm SL) shorter than 50% dorsal caudal-peduncle length, ICO 1–3 (Hulley, 1986a) (♀ > 50 mm SL); D 14 (13, rarely 15) {14 (13–14)}; A 21 (rarely 20–22) {20–22}; P 15 (rarely 14–17) {16}; max. size 68 mm SL; n = 34; Qld, LHI, NI, NSW, Vic, Tas, SA, WA *Hygophum hygomi* (Lütken, 1892)



37122004 Hygom's Lanternfish (♀, Nafpaktitis & Nafpaktitis, 1969)

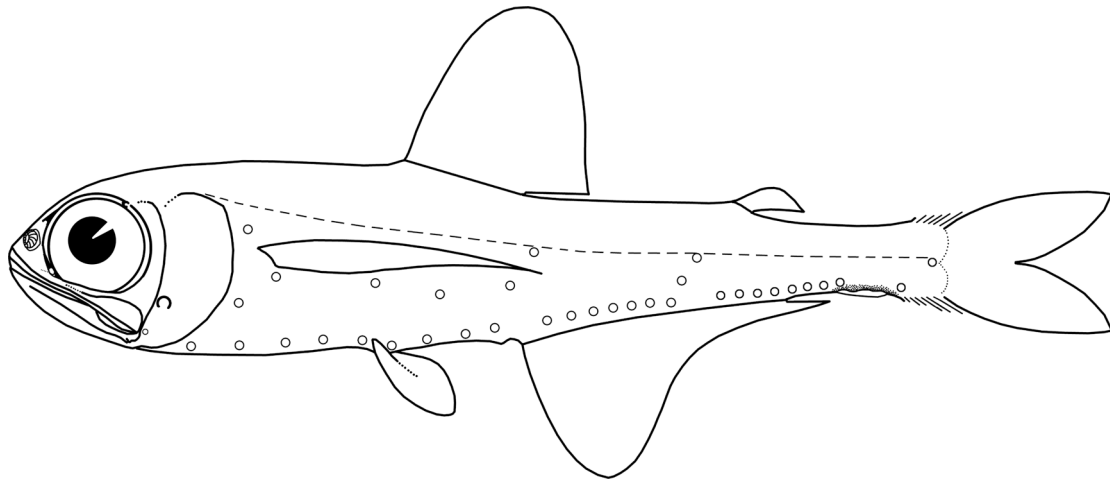
- VLO more than 2 diameters below lateral line; SAO₁ posterior to vertical through VO₂; GR 4 + 12–15, total 16–19 2
- 2 AOa series strongly arched with AOa₂₋₃ distinctly elevated; PO₅ elevated above pelvic-fin base; VLO distinctly closer to lateral line than pelvic-fin base, PLO-VLO line passing closer to SAO₂ than SAO₁; [AO 5–6 (rarely 7) + 7 (6–8), total 13 (12, rarely 14) {5–6 + 7–8, total 12–14}]; SCO 1 (♂ > 20 mm SL), shorter than 50% dorsal caudal-peduncle length, ICO 1–3 (Hulley, 1986a) (♀ usually > 25 mm SL); GR 4 + 13–14 (rarely 12), total 17–18 (rarely 16) {4–5 + 13–14, total 17–19}; D 14 (15) {13–14}; A 21 (20, rarely 22) {20–22}; P 15 (14–16) {14–16}; max. size 67 mm SL; n = 16; NSW, Vic, Tas, WA *Hygophum hansenii* Tåning, 1932



37122045 Hansens Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

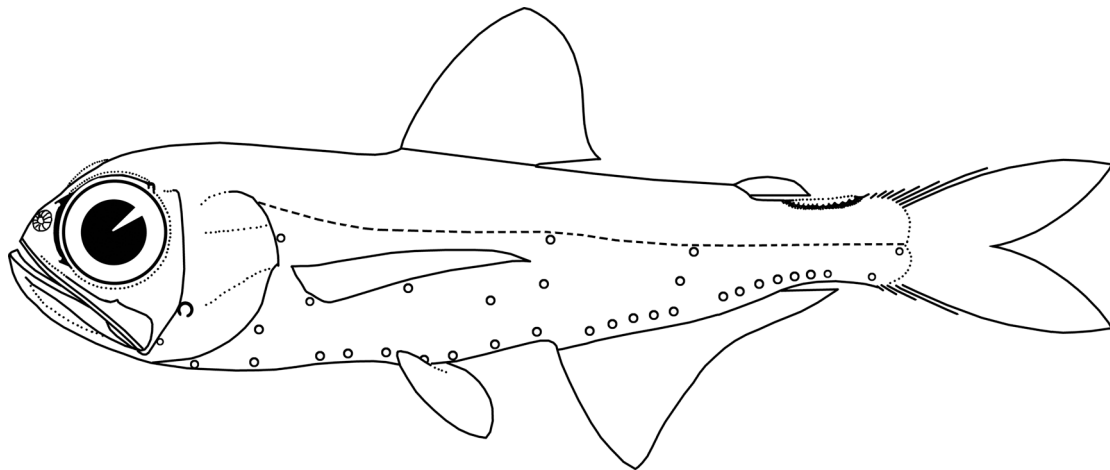
- AOA series level or slightly arched with AOA₂₋₃ level or slightly elevated; PO₅ not raised above pelvic-fin base; VLO about midway between lateral line and pelvic-fin base or slightly closer to lateral line, PLO-VLO line passing closer to SAO₁ than SAO₂ 3

- 3 A 22–23 (rarely 24) {22–23 (rarely 21, 24)}; end of dorsal-fin base to Prc₂ longer than (rarely = to) snout to pelvic origin; [AO 7 (6, rarely 5, 8) + 7–8 (rarely 9), total 14 (15, rarely 13) {6–7 (8) + 7–8 (6–9), total 13–15}]; SCO in ♂ > 30 mm SL usually < 60% (rarely 65%) dorsal caudal-peduncle length, ICO in ♀ > 30 mm SL 40–50% (rarely 60%) ventral caudal-peduncle length; GR 4 + 13–14 (rarely 12), total 17–18 (rarely 16) {4 (5) + 13–14 (12–15), total 17–18 (rarely 16, 19)}; D 14 (13, rarely 15) {14 (13–15)}; P 15 (14) {14–15 (13)}; max. size. 61 mm SL; n = 25; Qld, LHI, NI, NSW, ChI *Hygophum reinhardtii* (Lütken, 1892)



37122046 Reinhardt's Lanternfish (♀, Nafpaktitis *et al.*, 1977)

- A 19–20 (21, rarely 18) {20 (19, rarely 18, 21)}; end of dorsal-fin base to Prc₂ shorter than (rarely = to) snout to pelvic origin; [AO 5–6 (rarely 4) + 6–7 (8), total 12–13 (11–14); 5–6 (rarely 4) + 6–7, total 12 (11–13) in Coral Sea, n = 43; SCO in ♂ > 30 mm SL usually > 75% (rarely 65%) dorsal caudal-peduncle length, ICO in ♀s > 30 mm SL 40–65% ventral caudal-peduncle length; GR 4 + 14 (13, rarely 15), total 18 (17, rarely 19) {4–5 + 13–14, total 17–20}]; D 13–14 {14 (13, rarely 12)}; P 14–15 (rarely 16) {14 (13, rarely 15)}; max. size 54 mm SL; n = 30; Qld, NI, NSW, Vic, Tas, SA, WA, ChI (just outside EZ) *Hygophum proximum* Becker, 1965



37122023 Firefly Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

Hygophum remarks

Of the nine species recognised in the genus, Denton (2014) and Martin *et al.* (2018) sampled six and three species respectively in their DNA studies. In both investigations, the species were recovered in a clade related to a clade of species that will retain a generic name within the *Myctophum* complex (see **remarks** under *Myctophum* complex).

Most species of *Hygophum* have variation in one or more morphological characters of adults that define different populations, as discussed by Becker (1965), Wisner (1976), Nafpaktitis *et al.* (1977), and Hulley (1981). Australian adult specimens of some species display similar differences from other populations and further study is warranted. Moser and Ahlstrom (1974) demonstrated there are three basic larval forms with more apparent total species than recognised adult species. Yamaguchi (2000) provided a molecular phylogeny based on seven of the nine species and discussed a proposed evolution of the three larval forms. An expansion of that study to the population level could inform consistent species identification.

***H. hanseni*.** Circumglobal in region of, and north of STF (30°S–44°S). Not yet recorded from CCAMLR region, but reported from just outside CCAMLR boundary limits in southwest Atlantic and Indian sectors (Hulley, in prep.)

***H. macrochir*.** Paxton *et al.* (1989) and Hoese *et al.* (2006) recorded specimens off southern NSW and south-eastern WA as *H. cf macrochir*. As the Pol₁₋₂ line passed

through or anterior to the penultimate AOa in some of these seven specimens, they were considered most similar to the Atlantic endemic *H. macrochir*. However, comparison with a larger number of *H. proximum* now available indicates they represent the southernmost Australian specimens of this species, and *H. cf macrochir* should be removed from the Australian species list.

***H. reinhardtii*.** Although this species is sympatric with *H. proximum* off the entire east coast of Australia, *H. reinhardtii* is more common off NSW and *H. proximum* much more common in the Coral Sea.

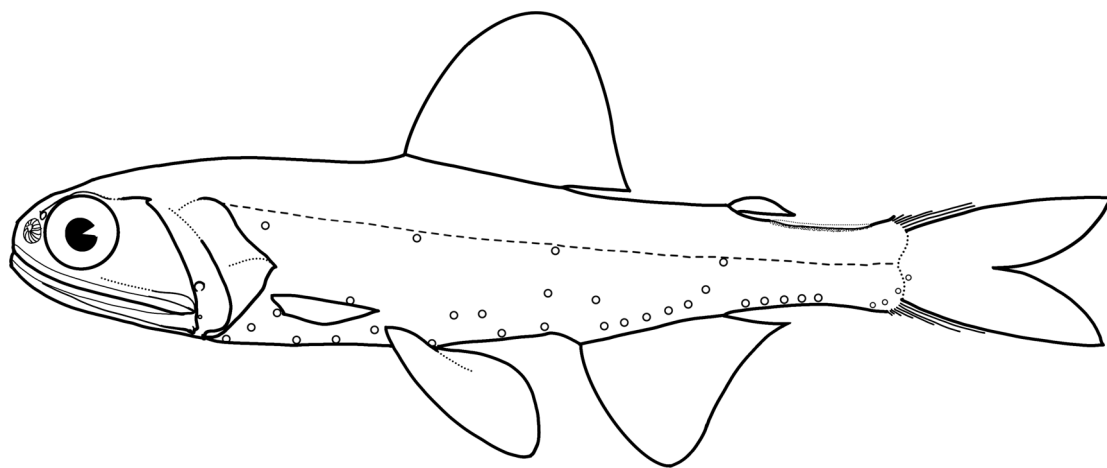
***Idiolychnus* Nafpaktitis & Paxton 1978**

A monotypic genus closely related to *Diaphus* and *Lobianchia*. These genera share characters including PLO, VLO, Pol photophores close to lateral line, but *Idiolychnus* differs in having 2 SAO not 3, VO₂₋₃ elevated and level, in a horizontal line dorsoposterior to VO₁; AOa₁ elevated above level of AOa₂₋₄.

The genus is known from the Indian Ocean off Madagascar and Reunion; the western Pacific and off Hawaii); and from New Caledonia, close to Australian waters in the Coral Sea; see Becker (1983, 1992); Schwartzhans (2013); Mostarda *et al.* (2023); and Liu *et al.* (2024).

Key to the genus *Idiolychnus*

Small Dn present, no Vn; SCO present in ♂, ICO present in ♀.
GR {6 (5, 7) + 14–15 (13), total 20–21 (18, 22); AO 7 (6–8) + 5–6 (7), total 12–13 (14); D 15 (14); A 15 (14–16); P 14 (13–15)};
Max. size = 110 mm SL]. Data from non-Australian specimens in {} are from the above sources. Not yet recorded from Australian waters .. *Idiolychnus urolampus* (Gilbert & Cramer, 1897)



37122126 Tail-lamp Lanternfish (♂, Nafpaktitis & Paxton, 1978)

***Idiolychnus* remarks**

The DNA studies by Martin *et al.* (2018) substantiated

the inclusion of *Idiolychnus*, *Lobianchia* and *Diaphus* as a monophyletic group, incorporated into the subfamily Diaphinae.

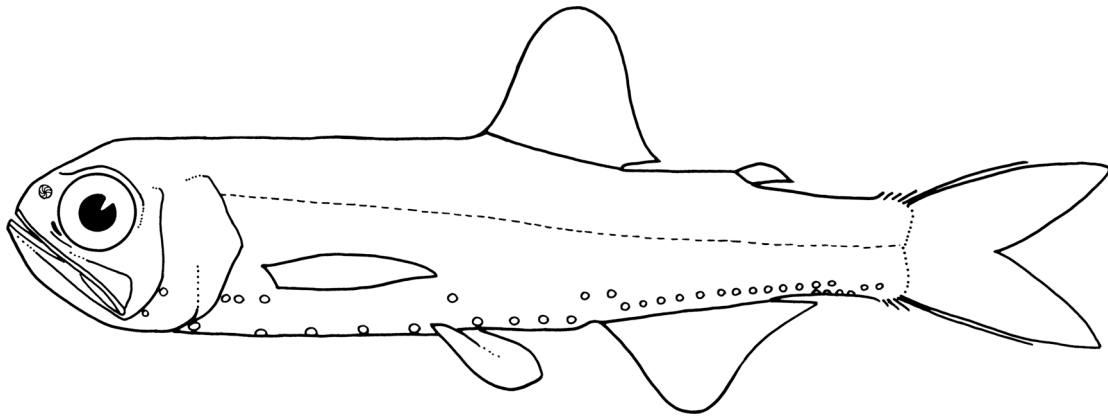
Krefftichthys Hulley, 1981

The single species has all photophores low on body; the PLO, PVO₁, and PVO₂ on a straight, horizontal line, and 2 SAO. Males have only an SCO comprised of 5–8 separate, individually complex, luminous organs with black margins, while the female has only an ICO of 2–5 separate, small, luminous organs without black margins.

This monotypic genus has a southern circumglobal distribution, see Wisner (1976); Hulley (1981, 1986a, 1990a, in prep.); McGinnis (1982); Becker (1983); Flynn and Williams (2011); Duhamel *et al.* (2014); Sutton *et al.* (2020); Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from the above sources.

Key to the genus *Krefftichthys*

AO 14–15 {12–13}; Prc 2 {2}; SCO 5–7 {5–8}; ICO 5 {2–4}; GR 6–8 + 19–20, total 26–28 {6–8 + 19–22, total 27–30}; D 11–12 (13, 14) {12–14}; A 17–18 {17–20}; P 14–15 {14–16}; max. size 82 mm SL; n = 5; Tas, MqI, HIMI *Krefftichthys anderssoni* (Lönnberg, 1905)



37122754 Rhombic Lanternfish (♀, Hulley, 1981)

Krefftichthys remarks

Denton (2014) recovered the monotypic *Krefftichthys* as a separate clade, sister to the larger clade of the speciose genus *Protomyctophum*, supporting previous considerations of relationships. The study of Martin *et al.* (2018), based on far fewer species, described a more complex clade.

Distributional records for *K. anderssoni* have been recently summarised by Hulley (in prep.); the species is circumglobally distributed in a 20° latitude belt centered on the Antarctic Polar Front, between the Subantarctic Front and the Southern Antarctic Circumpolar Current Front, and extending northwards between 080°W–120°W, and in the Falkland Current, to about 33°S; it is uncommon south of the Southern Antarctic Circumpolar Current Front, where populations appear to be non-reproducing, and less common as adults on peri-insular slopes. Its distribution is associated with Antarctic Intermediate Water and Circumpolar Deep Water.

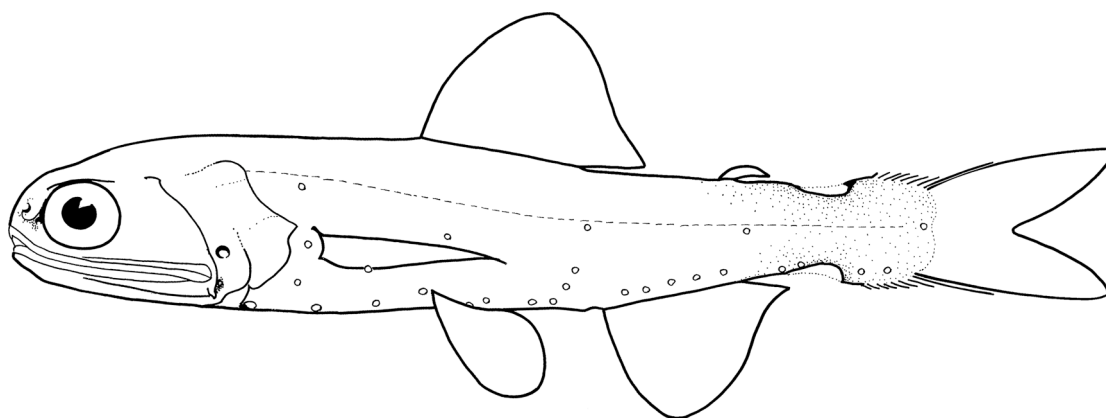
Lampadena Goode & Bean, 1893

One of only two genera (the other, *Taaningichthys*) with SCO and ICO present in both sexes as single, large, translucent organs without divisions and usually bordered by heavy black pigment. Pterotic spine present; no white crescent on posterior half of iris, but one species (*L. chavesi*) with white crescent on dorsal half of iris; single row of 3–9 strongly hooked teeth at posterior end of dentary; Prc 3.

The genus has a circumglobal distribution with nine world species in two subgenera; six occur in Australian waters, and all are in subgenus *Lampadena*, see Nafpaktitis and Paxton (1968); Krefft (1970); Nafpaktitis *et al.* (1977); Hulley (1981; 1984, 1986a, 1990b, in prep.); Becker (1983); Niass and Ozawa (2000); Hoese *et al.* (2006); Roberts *et al.* (2015); Hulley and Paxton (2016); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from the above sources.

Key to the genus *Lampadena*

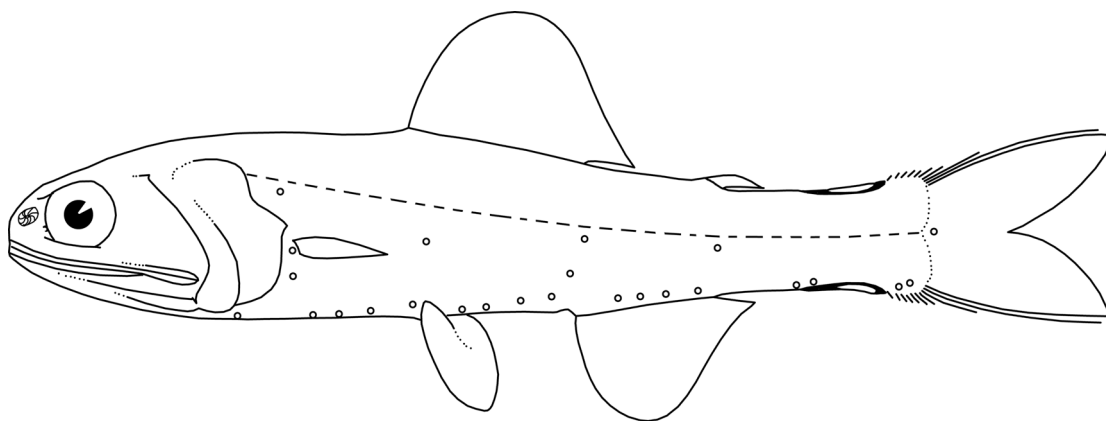
- 1 PO₄ highly elevated and anteriorly displaced towards vertical through PO₃; [posterior mesopterygoid teeth enlarged; AO 5 + 2, total 7 {6 (7) + 2, total 8–9}; GR 4 + 10 (11), total 14 (15) {4 + 10 (9–11)}; D 15 (rarely 14); A 14 (13–15); P 15–16 (rarely 14); max. size 200 mm SL; n = 11; Qld, LHI, NI, NSW, WA, CoI *Lampadena luminosa* (Garman, 1899)



37122094 Luminous Lanternfish (Nafpaktitis & Paxton, 1968)

— PO level or PO4 and PO5 slightly elevated, especially in larger specimens 2

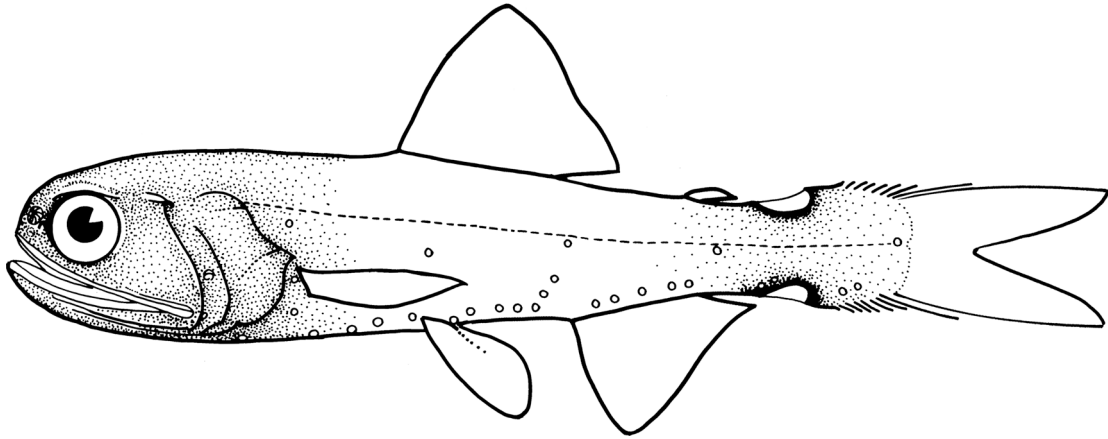
- 2 VO + SAO 5–6; AOa 3–4; SCO and ICO weakly developed with only moderate amount of black border, thin in cross section; body soft; [GR 5 + 11–12, total 16–17 {5 + 11–13, total 16–18}; AO {3–4 + 2, total 5–6}; D 15 {13–15}; A 12 {13–15}; P 13 {15–16}; max. size 200 mm SL; n = 1; Qld ***Lampadena anomala* Parr, 1928**



37122127 Anomalous Lanternfish (Nafpaktitis et al., 1977)

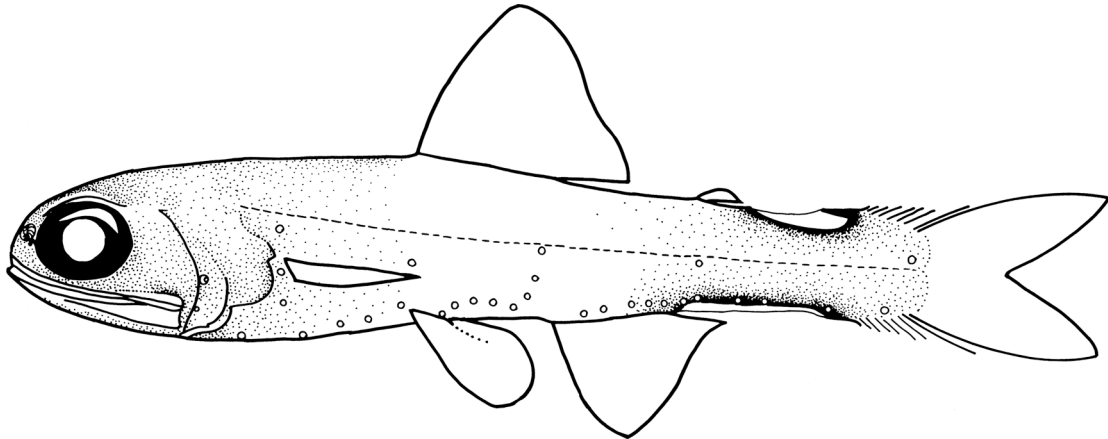
— VO + SAO 7–8 (rarely 9); AOa 5–7; SCO and ICO well developed with heavy black border, thick in cross section (except ICO in *L. chavesi*); body firm 3

- 3 GR 4 + 9, total 13 {3–5 + 9–11, total 12–16}; SCO equal to or, in largest specimens, longer than ICO; posterior mesopterygoid teeth noticeably enlarged; [AO 5 (6) + 2, total 7 (8) {5 (6) + 2 (3), total 7 (8–9)}; D 15 {15 (14–16)}; A 14 (15) {14 (13)}; P 17 (15–16) {17}; max. size 230 mm SL; n = 5; Qld, LHI, NSW, WA ***Lampadena urophaos* Paxton, 1963**



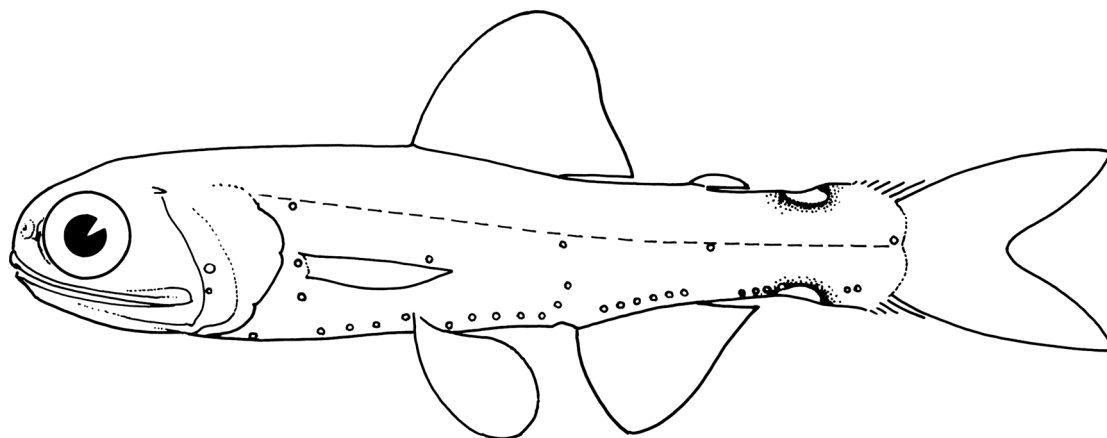
37122095 Tail-light Lanternfish (Nafpaktitis & Paxton, 1968)

- GR 6–8 + 13–18, total 19–26; SCO shorter than ICO; posterior mesopterygoid teeth not noticeably enlarged 4
- 4 Prc₁₋₂ interspace more than 3 times photophore-diameter; ICO length almost 2 eye diameters; AOp 2; crescent of white tissue on dorsal part of iris; [AO {7 + 7 (8) + 2, total 9 (10)}; GR 6 + 14, total 20 {6–7 + 14, total 20–21}; D 14 {14}; A 14 {13–14 (12)}; P -- {16–17}; max. size 80 mm SL; n = 1; WA.....*Lampadena chavesi* Collett, 1905



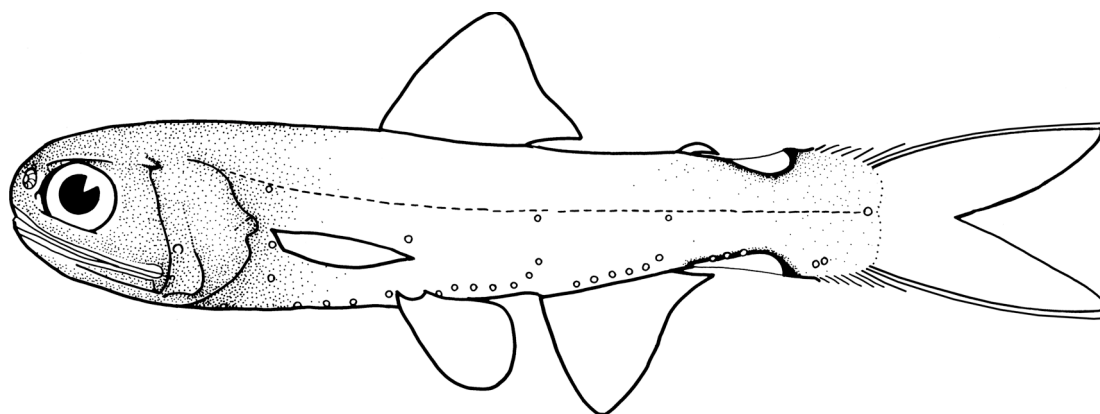
37122093 Chaves' Lanternfish (Nafpaktitis & Paxton, 1968)

- Prc₁₋₂ interspace less than two photophore-diameters; ICO length less than 1.5 eye diameters; AOp 3–5; no crescent of white tissue on dorsal part of iris ... 5
- 5 GR 6 (7) + 13 (14–15), total 19 (20–22) {6–7 + 14 (12–16), total 19–22 (23)}; distance between anal-fin base and ICO equal to or longer than length of ICO; distance between adipose-fin base and SCO greater than length of SCO; 1–2 AOp before ICO; photophores small, in specimens 30 mm or less; AOa separated by two photophore-diameters; [AOa usually level; AO 7 (6) + 3–4, total 10–11 {6–7 (5–9) + 3 (2–5), total 10 (7–12)}; D 13–14 {14 (13–15)}; A 13–14 {14 (13–15)}; P 15 (14–16) {14 (13–16)}; max. size 153 mm SL; n = 7; NSW, Tas, SA, WA *Lampadena speculigera* Goode & Bean, 1896



37122062 Mirror Lanternfish (Nafpaktitis & Paxton, 1968)

- GR 7–8 (9) + 17–18, total 24–26 {7–8 + 16–19, total 24–28 (23)}; distance between anal-fin base and ICO about one quarter the length of ICO; distance between adipose-fin base and SCO less than one half the length of SCO; all AOp over ICO; photophores large in specimens 30 mm or less; AOa separated by less than one photophore-diameter; [last AOa usually slightly elevated higher than rest of series; AO 6 (7, rarely 5) + 3 (4, rarely 2), total 9 (10, rarely 8, 11); D 14 (13) {14}; A 14 (13–15) {14}; P 15 (14, rarely 13) {14}; max. size 140 mm SL]; n = 19; LHI, NSW, Vic, Tas, MqI ... *Lampadena notialis* Nafpaktitis & Paxton, 1968



37122047 Notal Lanternfish (Nafpaktitis & Paxton, 1968)

Lampadena remarks

The DNA study of Denton (2014) presented *Lampadena* as paraphyletic, with *Taaningichthys* embedded within the genus. The study of Martin *et al.* (2018) gave similar results. Of the nine known species, four have yet to be sequenced; see also Poulsen *et al.* (2013). None of the studies proposed taxonomic changes and none should be done until most of the species are sampled.

L. anomala. Niass and Ozawa (2000) described differences between North Pacific and Atlantic specimens. Known from eastern Atlantic, Gulf of Mexico, Caribbean, and western Atlantic (40°N–16°S); Indian Ocean (18°N–05°S); South China Sea; off New Guinea and eastern Australia; and Central Pacific (28°N–10°S).

L. notialis. Oceanic, mesopelagic, generally between 30°S–47°S in Atlantic, Indian and Pacific oceans, including Tasman Sea (Flynn & Pogonoski 2012).

L. speculigera. Oceanic, mesopelagic, generally between 68°N–30°N, with isolated records S to 17°N in Mauritanian upwelling region, and 22°S–50°S; Indian and Pacific: 33°S–

43°S, and off Australia, New Zealand and Peru.

L. urophaos. 1 AMS specimen from LHI in stomach contents of Blue-eye Trevalla, *Hyperoglyphe antarctica*, taken by hook and line near the bottom at ca. 350m.

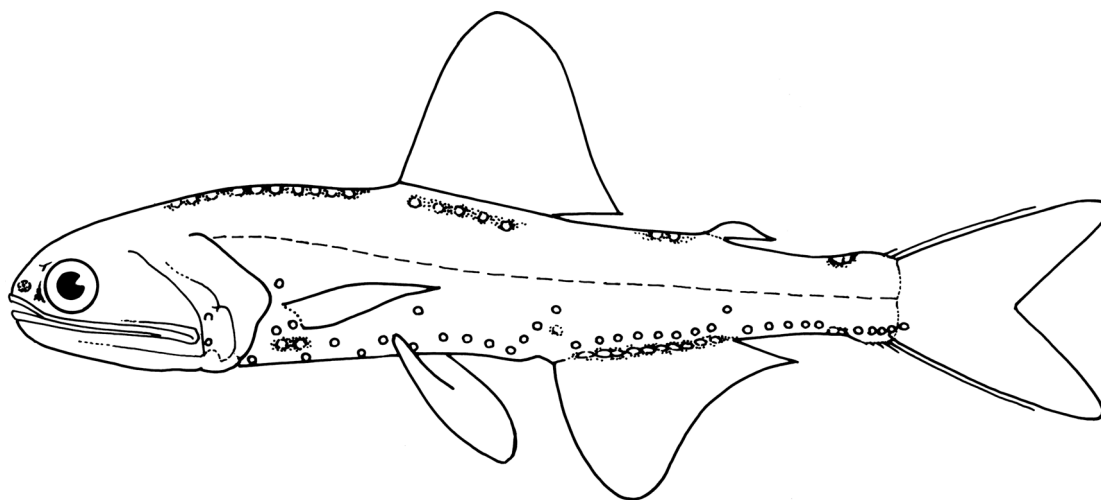
Lampanyctodes Fraser-Brunner, 1949

The single species has the PO₃ and PO₅ photophores elevated, 5 Prc photophores, and luminous patches along the dorsal body contour, pre-dorsally, under the dorsal-fin base, before the adipose fin, under the pectoral-fin base, and over the anal-fin base. There is an SCO and ICO in both sexes. See **remarks** for comment on relationships.

This monotypic, pseudoceanic genus has a Southern Hemisphere, temperate distribution, see: Becker (1983); Hulley (1986a, 1990b); Florence *et al.* (2002); Hoese *et al.* (2006); Paxton and Bray (2008); Roberts *et al.* (2015); Hulley and Paxton (2016); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Roberts *et al.* (2015).

Key to the genus *Lampanyctodes*

AO 8 (7–9) + 6 (5–7), total 14 (13–15) {8–9 + 6–7}, total 14–16; SCO 1–3 (4), ICO 1–3 (rarely 4); GR 10–11 (rarely 9) + 20–22 (rarely 18, 19, 23) total 30–33, (rarely 27, 29, 34) {10–11 + 19–22, total 29–33}; D 14 (rarely 13, 15) {14 (rarely 13, 15)}; A 16 (15–17) {15–17}; P 13 (12–14) {12–13 (rarely 14)}; max. size 70 mm SL; n = 50; NSW, Vic, Tas, SA, WA *Lampanyctodes hectoris* (Günther, 1876)



37122002 Hector's Lanternfish (Hulley, 1986a)

Lampanyctodes remarks

The DNA studies of Denton (2014) and Martin *et al.* (2018) both recovered strong support for a sister relationship with this genus and the clades of *Lampichthys* and *Gymnoscopelus*.

Occurs over continental shelves and upper slopes in depths of 100–850 m (day) and from surface to 850 m (night), and known from off South Africa, New Zealand, and southern Peru (Hulley & Paxton, 2016).

Lampanyctus Bonaparte, 1840

Distinguished from other related genera by a combination of 4 Prc, PO₄ highly elevated, and SAO₃ always posterior to vertical through last VO. Species with short or absent pectoral fins and soft body, previously recognised as the genus *Nannobranchium*, are now considered a junior synonym (see **remarks** below). In contrast, other *Lampanyctus* species have a firm body, and pectoral fins that are moderate to long, extending at least beyond base of pelvic fin (except *L. macdonaldi*, *L. simulator* and *L. iselinoides*, each with short pectoral fins not extending to pelvic-fin base, and with cheek photophores, but with a small luminous patch present at the adipose-fin origin in *L. macdonaldi* an additional PLO photophore in *L. simulator*, and secondary photophores in *L. iselinoides*, none of which is found in *Nannobranchium*). The SCO and ICO are composed of coalesced plates that are sometimes difficult to distinguish individually, but none have the structure of semi-translucent tissue surrounded by heavy black border typical of *Lampadena* and *Taaningichthys*. Some species with cheek photophores, and with secondary photophores and luminous tissue patch at the anterior border

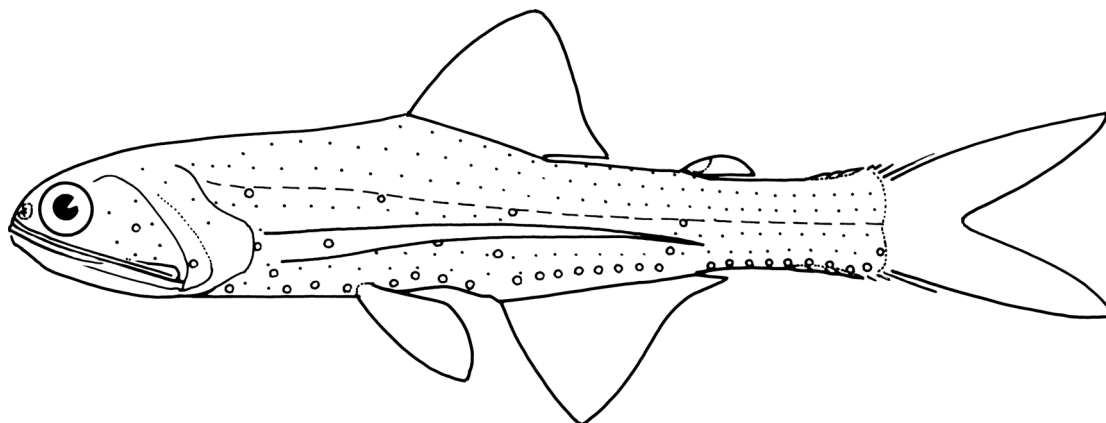
of the adipose fin; species without cheek photophores lack both secondary photophores and luminous tissue at adipose fin. Many species also have a Ce photophore, and the AO_p being continuous with 4 Prc. Trawl-caught specimens of *Lampanyctus* are prone to abrasion and loss of photophores; other characters may be of greater use to identify specimens to species-level. Sources of non-Australian data in {} are from Hulley (1981) except as shown in **remarks**.

The genus has a circumglobal distribution, and is the second largest genus in the family Myctophidae with 40 valid species (Fricke *et al.*, 2025), of which 15 occur in Australian waters with 1 other potentially occurring. Additional distributional data in **remarks** from Hulley (in prep.).

Recent studies (Denton, 2014; Martin *et al.*, 2018) based on DNA and analyses of previous morphologic and larval characters concluded that all species in *Lampanyctus* and *Nannobranchium* together form a monophyletic clade, but neither genus was monophyletic. In this key *Nannobranchium* is treated as a subgenus, but recognised as a junior synonym (see **remarks**); and see Bolin (1959); Nafpaktitis and Nafpaktitis (1969); Nafpaktitis (1973); Wisner (1976); Nafpaktitis *et al.* (1977); Hulley (1981, 1984, 1986a, 1990); McGinnis (1982); Paxton *et al.* (1989); Rivaton and Bourret (1999); Zahuranec (2000); Hoese *et al.* (2006); Poulsen *et al.* (2013); Denton (2014); Roberts *et al.* (2015); Hulley and Paxton (2016); Kobylansky (2016); and Clements and Stewart (2026). Data from non-Australian specimens in {} are from Wisner (1976) (*L. intracarius*); Nafpaktitis *et al.* (1977) (*L. festivus*); Hulley (1981) (*L. macdonaldi*, *L. vadulus*); Zahuranec (2000) (*L. lineatus*, *L. archirus*, *L. ater*, *L. niger*); and Clements and Stewart (2026) (*L. mendeleevi*).

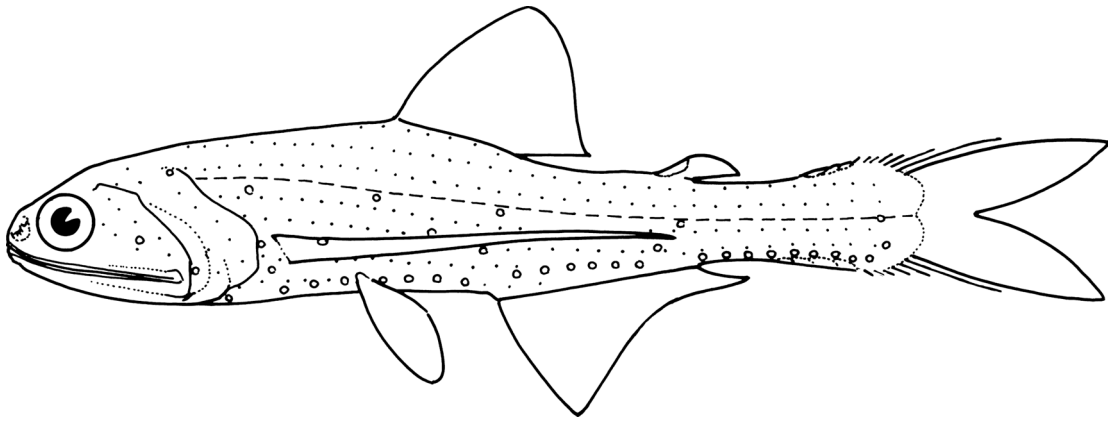
Key to the genus *Lampanyctus*

- 1 Pectoral fin short, rays not reaching outer pelvic-fin base, or pectoral fin absent 12
- Pectoral fin moderate to very long, rays extending posteriorly beyond outer pelvic-fin base – subgenus *Lampanyctus* ... 2
- 2 1–3 cheek photophores present; secondary photophores on head, including membrane between branchiostegal rays, and body, or restricted to lateral line... 3
- No cheek photophores; no secondary photophores; [no luminous patch at origin of adipose fin; pectoral fin extending to end of dorsal-fin base] 7
- 3 VLO at, or one diameter below, lateral line; pectoral fin very long, rays extending to adipose-fin origin; [luminous patch at adipose origin] 4
- VLO at least two diameters below lateral line; pectoral-fin moderate to long, rays extending to about end of dorsal-fin base at most ... 5
- 4 GR 6–7 (rarely 8) + 14–15 (rarely 13, 16), total 20–22 (rarely 19, 23) {6 (7) + 14–15 (16), total 20–21 (22–23)}; AO 7–8 (9, rarely 6) + 7–8 (rarely 6), total 14 (15, rarely 13, 16) {7–8 (rarely 9) + 7–8 (rarely 6 or 9), total 15 (14, rarely 16)}; P 14–15 (13) {14 (13, rarely 15)}; [1 cheek photophore; secondary photophores over whole body; ICO {4–5}; D 13 (12–14) {13 (12–14)}; A 18 (17, rarely 16, 19) {18 (17–19)}; max. size 131 mm SL]; n = 30; NSW, Vic, Tas, WA, MqI, HIMI *Lampanyctus (L.) australis* Tåning, 1932



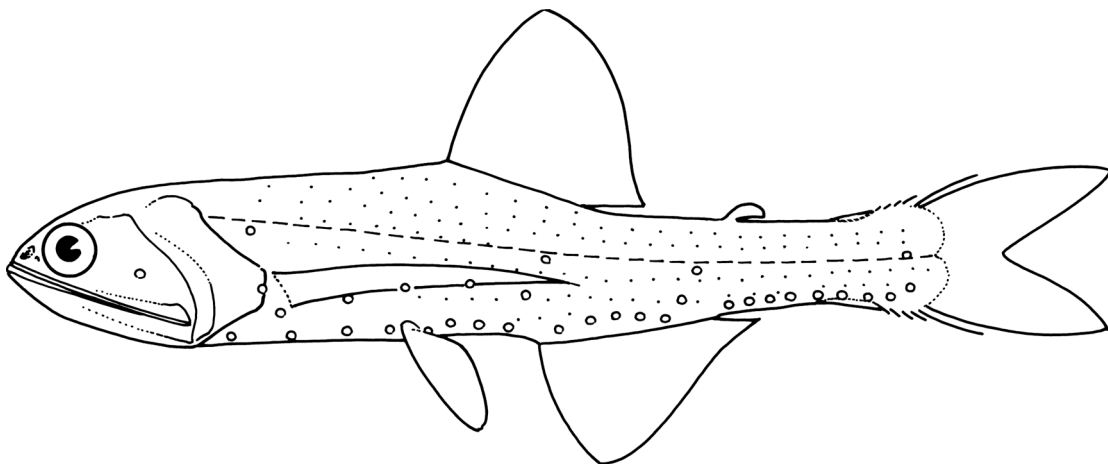
37122019 Austral Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- GR 3–4 + 10 (rarely 9, 11), total 13–14 (rarely 12, 15 {Southern Population: 3 + 10 (9), total 13 (12)}; AO 5–6 (rarely 7) + 6 (5–7), total 12 (11–13, rarely 14) {6 (5–7) + 6–7 (5–8), total 12–13 (11)}; P 12–13 (rarely 14) {12 (11–13)}; [1 cheek photophore; secondary photophores over whole body; ICO {4–5}; D 12–13 (11) {12 (11)}; A 17 (16, rarely 15, 18) {17 (16–18)}; max. size 61 mm SL]; n = 54; Qld, NSW, Vic, Tas, WA *Lampanyctus (L.) alatus* Goode & Bean, 1896



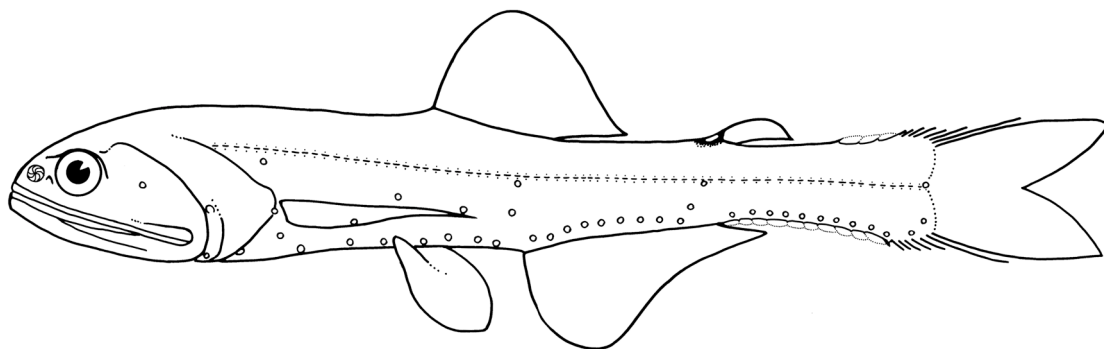
37122048 Winged Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- 5 No luminous patch at adipose origin; AOa₁ and AOa₂ in line with other AOa photophores. [Cheek photophores 1; secondary photophores over whole body; Prc continuous with AOp; ICO 3 (2–4), extending less than 50% of caudal-peduncle length; anal-fin origin under posterior third of dorsal-fin base; GR 3 + 9 (8), total 12 (11) {3 + 9 (rarely 10), total 12 (rarely 13)}; AO 4–5 (rarely 3) + 5–6 (rarely 7), total 9–11 {5 (4) + 5 (6), total 10 (rarely 9 or 11)}; D 12 (13, rarely 11, 14); A 14–15 (rarely 13) {14–15 (rarely 13)}; P 14–15 (13) {14 (13)}; max. size 43 mm SL; n = 25; NSW, Vic, Tas, WA .. *Lampanyctus (L.) pusillus* (Johnson, 1890)



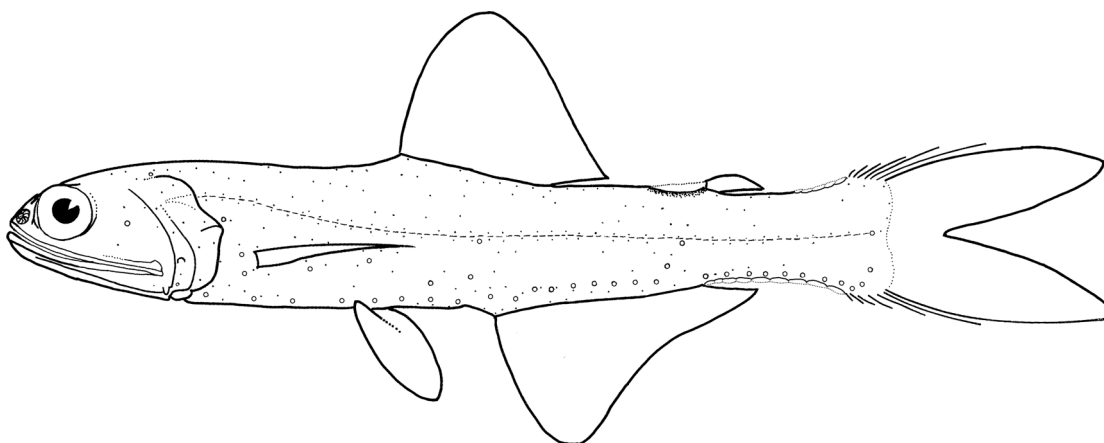
37122052 Pygmy Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- Luminous patch at adipose origin; AOa₁ and/or AOa₂ depressed below line of other AOa photophores 6
- 6 SAO₁ on or above level of SAO₂; adipose luminous patch shorter than adipose-fin base; P 14–15 (13, 16) {14 (13–15)}, reaching AOa₃ in specimens over 70 mm SL; PLO 1–2 diameters below lateral line; secondary photophores on each side of lateral line; caudal-peduncle depth less than head depth (taken on vertical through middle of orbit); [GR 4 (5) + 11, total 15 (16) {4 + 10 (11), total 14 (15)}; AO 9 (10) + 8 (9,10), total 17 (18) {8–9 (10) + 8–9 (10), total 17 (16–19)}; cheek photophores 1–2 (3); ICO 8–9 {8–10}; D 14–16 {14–15}; A 18–19 (20) {18–19}; max. size 200 mm SL; n = 15; NSW, Vic, Tas, WA *Lampanyctus (L.) intricarius* Tåning, 1928



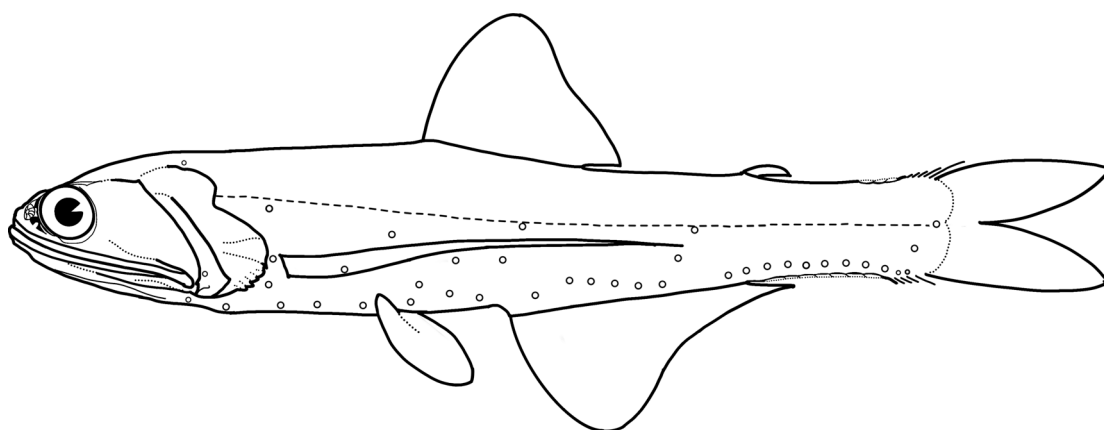
37122020 Intricate Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- SAO_1 below level of SAO_2 ; adipose luminous organ longer than adipose-fin base; P 11–13 {12–13 (rarely 14)}, not reaching anal-fin origin; PLO more than 2 diameters below lateral line (see **remarks** below); secondary photophores on all body scales; least depth of caudal peduncle equal to or greater than head depth (taken on vertical through middle of orbit); [AO 8–9 + 8 (7–9), total 16–17 (rarely 15) {8 (9 (rarely 7 or 10) + 8 (7–9, rarely 6), total 16 (15–17, rarely 18 or 19))}; GR 4 + 11 (rarely 10), total 15 (rarely 14) {4 (very rarely 3) + 11 (10, rarely 9 or 12), total 15 (14, rarely 13 or 16)}; 1 cheek photophore; ICO 8 (7); D 14–15 {15 (14–16)}; A 18–19 {19 (18–20)}; max. size 119 mm SL; n = 18; NSW, Vic, Tas *Lampanyctus (L.) lepidolichnus* Becker, 1967



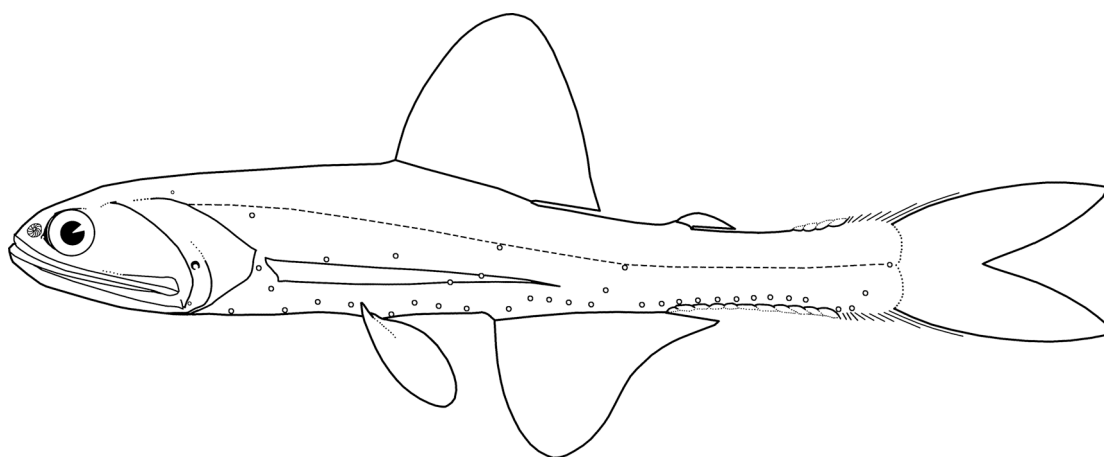
37122051 Mermaid Lanternfish (Hulley, 1986a)

- 7 VO_2 elevated and anteriorly displaced to lie just posterior to vertical through VO_1 ; [distance between VLO and outer pelvic-fin base 2.5–3 times as great as distance between VLO and lateral line; Pol_2 well in advance of adipose-fin origin; Prc_1 , Prc_3 , Prc_4 on same straight line, with Prc_2 level with but posterior to Prc_1 , so that line through Prc_2 – Prc_3 – Prc_4 appears antero-dorsally convex; GR 3 + 11, total 14 {3 + 9 (10), total 13 14}; AO 5 + 9, total 14 {4–6 + 8–9, total 13–15, with AOa arched}; ICO 10; D 14 {13–14}; A 17 {19–20 (18)}; P 14 {13–14}; max. size 33 mm SL; not yet recorded from Australian EZ, but records from Timor Sea *Lampanyctus (L.) macropterus* Brauer, 1904



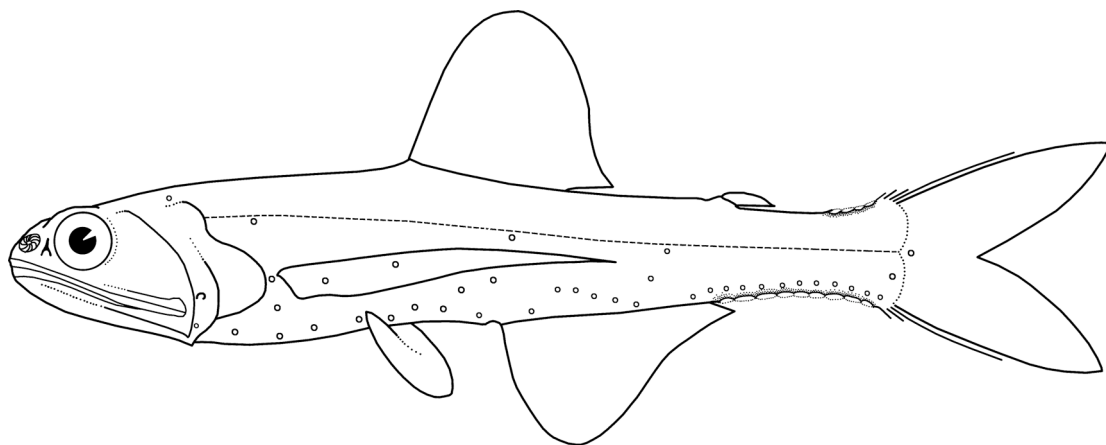
37122130 Longfin Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- VO₂ level with rest of VO series or only slightly raised, but never anteriorly displaced to vertical through VO₁ 8
- 8 SAO₁ behind vertical through VO₃; Prc₂₋₄ in straight oblique line or with Prc₃ less than two diameters anterior or posterior to Prc₂₋₄ line 9
- SAO₁ on or before vertical through VO₃; Prc₂₋₄ in curved line with Prc₃ more than two diameters posterior to Prc₂₋₄ line ... 10
- 9 Eye diameter 3.5–3.9 in upper jaw length; GR 3 + 10 (rarely 9–11), total 13 (rarely 12–14) {3 + 10 (9–11), total 14 (rarely 13 or 15)}; [AO 6 (5–7) + 9 (8–10), total 15 (16) {6 (5–7) + 9 (8–10), total 15 (14–16)}; ICO 9 (8); D15 (16) {15 (16)}; A 18–19 {18 (19)}; P 14–15 (16) {14 (13–15)}; max. size 125 mm SL; n = 5; Qld, NSW, Vic, WA *Lampanyctus (L.) nobilis* Tåning, 1928



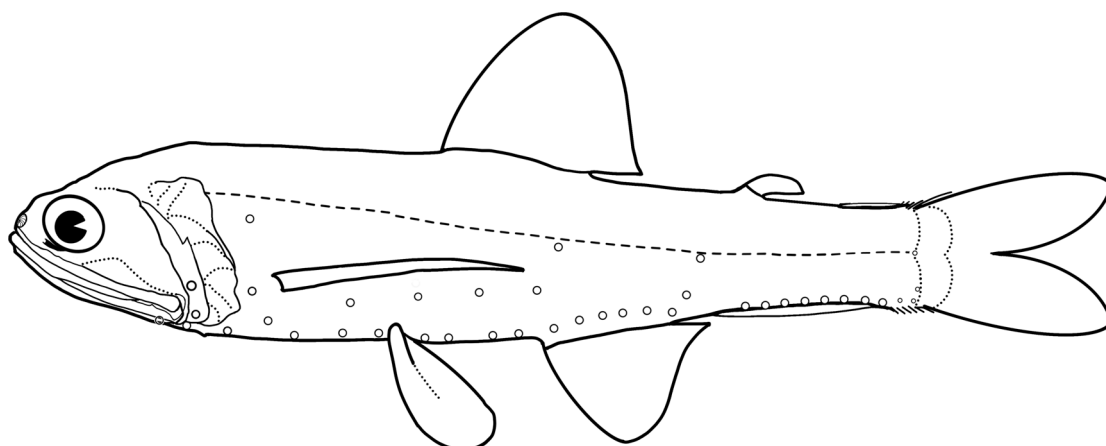
37122097 Noble Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- Eye diameter 2.8–3.2 in upper jaw length; GR 4 + 11, total 15 {4 + 11 (rarely 10 or 12), total 15 (rarely 14 or 16)}; [AO 6 (5) + 9 (8–10), total 15 (14) {6 (5–7) + 9–10 (8–11), total 15–16 (14–17)}; ICO 8–9; D 14 (15) {15 (14–16)}; A 18 (19) {18 (17–19)}; P 14 (rarely 15, 16) {14 (13–15)}; max. size 108 mm SL; n = 8; Qld, WA, but see **remarks** *Lampanyctus (L.) vadulus* Hulley, 1981



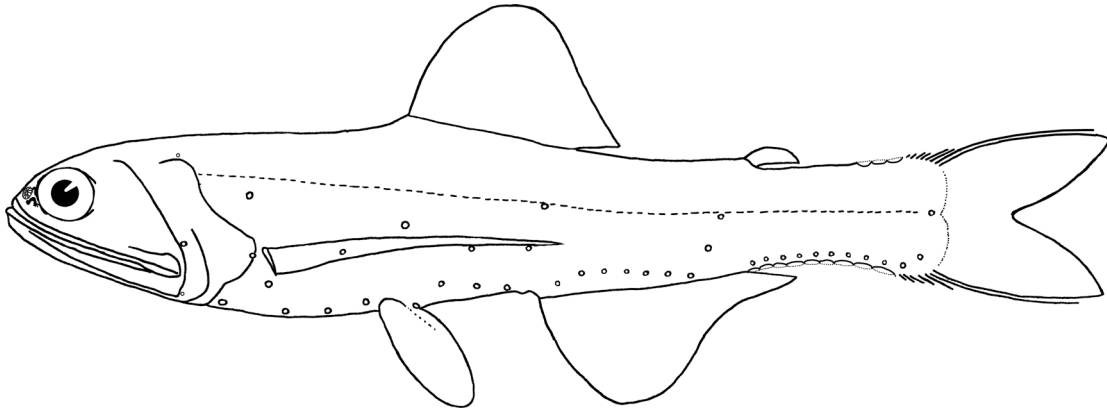
37122132 Nacreous Lanternfish (Hulley, 1981)

- 10** ICO expanded laterally with AOp photophores touching or less than a half diameter above ICO edge; SAO₃ directly above AOa₁; VLO midway between lateral line and pelvic-fin base or lower, on SAO₁₋₂ line; [AO 7 + 7 {6 (6–8) + 8 (6–8), total 14 (13–15)}; GR 4 + 10–11, total 14–15 {4 (4–5) + 10 (9–11), total 14 (13–15)}; D 12 (13) {12 (12–14)}; A 16 (17) {16 (15–17)}; P 14 (15) {14 (12–15)}; max size 61 mm SL; n = 5; Vic, Tas, SA, WA *Lampanyctus (L.) mendeleevi* Clements & Stewart, 2026



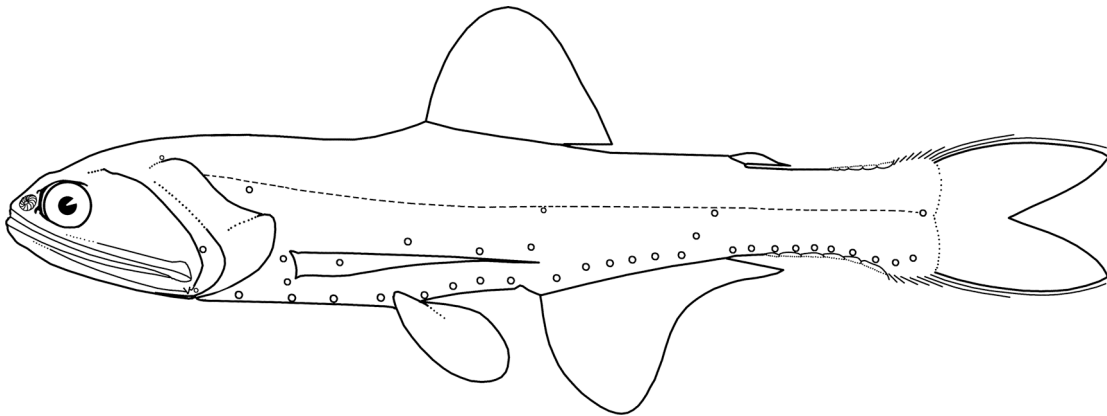
37122064 Mendeleev's Lanternfish (LM)

- ICO not expanded laterally, AOp photophores more than one half diameter above ICO edge; SAO₃ before vertical of AOa₁; VLO closer to lateral line than pelvic-fin base, above SAO₁₋₂ line **11**
- 11** VO arched with VO₂ elevated, but not anteriorly displaced; AO 7 (rarely 6, 8) + 9–10 (rarely 8), total 16–17 (rarely 15) {7 (6–8) + 8–9 (10), total 15–16}; AOp₁ usually over anal-fin base; Prc₃ higher than Prc₁; ICO 8–9, extending 95–100% of caudal peduncle between anal-fin base and procurrent rays; P 16–17 (15) {16 (15–17)}; [GR 4 + 10, total 14 {4 + 10 (9), total 14 (13)}; D 14–15 (rarely 13, 16) {13 (14)}; A 20–21 {19 (18–20)}; max. size 138 mm SL; n = 11; Qld, LHI, NI, NSW, Vic, Tas, WA *Lampanyctus (L.) festivus* Tåning, 1928



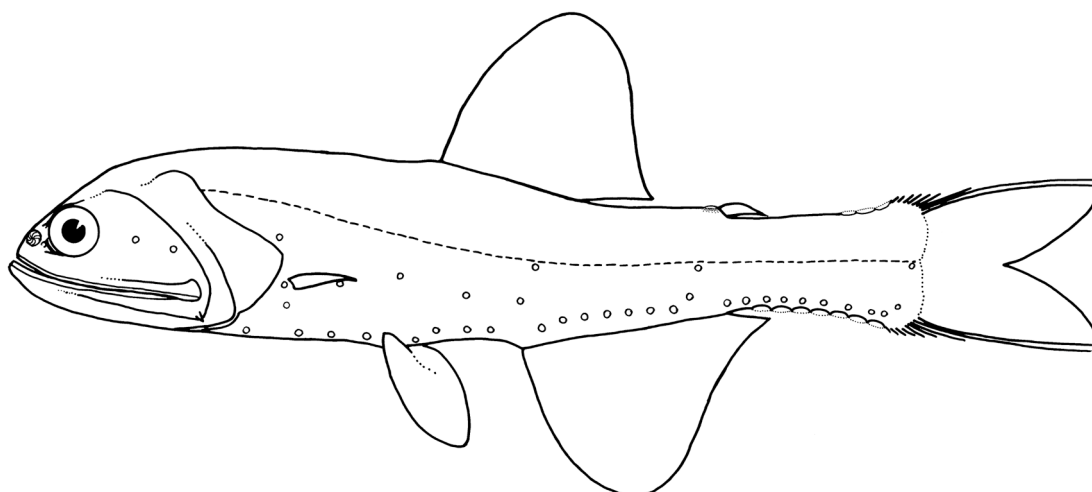
37122050 Festive Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- VO level or VO₂ slightly elevated, and not anteriorly displaced; AO 6–7 + 6, total 12–13 {6–7 + 6–7, total 12–13}; AOp₁ behind (rarely over) end of anal-fin base; Prc₃ at level of Prc₁; ICO= 10, not under entire caudal peduncle between anal-fin base and precurrent rays; P 14 {13–14}; [GR 4+11, total 15 {4 + 10, total 14}; D 15 {13–14}; A 19 {18 (17)}; max size 187 mm SL]; n=3; Qld, NSW, Tas ... *Lampanyctus (L.) tenuiformis* Brauer, 1906



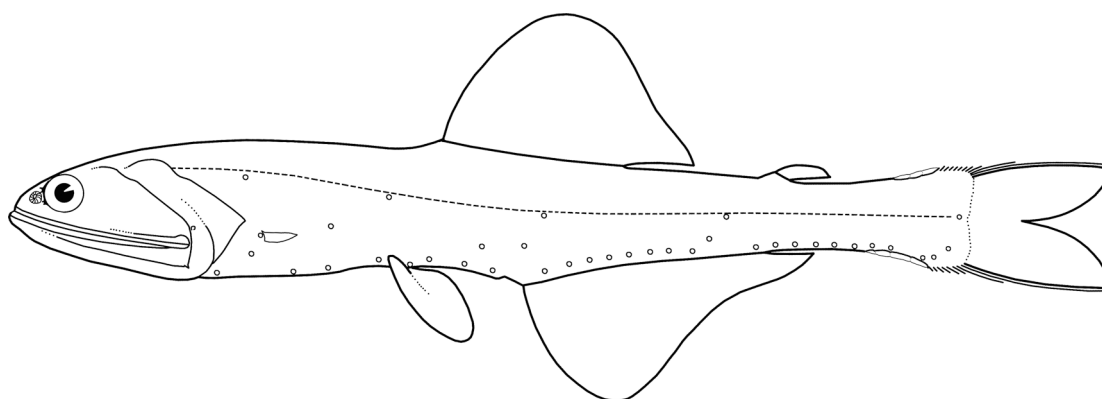
37122131 Slender Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- 12 Total GR 23–27 (22–28); 2 cheek photophores present; luminous patch present just before origin of adipose fin; body robust; [GR 8 (7–9) + 19 (17–18), total 27 (25–28), {7 (6–8) + 17 (15–18), total 24 (21–26); AOa level or slightly arched; AO 7–8 + 7–9, total 14–16 {6–7 + 7–8, total 13–15}; SCO 2–4; ICO 7–9, under 95% or more of caudal-peduncle length; D 14 (16) {14 (13–15)}; A 17–18 {17 (15–18)}; P 13 (12) {13 (12–13)}; max. size 160 mm]; n = 5; Vic, Tas, MqI ... *Lampanyctus (L.) macdonaldi* (Goode & Bean, 1896)

37122063 MacDonald's Lanternfish (Nafpaktitis *et al.*, 1977)

— Total GR 14–19 (rarely 12–13, 20–21); no cheek photophores;
no patch of luminous tissue at origin of adipose-fin base;
body soft ... *Lampanyctus (Nannobranchium)* 13

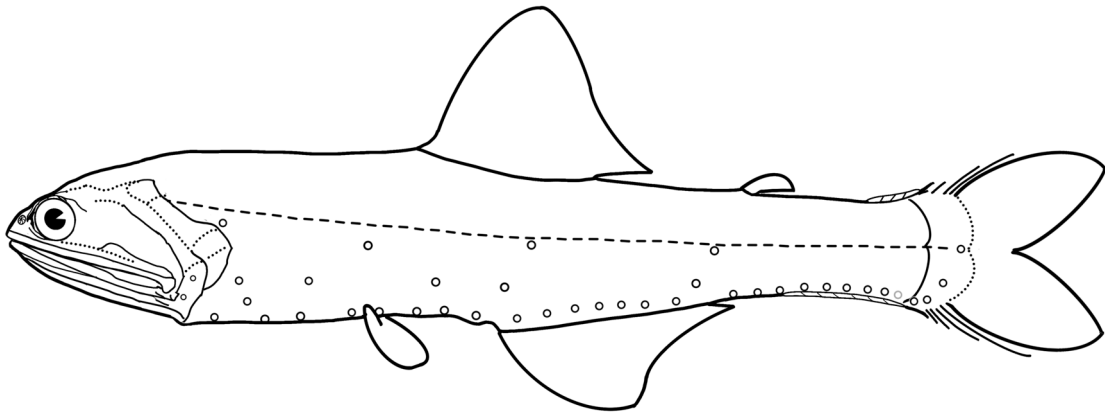
13 SAO₁ behind vertical through VO₃; Prc₃ usually closer to vertical
through Prc₂ than vertical through Prc₄; posterior tip of SCO and
ICO with black pigment cap (lost in many specimens); [AO 7 + 8,
total 15, {7–8 (rarely 9) + 7–8 (9), total 15–16 (17)}; GR 5 + 12,
total 17 {5 (rarely 4, 6) + 12 (13, rarely 11), total 17 (18, rarely
16, 19)}; SCO 3–6 {3 (4, rarely 2, 6)}; ICO 5 {0–i (rarely ii),
4–5}; D 16–17 {17 (16–18)}; A 20 {20–21 (rarely 19, 22–23)};
lateral line organs 39–40 {38–39 (40, rarely 37, 41–44)}; vertebrae
39–40 {39–40 (rarely 38, 41–44)}; max size 237 mm SL; n =
3; NI, Tas, ChI *Lampanyctus (N.) lineatus* (Tåning, 1928)



37122128 Longtail Blackcap Lanternfish (Nafpaktitis, 1973)

— SAO₁ in front of vertical through VO₃; Prc₃ closer to vertical
through Prc₄ than vertical through Prc₂, often directly below Prc₄;
posterior tip of SCO and ICO without black pigment cap. 14

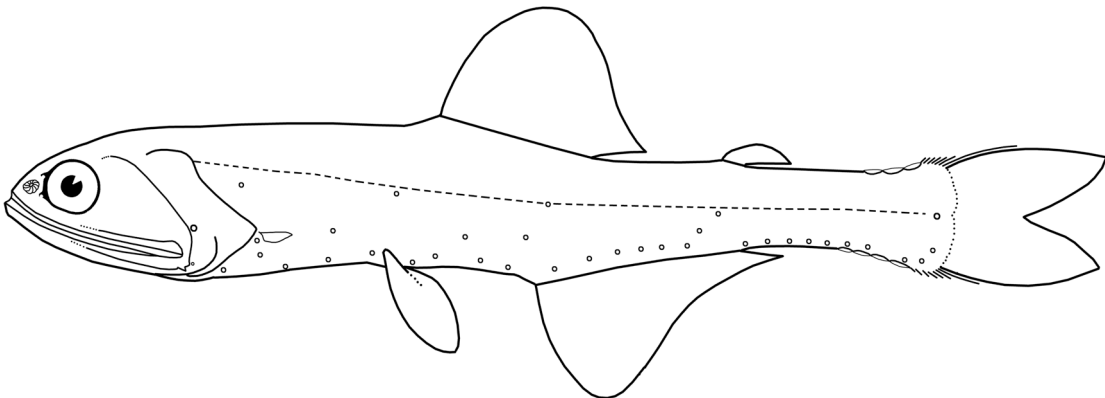
- 14** Pectoral-fin rays absent in adults over 100 mm SL, absent or present as thicker, stiffer rays pointing downwards in 40–100 mm specimens; ICO plates 0–i, 7 (6–8, rarely 9), over 60–75% of anal fin to 1st procurrent ray distance; single row of secondary photophores, 1 per scale, on scale row below lateral line scales in best specimens; [AO 7 (6–8) + 7–8, total 14–15, {7 (6, rarely 8) + 8 (7–9), total 15 (14–16)}]; adipose-fin origin over or behind vertical from last anal ray; GR 5 + 12–13, total 17–18 {5–6 (rarely 7) + 13 (12–14, rarely 11, 15), total 18–19 (17–20, rarely 16, 21)}; D 14–15 {13–14 (rarely 12, 15)}; A 17–18 {17–18 (rarely 15–16, 19)}; max. size = 162 mm SL; n = 5; NSW, Tas, Vic, WA, MqI ... *Lampanyctus (N.) achirus* (Andriashev, 1962)



37122096 Cripplefin Lanternfish (LM)

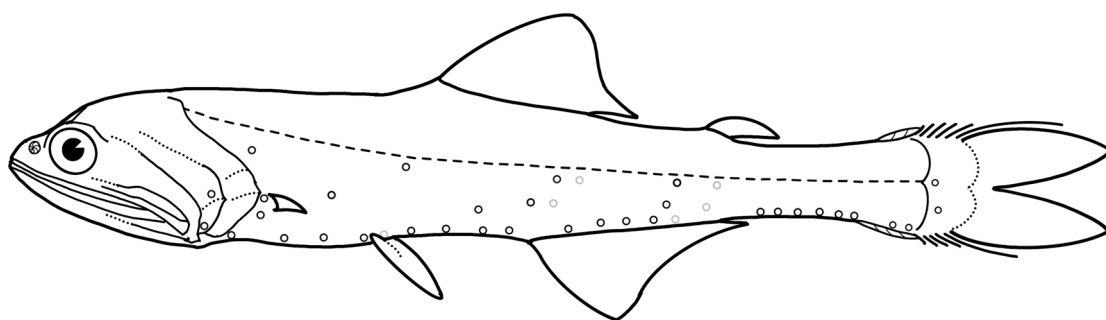
- Pectoral-fin rays always present, fine and flexible (difficult to see in damaged specimens); ICO plates 0–i, (rarely ii), 4–5 (3–6) **15**

- 15** Pol₂ on, slightly before, or slightly behind vertical through adipose-fin origin; adipose-fin origin well in advance of vertical through base of last anal-fin ray; lateral line organs 36–39 {37–38 (39, rarely 36), n = 111}; AO 6–7 (5–9) + 7–8 (6–9), total 13–15 (12) {6–7 (rarely 8) + 7 (8, rarely 2), total 14–15 (13, rarely 12)}; SAO₂ usually closer to vertical from VO₄ than AO_{a1}; SAO₃ usually well before vertical from AO_{a1}; [ICO 5 {5 (4, rarely 6, rarely i anterior, small, separate)}]; VLO over origin or base of pelvic fin; GR 4–5 + 11–13, total 16–17, {5 (rarely 4) + 12 (rarely 11–13), total 17 (rarely 16–18)}; D 13–14 (rarely 12–15) {14–15 (rarely 13)}; A 18–19 {19 (18–20, rarely 17, 21)}; max. size = 140 mm SL; n = 5; NSW, Vic, Tas, WA, NI ... *Lampanyctus (N.) ater* Tåning, 1928



37122049 Dusky Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- Pol₂ well in front of vertical through adipose-fin origin; adipose-fin origin on, slightly before or slightly behind vertical through base of last anal-fin-ray; lateral line organs 33 (32–34) {33 (32, 34), n = 23}; AO 5 (4–6) + 6 (5–7), total 11 (10–13) {5 (rarely 4–6) + 6 (rarely 5–7), total 11 (10, rarely 12)}; ICO 4 (3–5) {4 (3, rarely 5, rarely i anterior, small, separate)}; SAO₂ usually equidistant between verticals from VO₄ and AOa₁ or closer to AOa₁; SAO₃ usually slightly before or on vertical from AOa₁; [ICO {4 (3, rarely 5, rarely 1–2 small, separate, anterior)}, over 40–50% of anal-fin to 1st procurent ray distance; VLO over or behind posterior end of pelvic-fin base; SCO {3 (2, rarely 4)}; GR 5 + 12, total 17 {5 (rarely 4) + 12 (11, rarely 13), total 17 (rarely 15–18)}; D 13 (rarely 12–15) {13 (rarely 12, 14–15)}; A 16–17 (14–18) {16 (17–18, rarely 14–15)}; max. size = 111 mm SL]; n = 12; Qld *Lampanyctus* (N.) cf *niger* Günther, 1887



37122129 Black Lanternfish (Zahuranec, 2000)

Lampanyctus (*Lampanyctus*) remarks

The study of Denton (2014) confirmed the placement of *Lampanyctus* within a subclade of Lampanyctini that included the genera *Stenobranchius*, *Triphoturus* and *Parvilux* with strong support. However, the monophyly of *Lampanyctus* was not supported, as species of *Nannobranchium* were embedded in different areas of the *Lampanyctus* species clade.

***L. alatus*.** Oceanic, mesopelagic; Atlantic: mainly between 45°N–44°S, with isolated records to 59°N (eastern sector) and 46°N–08°S (western sector), including Gulf of Mexico and Caribbean but absent in Benguela upwelling region and off north-east Brazil; Indian Ocean (09°N–42°S); Southeast Asian seas (20°N–10°S); and western Pacific (35°N–42°S, west of 150°W). Off Australia, peak abundance in eddies with temperature of 19°C (Brandt 1983).

***L. festivus*.** Specimens recorded as *L. festivus* from NW WA in Paxton *et al.* (1989) and repeated in Hoese *et al.* (2006) were misidentifications of *L. nobilis* or *L. vadulus* (see *L. vadulus* below). Oceanic, mesopelagic; disjunct distribution in eastern Atlantic between 42°N–12°N and about 12°S to STF, but absent of Gulf of Guinea, northern Benguela upwelling region, and western regions of northern and southern gyres; Gulf of Mexico and western North Atlantic (40°N–26°N) with isolates to 50°N; southern Indian Ocean (28°S–42°S); disjunct distribution in western Pacific (35°N–22°N and 16°S–38°S); and eastern Pacific (40°N–35°S).

***L. intricarius*.** Oceanic, mesopelagic; temperate North Atlantic between about 65°N–30°N and in Mauritanian and Benguela upwelling regions, with isolated records north to 14°S in southeastern sector; circumglobal in region of STF (30°S–55°S), with northern extensions to 18°S in eastern boundary currents; also reported from western North Pacific (15°N–30°N).

***L. lepidolichnus*.** Oceanic, mesopelagic, circumglobal between SAF and about 28°S.

***L. macdonaldi*.** Hulley (1981) recognized two Bitemperate Pattern populations on the basis of GR counts (see Key, where meristics within {} from Hulley (1981: 208) for South Atlantic specimens only, within / / from Bolin (1959: 32) for the North Atlantic). Oceanic, mesopelagic; disjunct distribution in Atlantic between 82°N–34°N (east of 030°W) or 72°N–32°N (west of 030°W) and between SACCF and 32°S in Atlantic, Indian and Pacific oceans, with northern extension to 21°S in Benguela upwelling region (Rubiés, 1985).

***L. macropterus*.** Although not yet recorded from Australian EZ, is likely to occur here on the basis of its distribution in the tropical and subtropical Indian and Pacific oceans, including Timor Sea, and in the South China and South-east Asian seas.

***L. pusillus*.** Oceanic, mesopelagic; Atlantic: disjunct between 55°N–24°N (eastern sector), between 50°N–24°N (western sector), and between 14°S and STF, but absent in Benguela upwelling region; circumglobally in southern hemisphere (24°S–STF), with isolates further south in western South Atlantic.

***L. tenuiformis*.** Nafpaktitis *et al.* (1977) noted that the characters differentiating this species from *L. festivus* break down in a specimen from 20°S, 174°E and questioned the distinction of the two species. Hulley (1981: 196) also described the problem for the Atlantic and recognised both species as valid pending further studies. Clements and Stewart (2026) found no single character that definitively separated southwest Pacific specimens of the two species, and suggested that a detailed comparison of Atlantic, Pacific and Indian Ocean material is needed to determine whether *L. festivus* is valid (*L. tenuiformis* being the senior synonym). (In Australian waters south of 30°S, specimens clearly correspond to *L. festivus*, while northern specimens have mostly the features of *L. tenuiformis*. The poor condition of most specimens with photophores and/or ICO plates missing compounds the problem.)

***L. vadulus*.** Hulley (1981: 217) described this new species from the tropical Atlantic, based on more than 200 specimens and distinguished it from the very similar *L. nobilis* using the two primary characters in the key above, eye size in relation to upper jaw length, and gill-raker counts. In more than 280 Atlantic specimens of *L. nobilis* counted, GR 3 + 10 (rarely 9 or 11), total 13 (rarely 12 or 14), while for all *L. vadulus*, GR 4 + 11 (rarely 10 or 12), total 15 (rarely 14 or 16). In *L. vadulus* UJL/ED = 2.8–3.2, for *L. nobilis* 3.5–3.9 for a much smaller subset of each. Additional differences included swimbladder thickening, size at maturity and maximum size, possible spawning seasons, and depth in the water column.

In Australian specimens previously identified as *L. nobilis* from the tropics in northwest Australia in the eastern Indian Ocean (Paxton *et al.*, 1989; also see **remarks** for *L. festivus* above) and from the Philippines to the Coral Sea in the western Pacific, a range of UJL/ED values was found, from 2.8–4.3 in specimens >50 mm SL, increasing to 5.0 in smaller specimens. There is no distinct break in values, with seven specimens of 37 measured with 3.3–3.4, nor is there a clear correlation with GR counts. While the majority of specimens have large eyes and GR 4 + 11, eight specimens with GR 4 + 10–11 have UJL/ED 3.5–4.1 and one with UJL/ED 3.0 has GR 3 + 10. The position of the Prc₃ in relation to Prc₂ and Prc₄ is indicative in some specimens, but not all. A more detailed study with more large specimens in better condition is needed to confirm the presence of *L. vadulus* in the Indo-Pacific. In couplet 10 above, meristic values are only given for those Australian specimens with both diagnostic characters of GR (3 + 10 *L.n.*, 4 + 11–12 *L.v.*) and UJL/ED (3.5–5.0 *L.n.*, 2.8–3.2 *L.v.*) for each ‘species’. Values between {} are from Hulley (1981) for central Atlantic specimens.

***Lampanyctus (Nannobranchium)* remarks**

Nannobranchium Günther, 1887 was resurrected from the synonymy of *Lampanyctus* Bonaparte, 1840 by Zahuranec (2000: 4) on the basis of the characters described in the genus introduction above and the adult swimbladder being either greatly reduced or lost, but never well developed and filled with gas. Due to an unfortunate change from an earlier draft*, definition of these characters appeared to be attributed to Paxton (1972), who, apart from the presence of short pectoral fins and brief discussion of otolith variation, did not consider any of the other characters and used none in the formal definitions of taxa. Zahuranec (2000) noted that a straight-sided, vertically elongate otolith, short pectoral-fin rays, and flaccid body were also shared with *Lampanyctus macdonaldi*, but did not clarify why this species was not included in *Nannobranchium*. Bolin (1959) considered *L. macdonaldi* most closely related to those species with a robust body, an elongate pectoral fin, cheek photophores, and luminous tissue at the origin of the adipose fin. Further study of all species and characters, including those of larvae, is required to determine relationships within these two nominal genera. [* from ‘Species of the tribe Lampanyctini as defined by Paxton (1972) that have: ...’ to ‘The species of the Tribe Lampanyctini were defined by Paxton (1972) to have the following features: ...’].

Denton (2014) included eight species of *Nannobranchium* and 11 species of *Lampanyctus* in his study of myctophiform relationships. He found neither genus monophyletic, although the pair formed a monophyletic clade, with the various species of the two genera mingled in the clade. His results did not recover the five species groups established within *Nannobranchium* by Zahuranec. Denton concluded that much more research is needed on this complex.

Kobyliansky (2016) also confirmed the monophyly of the genus based on the anatomy of head and skeletal elements. Martin *et al.* (2018) discussed the value of Zahuranec’s diagnostic characters and pointed out none were unique to the taxon, considering it a synonym of *Lampanyctus*. Here *Nannobranchium* is treated as a subgenus within *Lampanyctus*, to retain most of the structure of the previous draft keys, while agreeing it will not be recognised in future.

Lampanyctus (Nannobranchium) specimens are very fragile, and the vast majority are badly damaged by the trawl and lack scales. However, a few specimens in good condition have specialised lateral-line scales on the caudal peduncle with dorsal and ventral elongations. Associated with these are two vertical rows of papillae (free neuromasts) in the thin transparent skin overlying the scales that can be as many as 13 dorsal and 13 ventral to the lateral line; the second row is at the posterior margin of each scale. The elongated scales and papillae are present in some Australian specimens of *L. (N.) cf. niger* from the Coral Sea and a few *L. (N.) ater*, with a few papillae present in remnants of scale pockets from specimens further south. No other Australian specimens are in good enough condition to determine if papillae are present in the other two species. Two specimens of *L. (N.) idostigma* 62–72 mm SL at the southern limit of known distribution over the Peru-Chile Trench in better shape have 8–15 and 11–13 lateral line scales remaining on each with extensions on the posterior scales, but no papillae are visible.

The fragility of the specimens, combined with the striking variation in both meristics and photophore positions as described by Zahuranec, results in exceptional difficulty with identifications. They also result in the frustrating differences between text and figures in that publication. The full range of diagnostic meristics for each of the four Australian species from Zahuranec’s Appendix Tables is included between the {}, as the combination of counts seems the best chance for correct identification.

***L. achirus*.** Zahuranec (2000: p 37) reported the single row of secondary photophores below the lateral line scales, most prominent on the caudal peduncle; none of our study specimens had any scales or indication of secondary photophores. Oceanic, bathypelagic; circumglobal between STF and SACCF and south into Ross Sea, and with northern extensions to 21°S in meridional currents.

***L. ater*.** Oceanic, mesopelagic; Atlantic: disjunct distribution between 59°N–15°N (east of 030°W) / 42°N–25°N (west of 030°W), including Gulf of Mexico, and between 14°S–46°S; Indian Ocean (12°S–43°S); and western Pacific (24°S–42°S).

***L. lineatus*.** Zahuranec (2000: 36) discussed geographic variation between Atlantic and Indo-Pacific specimens and provided separate counts in his Appendix Tables and noted 122 mm SL as the largest Indo-Pacific specimen seen. The counts listed here between {} are restricted to his Indo-Pacific data for this species.

***L. cf. niger*.** Previously Qld. specimens of this species were misidentified (Paxton *et al.*, 1989 as *Lampanyctus ater*; Hoese *et al.*, 2006: 527 as *Nannobranchium atrum*). Now known from at least 12 AMS specimens from the Coral Sea. The identification of this species is based on the description and figure in Zahuranec (2000: 14–17, Fig. 4, Table 3). We have been able to distinguish the two species based on the combination of a number of characters, coupled with distribution: *L. (N.) cf. niger* is mostly tropical off eastern Australia, *L. (N.) ater* mostly temperate. However, variation in the characters is significant, particularly photophore position.

In the discussion of two specimens from near the Ogasawara Islands in the NW Pacific described by Fujii (1984: 65–68), Zahuranec considered them “almost certainly a different species because of their large size ..., high ... counts, Pol well in advance of origin of adipose fin (rather than below adipose-fin base, see Table 3) ...” His Fig. 4 is of a specimen from near the Hawaiian Islands that has the Pol under the centre of the adipose-fin base, and is the basis of our identification. However, Günther’s holotype (BMNH 1877.12.7.29) of *N. nigrum* from south of the Philippines was figured by Nafpaktitis (1973: fig. 37), Bolin in Wisner (1976: fig. 163) and Nafpaktitis *et al.* (1977: fig. 140) and clearly has the Pol significantly anterior to the origin of the adipose fin. None of our specimens have this arrangement, and the name is used with some hesitation. A study of specimens from the tropical West Pacific north of the Equator is needed to confirm the nomenclature.

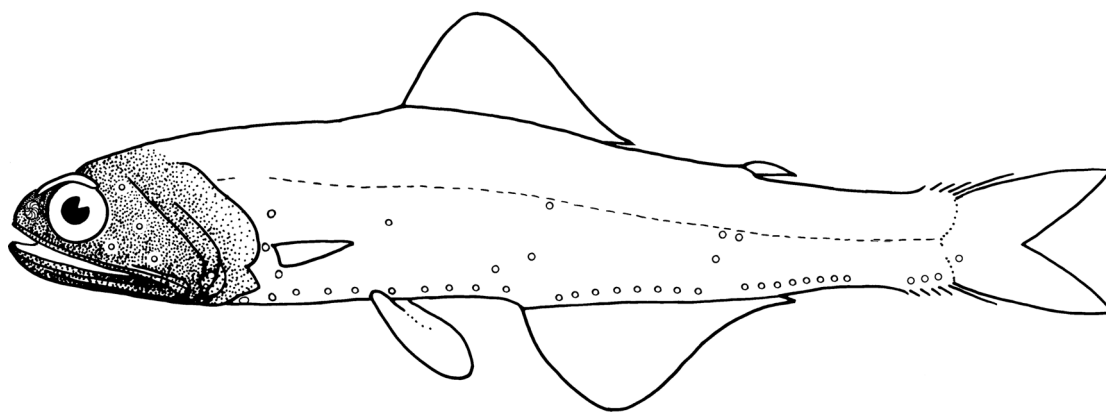
Lampichthys Fraser-Brunner, 1949

This genus is unique in the family in its combination of 3–6 cheek photophores and elongate Dn as Suo; the Dn is much more conspicuous in males; the head is darkly pigmented, but the body appears pale in colour because the body scales, photophores and luminous tissue remnants are almost always abraded during net capture (hence common name).

The genus is monotypic, with a southern circumglobal distribution; see **remarks** below, and Bussing (1965); Wisner (1976); Hulley (1981, 1986a, 1990a, 1990b); McGinnis (1982); Becker (1983); Linkowski (1985); Hoese *et al.* (2006); Roberts *et al.* (2023); Hulley & Paxton (2016); Sutton *et al.* (2020); Mostrada *et al.* (2023). Data from non-Australian specimens in {} from Hulley (1981), Linkowski (1985), and Roberts *et al.* (2015). Linkowski described specimens as *L. rutkovichi* from two stations in the SE Atlantic at 23.6°S and 24.73°S, but that species is not recognised as valid.

Key to the genus *Lampichthys*

Dn as elongate Suo, wider in males surrounded by much black tissue, narrow in females with grey borders if undamaged; Vn tiny, at anteroventral tip of Dn; small luminous tissue patches near dorsal profile from nape to end of D base and Pol₁; adults with SCO and ICO (smaller) of coalesced scale-like plates, originating closer to procurent rays than adipose or anal-fin bases, larger in males; {AO 8 + 8–9, total 16–17}; GR 5 + 14–16, total 19–21 {5 + 14–15, total 19–20}; D 17 (18) {17–18}; A 22 (rarely 23, 24) {22–23}; P 14 (13–15, rarely 16) {12–15}; max. size 100 mm SL; n = 12; NSW, Vic, Tas, WA, MqI *Lampichthys procerus* (Brauer, 1904)



37122017 Blackhead Lanternfish (♂, Hulley, 1986a)

Lampichthys remarks

The DNA studies of Denton (2014) and Martin *et al.* (2018) both recovered strong support for a sister relationship with this genus and *Gymnoscopelus*.

***L. procerus*.** Oceanic, mesopelagic, mainly circumglobal in STF region (30°S–45°S), with northern extensions to 17°S (off Chile), and to 21°S (off Namibia) in eastern boundary currents. In CCAMLR region from 53.12°S, 037.88°W and 53.90°S, 035.33°W (Atlantic sector) and from about 45°S–50°S, 070°E–075°E (Indian sector).

Lobianchia Gatti, 1903

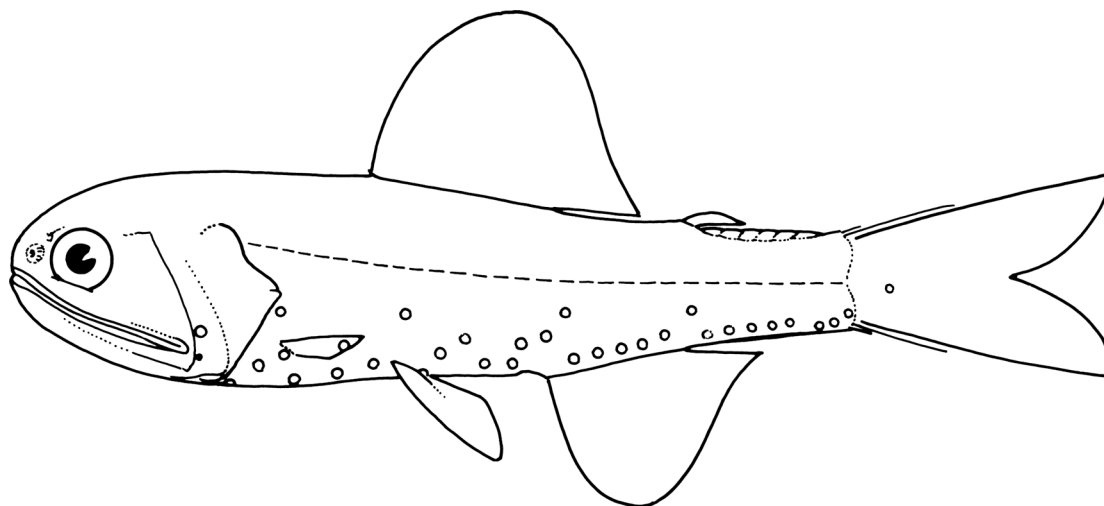
The characteristics of this genus are very similar to *Diaphus*, but *Lobianchia* are distinguished by the presence of caudal

light organs, SCO and ICO. They exhibit sexual dimorphism with males having an only an SCO composed of overlapping luminous patches and females only an ICO composed of contiguous luminous patches flanked by pairs of smaller patches. Species of *Lobianchia* also have a small Dn, and no Vn or luminous patch below PLO.

The genus has a circumglobal distribution with two world species, both occur in Australian waters, see Wisner (1976); Nafpaktitis (1978); Hulley (1981, 1984, 1986a, 1990b); Becker (1983); Hoese *et al.* (2006); and Hulley and Paxton (2016), with extra-limital maximum size data; Sutton *et al.* (2020); Mostarda *et al.* (2023); Koubbi *et al.* (2025); and Roberts *et al.* (2015). Data from non-Australian specimens in {} are from Roberts *et al.* (2015).

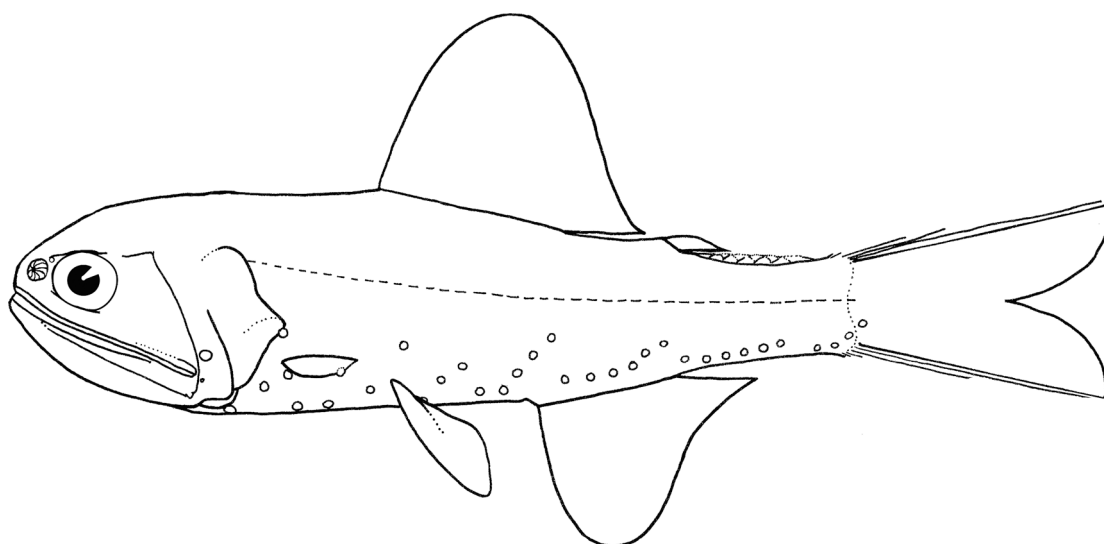
Key to the genus *Lobianchia*

- 1 Prc₄ widely separated from Prc₃; Pol closer to lateral line than anal-fin base; SAO₁₋₃ slightly concave anterodorsally; [GR 5 (6) + 14 (15), total 19 (20) {5 (rarely 6) + 14–15 (rarely 13), total 18–21}; AO 5 (4) + 5 (6), total 10 {4–5 + 5–6}; SCO 6–8, ICO 1–2 + 2 lateral pairs; D 15–16 {15–17}; A 13 (12) {13–15}; P 11–12 (10) {11–13}; max. size 50 mm SL]; n = 12; NI, NSW, Tas, SA, WA *Lobianchia dofleini* (Zugmayer, 1911)



37122053 Doflein's Lanternfish (♂, Nafpaktitis, 1978)

- Prc₁₋₄ evenly spaced; Pol midway between lateral line and anal-fin base or lower; SAO₁₋₃ straight or slightly concave posteroventrally; [AO 5 (6) + 6, total 11 (12) {5 (rarely 4) + 5–6 (rarely 7)}; SCO 6–8, ICO 1–2 + 2 lateral pairs; GR 5 (4) + 12 (11), total 17 (15) {5 (rarely 4) + 12–13, total 16–18}; D 15 (16) {17}; A 13–14 (15) {14–15 (rarely 13)}; P 10 (11–12) {10–12}; max. size 65 mm SL]; n = 10; Qld, NI, NSW, WA *Lobianchia gemellarii* (Cocco, 1838)



37122054 Gemellaro's Lanternfish (♂, Nafpaktitis, 1978)

***Lobianchia* remarks**

Although most authorities give 1904 as the date for the description of this genus, Gatti's stand-alone reprints show the work was first published, posthumously, in 1903 via his supervisor, Professor Vinciguerra (who documented that Gatti finished his thesis in June 1900, but died in 1901) – authors' unpublished data.

The DNA study of Denton (2014) sampled both species of *Lobianchia* and recovered a monophyletic clade as a sister to the clade of all other sampled species of *Diaphus*.

***Loweina* Fowler, 1925**

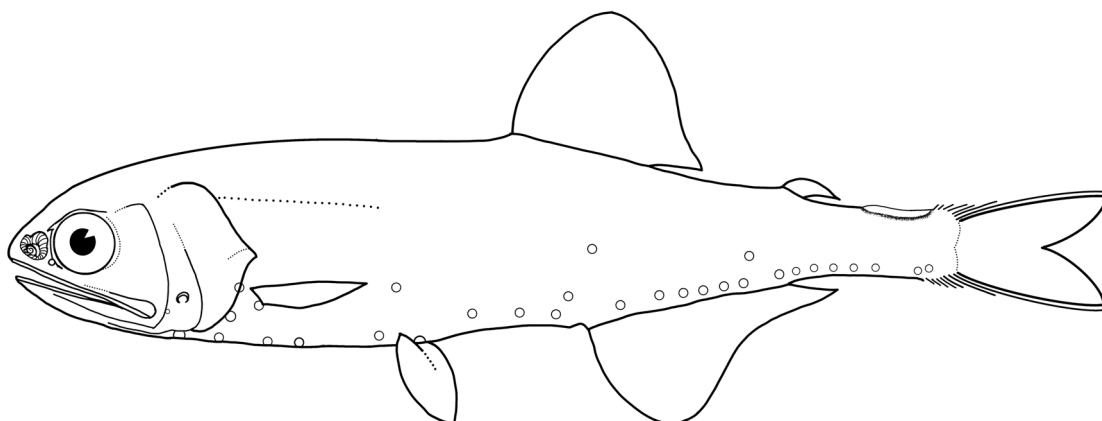
Loweina is one of four slender-tailed lanternfish genera (Becker, 1964); the others in Australian waters are *Centrobranchus* and *Gonichthys*. Among them, *Loweina* differs in possessing an Suo (small, deeply buried over

the posterior orbit), a more posterior Pol, a deeper caudal peduncle, and a less-developed snout with a less-defined subterminal mouth. The lateral line is weakly developed, with perforated scales rarely extending beyond the level of the pelvic-fin origin. The palatine teeth are enlarged. Only males have a single, undivided SCO, with no ICO in either sex.

The genus has a circumglobal tropical and subtropical distribution with 3–4 world species (*L. laurae* may be a junior synonym of *L. rara*), 2 occur in Australian waters; see Becker (1964, 1983); Nafpaktitis and Nafpaktitis (1969); Wisner (1976); Nafpaktitis *et al.* (1977); Hulley (1981, 1984, 1986a, 1990b); Paxton and Hulley (1999); Rivaton and Bourret (1999); Hoese *et al.* (2006); Roberts *et al.* (2015); Hulley and Paxton (2016); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Nafpaktitis *et al.* (1977).

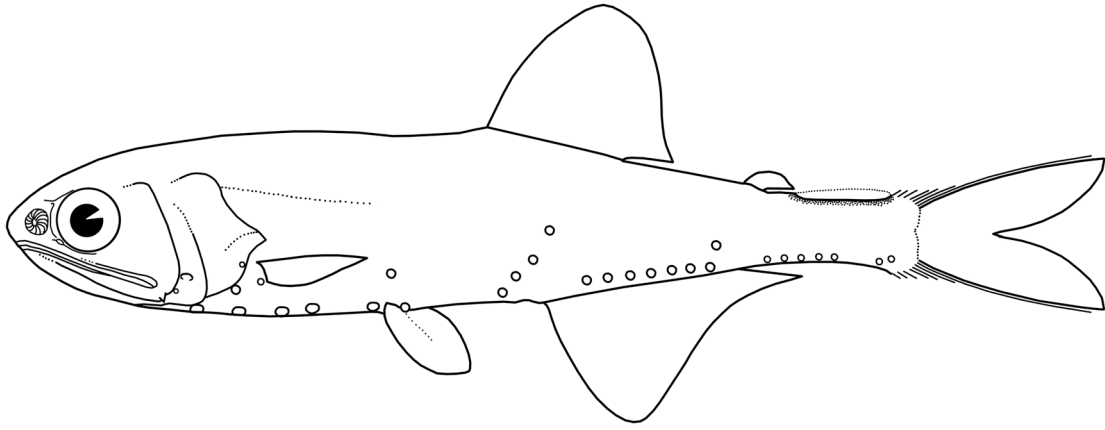
Key to the genus *Loweina*

- 1 SAO 2; VO 4; PVO₁ behind centre of PO₂; GR 2 + 6–7, total 8–9 {2 + 6–7, total 8–9}; [AO 5–6 + 6 (5–7), total 12 (10–11) {5–6 + 4–6, total 10–12}; (D 10–13 {11–12}; A 15–16 {14–16}; P 11 (10–12) {9–11}; max. size 45 mm SL]; n = 7; Qld, NSW, WA ***Loweina rara* (Lütken, 1892)**



37122098 Rare Lanternfish (♂, Nafpaktitis *et al.* 1977)

- SAO 3; VO 2, at positions corresponding to VO₁ and VO₄; PVO₁ in front of centre of PO₂; GR 3–4 + 9–11, total 12–15 {3 + 9–10 (8–11), total 12–13 (11–14)}; [AO 7 (6, 8) + 6–7, total 12–15 {total 11–14 (10–15)}]; (D 12–14 {11–12}; A 15–17 {15–16}; P 10–11 {11–12}; max. size 39 mm SL]; n = 5; NSW, Tas, WA ***Loweina interrupta* (Tåning, 1928)**



37122109 Barebelly Lanternfish (♂, Nafpaktitis *et al.*, 1977)

Loweina remarks

The “slendertail” lanternfish genera (*sensu* Gonichthyini Paxton, 1972) were not recovered as a monophyletic group in the DNA analyses by Denton (2014). Similar results, based on nuclear, protein-coded, and morphological analyses were obtained by Martin *et al.* (2018).

Metelectrona Wisner, 1963

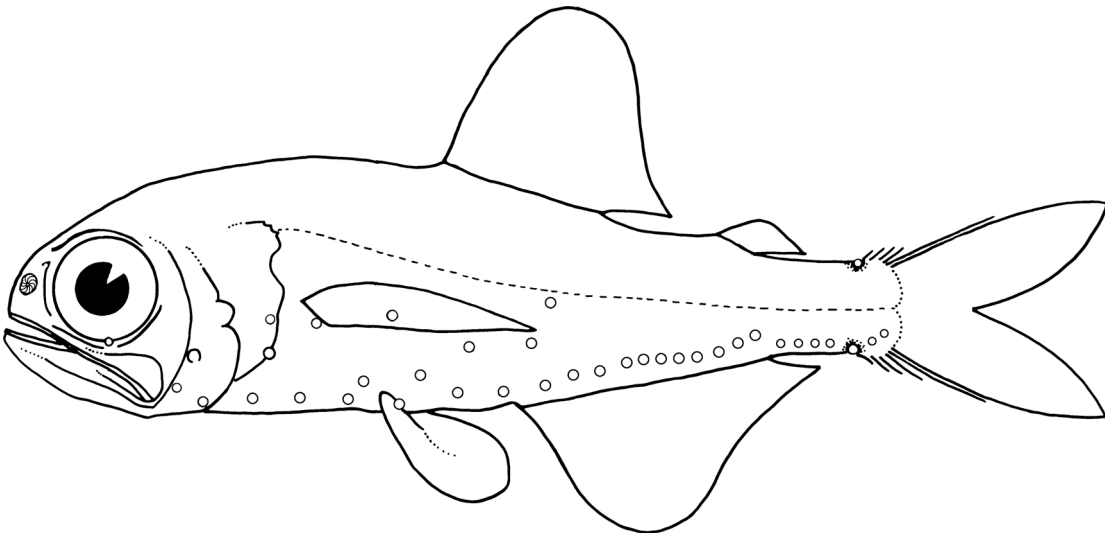
The genus is distinguished from the related genus *Electrona* by its elevated VO_2 and a distinct posterodorsal lobe of

operculum, which is serrated in largest specimens. The elevation of the posterior AO photophores is highly variable, but the last 3-4 are lower than others. There is a single SCO and ICO in both sexes.

The genus has a southern circumglobal, temperate – subantarctic distribution with two world species, both of which occur in Australian waters, see Wisner (1976); Hulley (1981, 1986a, 1990a); McGinnis (1982); Becker (1983); Hoese *et al.* (2006); Duhamel *et al.* (2014); Roberts *et al.* (2015); Sutton *et al.* (2020); Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from the above sources.

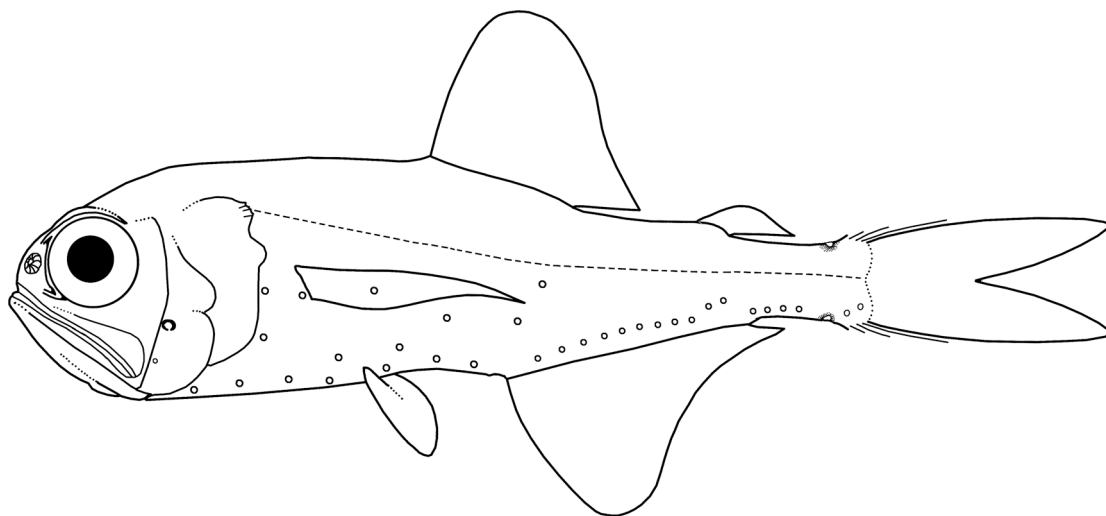
Key to the genus *Metelectrona*

- 1 Vn absent; So below vertical through middle of eye; GR 5 (6) + 17–18, total 22–23 {5 (4) + 16 (15–17), total 22 (21–23)}; [AO 15 (16) {15 (15–16)}; ♂ and ♀ with SCO 1, ICO 1; D 14 {14}; A 20 {20}; P 14 {15 (14)}; max. size 59 mm SL]; n = 5; NSW, Vic, Tas*Metelectrona herwigi* Hulley, 1981



37122107 Herwig Lanternfish (Hulley, 1981)

- Vn present at anterior margin of orbit; So absent; GR 6 (7) + 18–19 (17), total 24–25 (23–27) {6 (7) + 18–19 (17–20), total 24–25 (23–27)}; [♂ and ♀ with SCO 1, ICO 1; AO 15 (14–16) {16 (13–17)}; D 14 {13–15}; A 19–20(21) {20–22}; P 15 (14–16); max size 107 mm SL]; n = 9; NSW, Vic, Tas, SA, HIMI, WA *Metelectrona ventralis* Becker, 1963



37122016 Flaccid Lanternfish (Hulley, 1981)

Metelectrona remarks

M. ventralis. Oceanic, mesopelagic, circumglobally distributed between the Subtropical Front and Antarctic Polar Front, but generally found north of the Subantarctic Front, and with extensions to 35°S in Australian Bight, 21°S off Namibia, and 32°S (off Argentina and Chile).

M. herwigi. At present known only from the South Atlantic (type locality) and the Australian records (see above).

Myctophum complex

The recent split of the genus *Myctophum* into 3 genera (Martin *et al.*, 2018), is recognised here, namely *Ctenoscopelus* Fraser-Brunner, 1949; *Dasyscopelus* Günther, 1984; and *Myctophum* Rafinesque, 1810, see **remarks**. However, all three genera require major taxonomic revision.

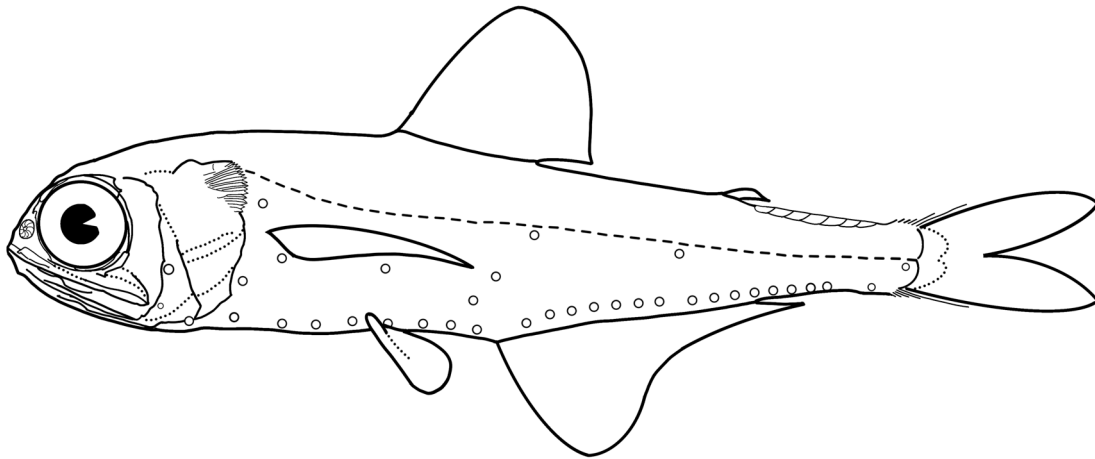
Species of the *Myctophum* complex have the SAO₁₋₃ usually in a straight line or obtusely angled, with SAO₁ always posterior to vertical through VO₃. Scales cycloid, crenulate (minutely scalloped), or spinoid, two species with elongate ventral spines on scales over anal-fin base, the latter two states not developed in juveniles; posterodorsal margin of operculum serrate or denticulate in some species, denticles/spines developing in some species by 30 mm SL, but not until 40+ mm SL in others. Small Suo without black border present in two species under posterolateral edge of frontal/6th circumorbital. SCO (males only, in most species) and ICO (females only, in most species) are variable,

particularly with size, developing as separate, usually triangular, plates that overlap in mature specimens, some with smaller plates ventrolaterally; SCO and ICO usually developing at 30 mm SL, but at larger size in some species including *D. selenops* and relatives; details of individual plate shape and pigmentation variable within and among species, deserving further study; specimens < 30 mm SL often difficult to key. Non-Australian specimen data included below between {} are from Wisner (1976) unless otherwise indicated in the **remarks**.

Species in the complex generally have a circumglobal distribution with about 16 world species; 14 occur in Australian waters, three are undescribed. See Sarnas (1954); Becker (1967, 1983); Nafpaktitis and Nafpaktitis (1969); Becker & Borodulina (1971, 1976, 1978); Kawaguchi and Aioi (1972); Kawaguchi *et al.* (1972); Paxton (1972); Nafpaktitis (1973); Wisner (1970; 1976); Nafpaktitis *et al.* (1977); Hulley (1981, 1986a); Moser *et al.* (1984); Tsarin (1985); Paxton *et al.* (1989); Nakabo (2002); Mundy (2005); Hoese *et al.* (2006); Poulsen *et al.* (2013); Denton (2013); Bian and Wan (2014); Roberts *et al.* (2015); Martin *et al.* (2018); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from: Hulley (1981) (*C. phengodes*; *M. nitidulum***); Hulley (unpublished from the Central equatorial Pacific) (*M. aurolaternatum*; *M. nitidulum**; *D. lunatus*#); Becker (1983) (*D. lychnobius*; *D. lunatus**); Sarnas (1954) (*D. lychnobius*); Becker & Borodulina (1978) (*D. lunatus**) (*, **, # see notes in the **remarks**).

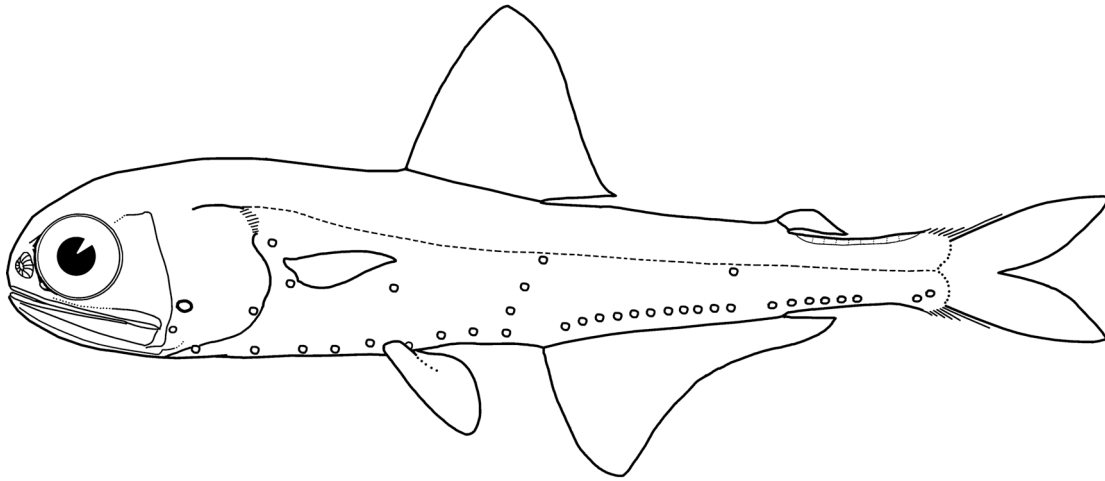
Key to the genera *Ctenoscopus*, *Myctophum* and *Dasyscopus*

- 1 Prc₂ 1 diameter or less below lateral line; PLO much nearer lateral line than upper margin of pectoral-fin base; 4–5 AOp over anal-fin base; [upper operculum strongly serrated (specimens over 25 mm SL); scales cycloid; SAO₁₋₃ line straight, SAO₁ over or before vertical through VO₄; Pol well in advance of adipose-fin origin; AO 7 (rarely 6, 8) + 8 (7, rarely 9), total 15 (rarely 14) {7 (6-8) + 8 (7-9), total 15 (14-16, rarely 17)}; SCO of ♂s composed of 7 (6) ovoid overlapping plates with posterior points, ICO of ♀s 4 (2–3) separate or partially coalesced plates; GR 8 (7) + 19 (18), total 27 (26, rarely 25) {GR 7-8 + 18-19 (17), total 25-27 (24)}; D 13 (rarely 12) {13 (12-14)}; A 21–22 (rarely 20) {21 (20-22)}; P 15–16 {16 (15-17)}; max. size 94 mm SL; n = 20; LHI, NI, NSW, Vic, Tas, SA, WA]*Ctenoscopus phengodes* (Lütken, 1892)



37122003 Bright Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

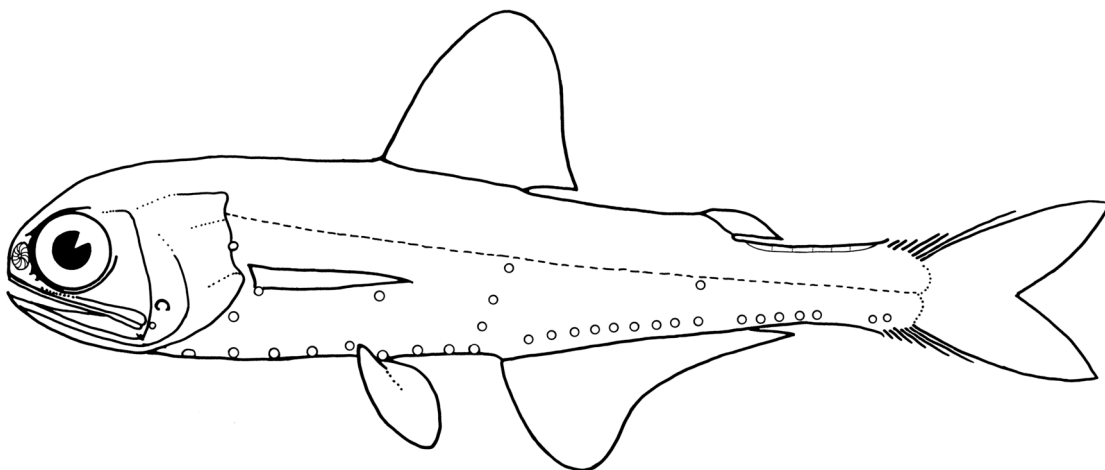
- Prc₂ more than 2 diameters below lateral line; PLO nearer upper margin of pectoral-fin base or halfway between pectoral-fin base and lateral line; 1–2 AOp over anal-fin base 2
- 2 Body depth at pectoral-fin base 5–6 in SL; A 23 or more (rarely 22) {24 (22–26)}; [upper operculum strongly serrated, rounded; scales cycloid; single row of enlarged palatine teeth; AO 10–11 + 6, total 16–17 {total 16–17 (15–18, rarely 13, 14, 19)}; SCO of ♂s composed of 7 {6–9} partially overlapping plates, ICO of ♀s 5 {3–7} usually contiguous plates; GR 4 + 13, total 17 {4-5 + 11-12, total 17-18 (16)- gill rakers short and stubby with spatulate tip; D 15 {14 (13–15)}; P 14 {14 (12–15)}; max. size 110 mm SL; n = 7 (6 larvae); Qld, WA, NT..... *Myctophum aurolaternatum* Garman, 1899



37122133 Goldenside Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

— Body depth at pectoral-fin base 2.9–4.5 in SL; A 21 or less (very rarely 22) 3

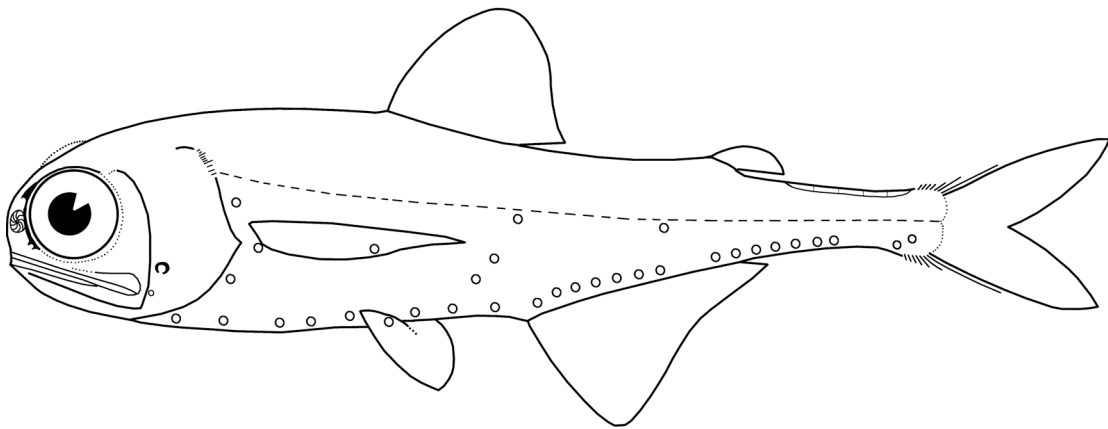
- 3 Posterodorsal corner of operculum acutely angled in specimens over 20 mm SL and smooth in specimens < 40 mm SL, denticulated in larger specimens; [scales cycloid; single row of enlarged palatine teeth; Pol usually behind vertical through adipose-fin origin; SAO₁₋₃ line straight, SAO₁ over or slightly behind vertical through VO₄; SCO of ♂s composed of 5-6 {5-8} partially overlapping plates extending > 90% caudal-peduncle length in largest specimens; ICO of ♀s 1-3 (4) {2-6} contiguous or slightly overlapping plates under > 50% caudal-peduncle length in largest specimens, very rarely also 3 separate SCO plates with heavy black borders; AO 9-10 (8) + 5-6 (rarely 7), total 14-15 (16, rarely 13); GR 5 (rarely 6) + 14 (15), total 19 (20); {7 (5-8, rarely 4) + 17-18 (14-19, rarely 13, 20), total 24-26 (19-27, rarely 18, 28)*; 5 (6, rarely 4) + 14 (12-16), total 19 (17-22)**}; D 13-14 (rarely 12); A 19-21 (rarely 22); P. 14 (13-15) {pigmented in large specimens}; max. size 83 mm SL; n = 19; Qld, LHI, NI, NSW, WA, ChI, see **remarks** (including for *, **) . *Myctophum nitidulum* Garman, 1899



37122056 Pearly Spotted Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

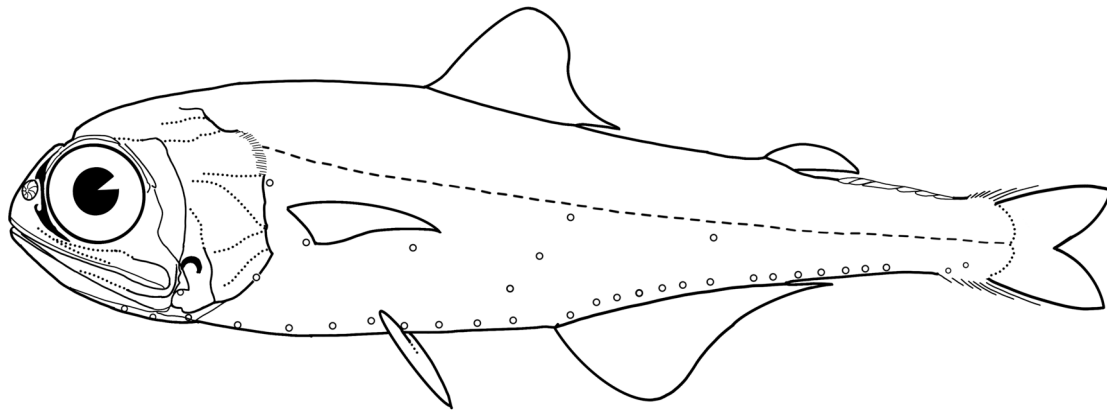
— Posterodorsal corner of operculum rounded... 4

- 4 Scales over AO series, and often over ventral midline, very spinoid, with 1–3 ventral-most spines elongate; ventral-most spine ca. 3 times length of upper-most spines (only in specimens over 35 mm SL) 5
- Scales over AO series cycloid, crenulate, or spinoid, with ventral-most spine, if present, less than 2 times length of upper spines..... 6
- 5 SAO obtusely angled; SAO₁ on vertical closer to midway between VO₃₋₄ than VO₄ or further anterior; SAO₁₋₂ line more than one photophore-diameter posterior to SAO₃; body colour dark brown above lateral line and light to medium brown below lateral line, darker posteriorly; body depth 3.9–4.2 (4.3–4.4, rarely 4.6) in SL; [upper operculum strongly serrated in specimens over 50 mm SL, with tiny spines over 35 mm SL; AO 7 (8, rarely 6) + 6 (rarely 7, 5), total 13 (14) {7 (8, rarely 6) + 6–7 (rarely 5, 8), total 13–14 (rarely 16, 15)}; SCO of ♂s over 60 mm SL composed of 5–6 (rarely 7) overlapping plates with black borders extending 60–75% caudal-peduncle length, 3–4 separate, tiny–small plates, grey in colour in specimens over 35–45 mm SL; ICO of ♀s over 60 mm SL 2–3 (1, 4) contiguous or slightly overlapping smaller plates with lightly pigmented borders under 10–40% caudal-peduncle length, number of plates not correlated with size (rarely SCO composed of 1–3 tiny separate plates over 10–30% caudal-peduncle length {40% of ♀s in some areas of equatorial western Pacific also with SCO 1–3 (Wisner, 1976)}; GR 6 (7, rarely 5) + 15 (14–16, rarely 17), total 21 (20–22, rarely 24) {6 (7, rarely 5) + 15–16 (14–16), total 20–23 (rarely 19–24)}; D 13 (14) {13 (14, rarely 12); A 19 (18–20) {19 (18–20, rarely 21)}; P 14 (13–15, rarely 16) {14–16, (13, rarely 17)}; max size 86 {ca 90} mm SL]; n = 17; Qld, LHI, NSW, WA *Dasyscopelus spinosus* (Steindachner, 1867)



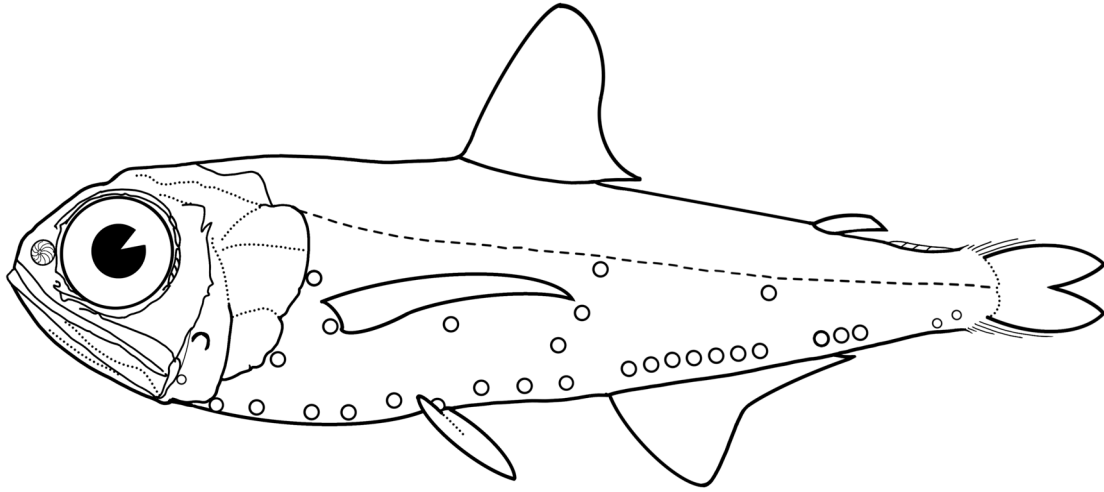
37122101 Spiny Lanternfish (♂, after Nafpaktitis & Nafpaktitis, 1969)

- SAO in straight line; SAO₁ from slightly anterior to slightly posterior vertical through VO₄, closer to VO₄ than midway between VO_{3,4}; SAO₁₋₂ line through SAO₃ or less than a photophore-diameter anterior or posterior; body colour solid dark brown to black above lateral line and medium dark brown below; body depth 3.8–4.1 in SL; [upper operculum strongly serrated in specimens over 50 mm SL; AO 7 (6) + 6–7 (8), total 13–14 (15) {7 (6–8) + 7 (5–9)}; SCO of ♂s over 70 mm SL composed of 6 (5) {6–7 (5–8)} overlapping plates with black borders extending 65–75% caudal-peduncle length, ICO of ♀s over 70 mm SL 2 (1–3) contiguous or slightly overlapping smaller plates with lightly pigmented borders under 10–40% caudal-peduncle length; GR 6–7 + 15–16, total 21–23 {7 (6) + 16, total 23 (22)}; D 13–14 {13 (14)}; A 19–20 (rarely 18, 21) {19}; P 16 (15–17, rarely 14) {15 (16)}; max. size 116 mm SL]; n = 12; Qld ***Dasyscopelus lychnobius* Bolin, 1946**



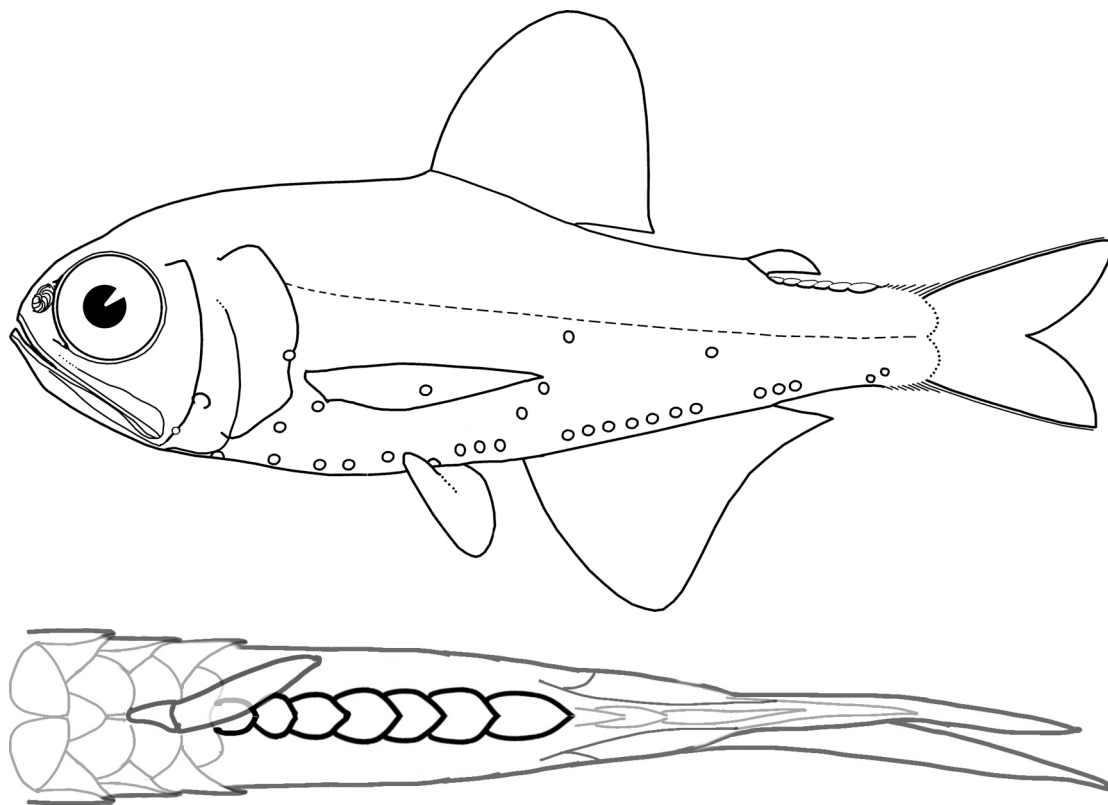
37122135 Nightlight Lanternfish (♂, LM)

- 6 Body depth 2.9–3.7 in SL; least depth of caudal peduncle 1.3–1.7 in caudal-peduncle length; [scales spinoid] 7
- Body depth 3.9–4.7 in SL; least depth of caudal peduncle 2 or more in caudal-peduncle length; [scales spinoid, crenulate, or cycloid] ... 9
- 7 SCO composed of 4 coalesced plates, each with light black border, extend over posterior 55–60% caudal-peduncle length; ICO of 3 slightly overlapping plates with narrow posterior black borders, under middle 45–50% caudal-peduncle length; both SCO and ICO in same individuals of at least one sex; pectoral-fin base midbody, PLO on horizontal level closest to ventral margin of pupil; [body depth 3.4–3.6 in SL; least depth of caudal peduncle 1.3–1.6 in caudal-peduncle length; upper operculum smooth; scales strongly spinoid; AO 7+3, total 10; GR 5–6 + 14–15, total 20; D 12–13; A 17–19; P 16–17; max. size 62 mm SL]; n = 2; WA .. ***Dasyscopelus* sp. B**



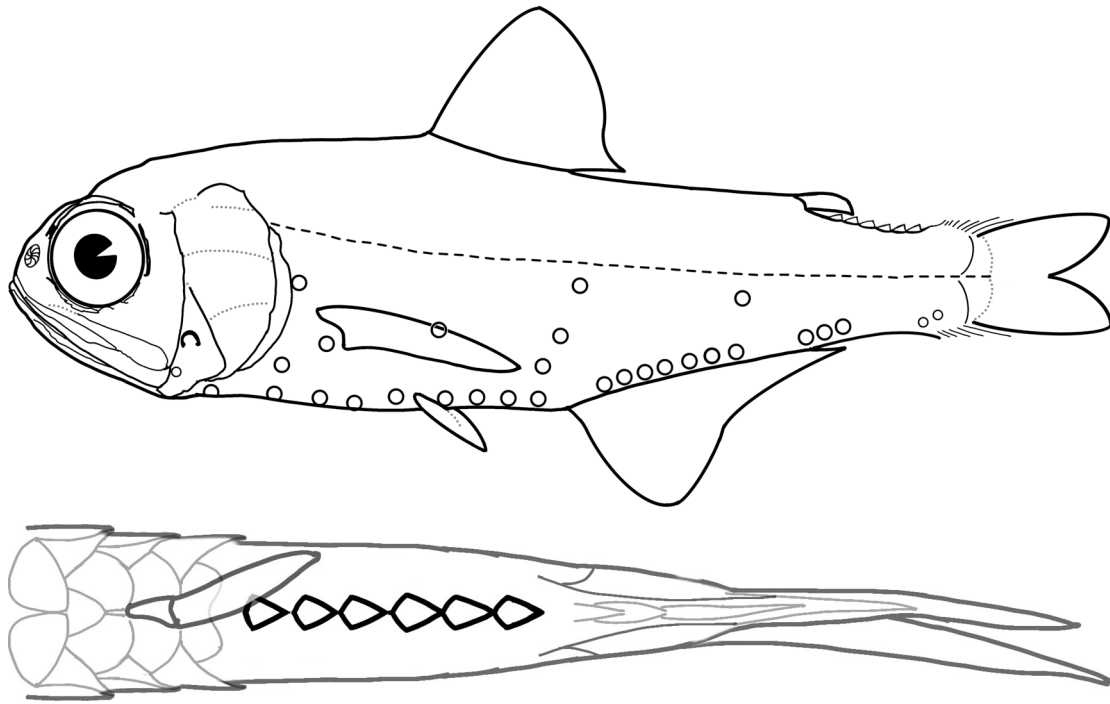
37122138 Lanternfish sp. B (♂, LM)

- SCO composed of 6–7 large overlapping plates each with complete heavy black border (mature ♂s), 3–4 moderate, slightly overlapping plates each with complete narrow black borders (mature ♀s), or 3–5 small separate or contiguous plates with complete black borders (immature > 35 mm SL); ICO absent in both sexes; pectoral-fin base low, PLO on horizontal level closest to ventral margin of orbit 8
- 8** GR 7–8 {6, rarely 8} + 17–18 (16–19) {16 (15–18)}, total 25–26 (23–24) {22–25 (rarely 20–21, 26)}; body depth 3.2–3.5 {3.0–3.3} in SL; SCO of ♂s with 6–7 slightly overlapping plates extending > 90% caudal-peduncle length in 65 mm SL gravid specimen; SCO of ♀s with 3–4 weakly developed, usually contiguous plates extending ~ 40% caudal-peduncle length in 67 mm SL gravid specimen; [least depth of caudal peduncle 1.4–1.5 (1.1–1.7 in specimens <35 mm SL) in caudal-peduncle length; upper operculum smooth; scales strongly spinoid in specimens > 50 mm SL, weakly spinoid > 30 mm SL; AO 7 (8) {7 (8)} + 3 (2) {3 (2)}, total 10 {10 (9–11)}; D 13 (14) {13 (14)}; A 18 (19) {18 (16–19)}; P 17–19 {17–19 (16–17)}; max. size 72 mm SL; n = 7; Qld, NSW, WA, ChI *Dasyscopelus selenops* Tåning, 1928



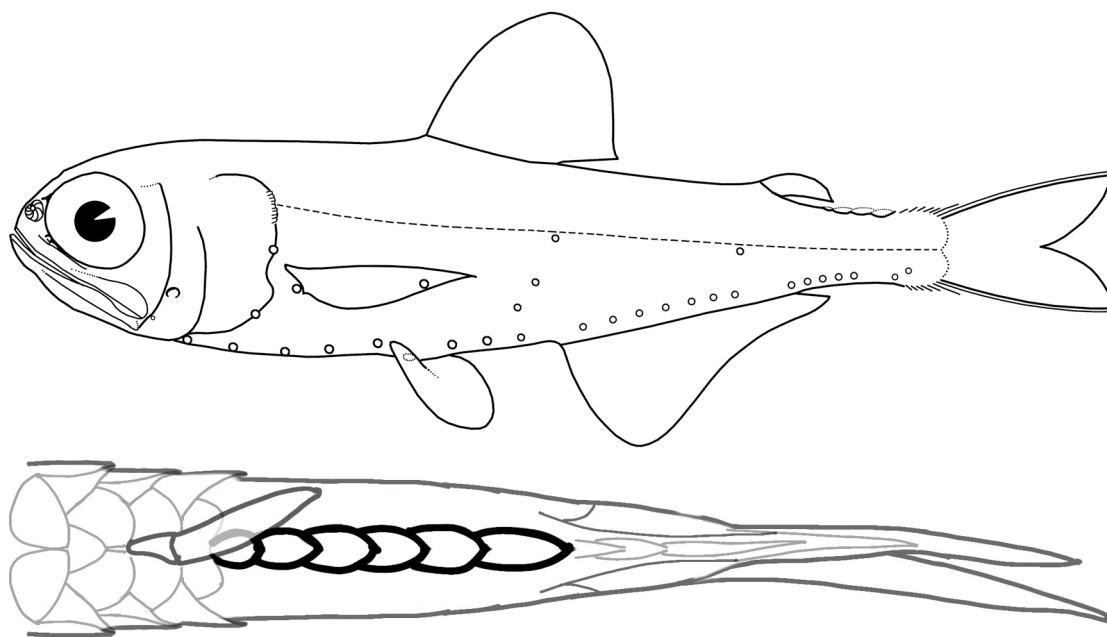
37122100 Lunar Lanternfish (♂, Nafpaktitis, 1973) and SCO

- GR 4 + 12 (11–13), total 16 (15–17); body depth 3.5–3.7 in SL; SCO of ♂s (presumed immature 40–45 mm SL) with 6 separate but almost contiguous, triangular luminous plates extending 70% caudal-peduncle length; SCO of ♀s with 2–4 separate, triangular luminous plates extending 25–55 % caudal-peduncle length (4 specimens 44–50 mm SL), no SCO in immatures < 40 mm SL (1 specimen 39 mm SL); [least depth of caudal peduncle 1.3–1.6 in caudal-peduncle length; upper operculum smooth; scales weakly spinoid; AO 7 + 3 (4), total 10 (11); D 13 (14); A 18 (19); P 18 (17); max size 50 mm SL]; n = 7; Qld, NSW *Dasyscopelus* sp. A



37122137 Lanternfish sp. A (♂, LM) and SCO

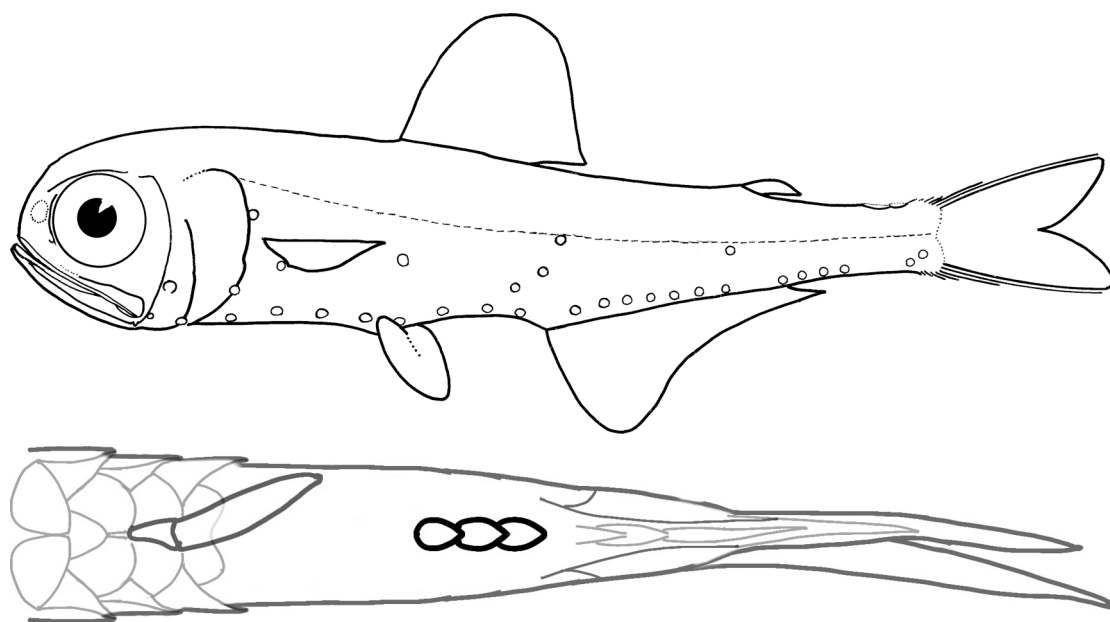
- 9 GR 7–9 + 16–22, total 24–31; scales finely denticulate, crenulated, or cycloid... 10
- GR 4–6 + 10–16, total 14–22; scales distinctly spinoid ... 12
- 10 Upper opercular margin with fine denticulations in specimens > 30 mm SL; post-orbital head length greater than eye diameter; only anterior scales below lateral line weakly crenulated, other scales cycloid; SCO of mature ♂s with 6–7 (4 in smallest specimen 65 mm SL; n = 4) {5 (3–6)} overlapping plates with pigment bordering individual plates, extending 85–95% caudal-peduncle length (60% in specimen 65 mm SL); PLO closer to upper border of pectoral-fin base than halfway between lateral line and upper border of pectoral-fin base; SAO straight or with slightly obtuse angle; [AO 7 + 5, total 12 {7 (6–8) + 4–5 (6), total 12 (11–13)}; ICO of ♀s 2–4 (4 in largest specimens 94–95 mm SL) {2(1–3)} contiguous or slightly overlapping smaller plates with lightly pigmented edges under 30–60% caudal-peduncle length; GR 7 + 17 (18), total 24 (25) {7 (6–8) + 17–18 (16–19), total 23–25 (22–27)}; D 13 (12); A 19 (17–20); P 18–19 (17); max. size 95 mm SL]; n = 10; Qld, LHI, NI, NSW ... *Dasyscopelus obtusirostris* Tåning, 1928



37122099 Bluntsnout Lanternfish (♂, Nafpaktitis, 1973) and SCO

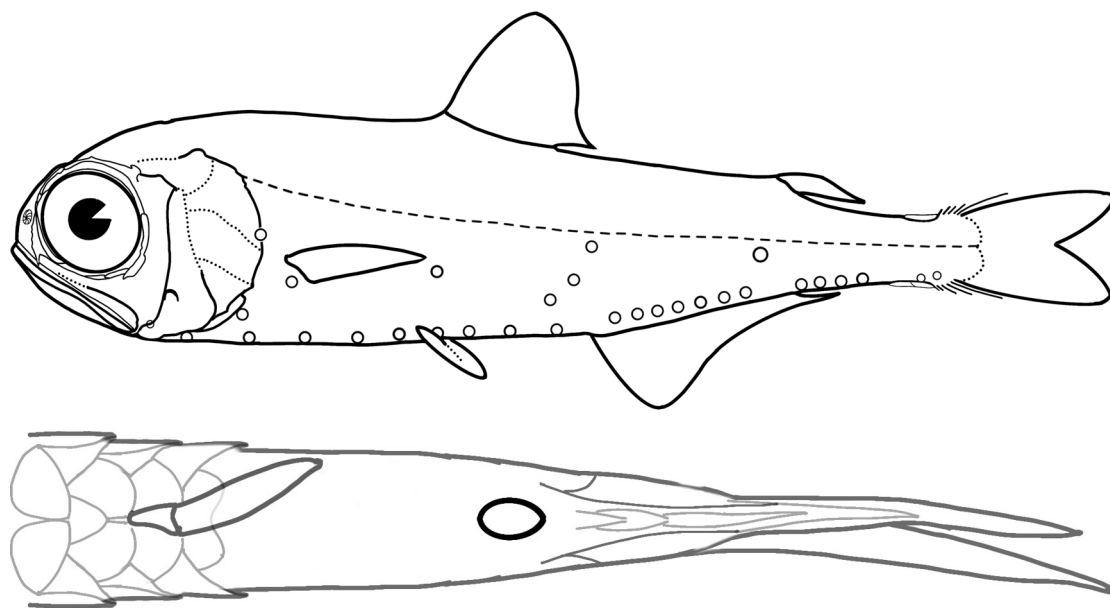
— Upper opercular margin smooth; eye diameter nearly equal to (slightly greater or lesser than) post-orbital head length; all scales except those of lateral line finely denticulate; SCO of ♂s with 1–3 small overlapping plates (rarely 1st plate separate) extending no more than 50% caudal-peduncle length; PLO closer to halfway between lateral line and upper border of pectoral-fin base than upper border of pectoral-fin base; SAO with distinct angle **11**

- 11** SCO of ♂s with 3 (2–4, 1 in smallest specimen 38 mm SL) small overlapping plates with narrow black borders in specimens > 60 mm SL, extending 35–50% (30% in specimen 64 mm SL) caudal-peduncle length, ICO 0 (n = 13: 61–74 mm SL); ♀s with SCO 0, ICO of 1–2 (1st 1/10th – 1/3rd size of 2nd, rarely =) small contiguous plates with faint black borders, under 15–30% caudal-peduncle length (n = 8: 62–73 mm SL); [AO 7 + 4 (3, 5), total 11 (10, 12), {7 (6–8) + 4 (3–5), total 11 (10–12)}; GR 7–8 + 17–19 (20), total 24–27 {7–8 + 19 (17–20), total 24–28}; D 12–13 (11); A 18 (19); P 18–19 (17, 20); max. size 74 mm SL; n = 22; Qld, NSW, WA ***Dasyscopelus brachygnathos* (Bleeker, 1856)**



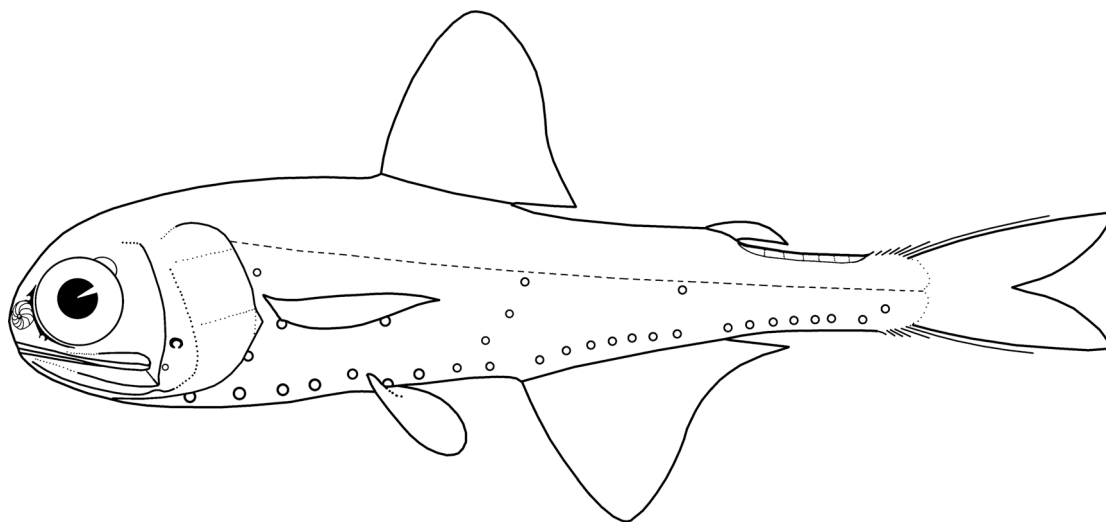
37122055 Shortjaw Lanternfish (♂, Nafpaktitis, 1973) and SCO

— SCO of ♂s with 1 ovoid plate with light black border extending 20–30% caudal-peduncle length; ICO of 2 contiguous very thin ovoid plates under 20–40% caudal-peduncle length (n = 7: 52–60 mm SL); ♀s with SCO 0, ICO of 2 (rarely 1) contiguous, very thin ovoid plates under 30–45% caudal-peduncle length (n = 10: 52–64 mm SL); [AO 7 + 3–4, total 10–11; GR 8 (7, 9) + 18–19 (20–22), total 26–29 (25, 31); D 13 (14); A 18 (19); P 18 (16–19); max. size 64 mm SL]; n = 19; WA *Dasyscopelus* sp. C



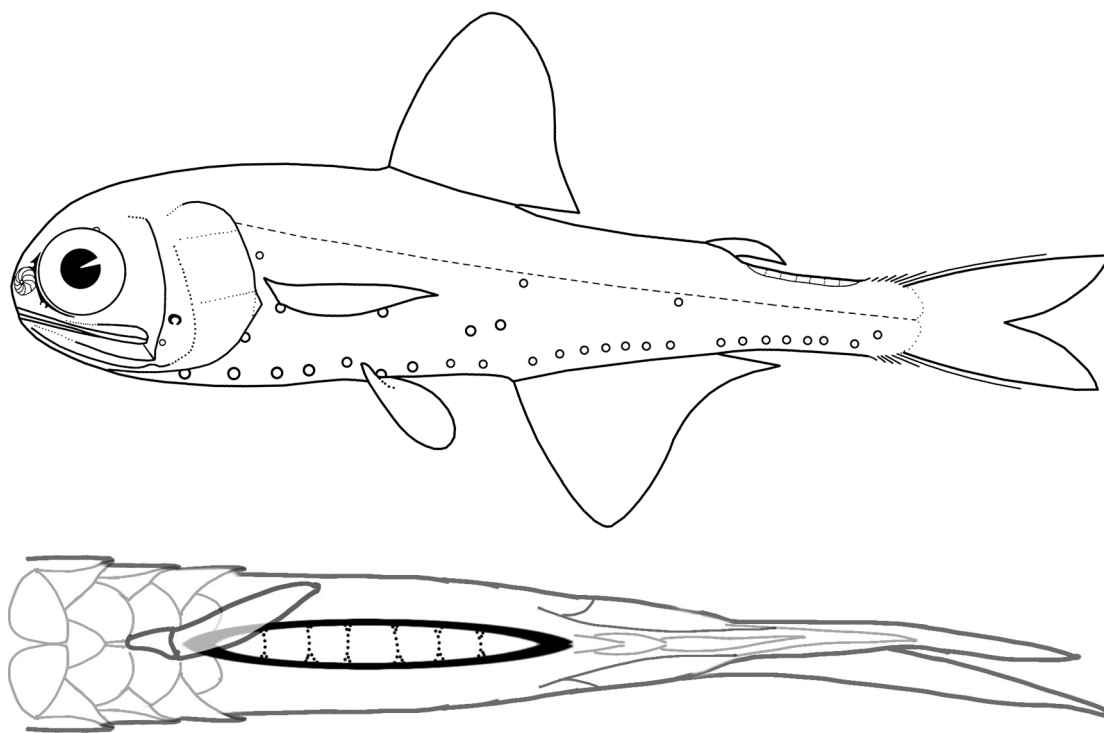
37122139 Lanternfish sp. C (♂, LM) and SCO

- 12** Suo luminous patch small but distinctive, above posterodorsal margin of orbit under ventral surface of posterolateral edge of frontal and/or 6th supraorbital, lacking black border; SAO obtusely angled, SAO_{1,2} line passing closer to VO₃ than VO₂; GR {5–6 + 13, total 18–19; 5–6 + 12–14*; 5 (rarely 4) + 12 (13), total 17 (18, rarely 16)#}; [AO {7 + 6–7, total 13–14; 7 (rarely 8) + 6 (rarely 5, 7), total 13 (rarely 12, 14), n = 53*}; upper operculum smooth; scales spinoid; D {13; 12–14*; 13 (rarely 12)#}; A {17; 17–18*; 17 (16, rarely 15, 18)#}; P {14–16; 14–15*; 15 (14–16)#}; SCO of ♂s {7 overlapping plates extending 80–85% caudal-peduncle length; >95% based on figure in Becker, 1983}; ICO of ♀s {1–3*}; max size 77 mm SL; not yet recorded from Australian waters, see remarks... ..*Dasyscopelus lunatus* Becker & Borodulina, 1978



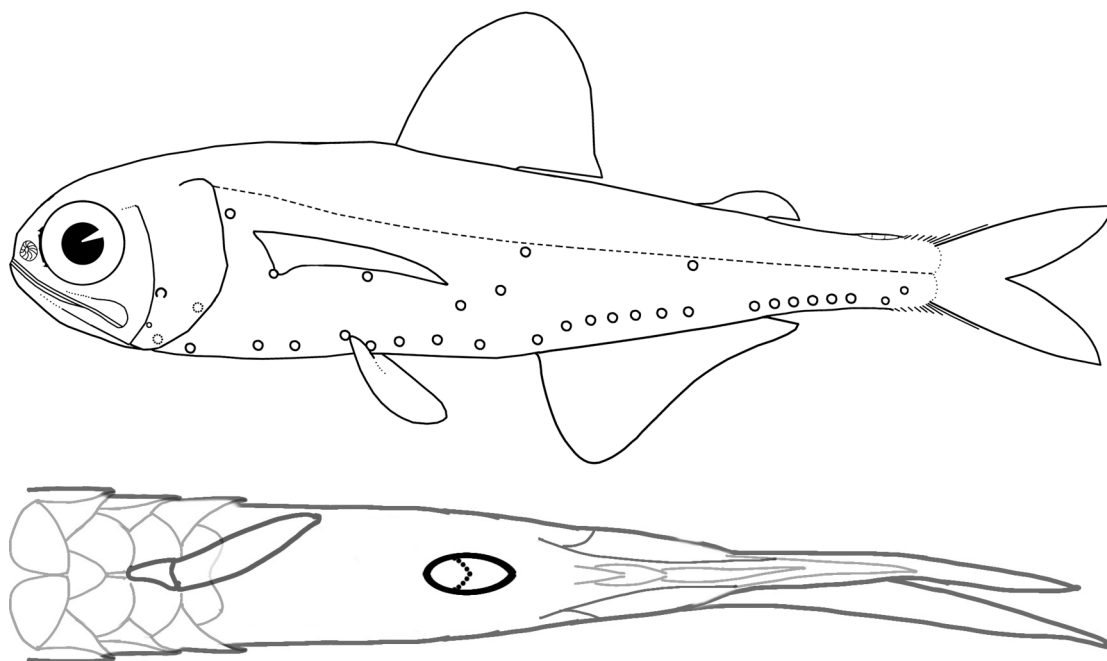
37122134 Mascara Lanternfish (♂, Becker & Borodulina 1978)

- Suo luminous patch above posterodorsal margin of orbit under ventral surface of 6th circumorbital absent or tiny, visible only in undamaged specimens; SAO more acutely angled, SAO_{1,2} line through or anterior to VO₂; GR 4 (rarely 5) + 11 (12), total 15 (16, rarely 17) **13**
- 13** SCO of ♂ with 6–8 coalesced plates, extending > 70–100% caudal-peduncle length in specimens > 60 mm SL (n = 14); degree of coalescence and surrounding pigment is variable; Suo luminous patch above posterodorsal margin of orbit under ventral surface of 6th circumorbital tiny, only visible in undamaged specimens, some as small as 30 mm SL; [AO 7 (8, rarely 6) + 6 (5–7), total 13 (14, rarely 12); ICO of ♀s 2–4, 8–50% caudal-peduncle length in specimens > 60 mm SL; upper opercular margin smooth; scales spinoid; GR 4 (rarely 5) + 11 (12), total 15 (16, rarely 17) {4 (rarely 5) + 11 (10), total 15 (14, rarely 16)}; D 13 (12, rarely 14); A 18 (17–19); P 15 (14); max size 76 mm SL]; n = 20+; Qld, LHI, NI, NSW, Tas, WA, ChI, Col*Dasyscopelus asper* Richardson, 1845



37122009 Prickly Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969) and SCO

- SCO of ♂ composed of 2–3 coalesced plates (1 in smallest specimen) (n= 5, 42–63 mm SL) {2–3, n = 6 (65–71 mm SL)}; plates slightly overlapping, > 25–32% (15% in smallest specimen, {25–40%}) caudal-peduncle length; Suo luminous patch above posterodorsal margin of orbit under ventral surface of 6th circumorbital absent; [AO 7 + 5–6, total 12–13 {6–7 (8, rarely 5) + 5–6 (rarely 4, 7), total 12–13 (rarely 10, 11), n = 161 from Indian Ocean (Tsarin, 1985)}; ICO of ♀s of {2, n=3: 62–69 mm SL} thin contiguous plates less than 25–30% caudal-peduncle length; upper opercular margin smooth; scales spinoid; GR 4 + 9–12, total 13–16 {4 (5) + 10–12, total 14–16 (17)}; D 12–13 {12–14}; A 17–19 {17–18}; P 13–15 {13–15}; max. size 72 m SL]; n = 6; Qld *Dasyscopelus ovcharovi* Tsarin, 1985



37122136 Ovcharov's Lanternfish (♂, LM) and SCO

Myctophum complex remarks

Here, we accept the genera proposed from recent genetics studies (Poulsen *et al.*, 2013; Denton, 2014; Martin *et al.*, 2018) namely *Ctenoscopelus*, *Dasyscopelus* and *Myctophum*. The former, *Ctenoscopelus*, may be easily distinguished in the field by the high position of Prc_2 ; a Prc_1 - Prc_2 interspace about equal to the AOp - Prc_1 interspace; the position of the PLO ; and the strongly serrate posterodorsal margin of the opercle. However, diagnostic characters for *Dasyscopelus* and *Myctophum* include only molecular differences, and non-consistent differences in otolith morphology (Lin & O'Dea 2025). Such characters are unsuited to field work, hence our rationale for the amalgamation of the three genera into a complex for purposes of this key.

***D. asper*.** The description of “ SAO_1 over VO_{2-3} interspace” by Wisner (1976: 61) is a *lapsus* for VO_{3-4} , as indicated by his figure on that page. The *Dasyscopelus asper* species group includes *D. lunatus* and *D. ovcharovi*, as well as the nominal species with a number of different forms that may represent other distinct species (see Wisner, 1976 and Becker & Borodulina, 1978). Cleared and stained specimens of all species in the group should be examined for the presence of rounded tooth tips on the third pharyngobranchial tooth plate, as described by Paxton (1972: 26) for *D. asper*. Taxonomic work on the species group is hampered by uncertainty about the type locality, although a lectotype was designated (Wisner, 1970).

***M. aurolaternatum*.** New record for Australia based on 2 AMS and 4 MCZ larvae 5–24 mm TL/SL and 1 AMS adult in poor condition from the Coral Sea off north Qld (11.77–14.47°S). Larvae of this species have distinctive stalked eyes and trailing gut (see Moser *et al.*, 1984: fig. 117F; Bian & Wan 2014: fig. 6). The species has an equatorial distribution across the Pacific and is more common

in the east, where it expands to 27°N. There is a gap in the distribution from 145° to ca 170°E, and no specimens had been recorded south of 10°S in the Pacific (Kawaguchi & Aioi, 1972; Becker, 1983; Hulley, unpublished data). Wisner (1976) demonstrated differences in meristics of specimens from a number of Pacific Ocean regions. The shape of the upper operculum in the single Australian adult and a 39 mm SL AMS specimen from 4°S off Madang, PNG is similar to that figured by Kawaguchi and Aioi (1972, fig. 5). Meristic data of fins in {} from Nakabo (2002).

***D. brachygnathos*.** The new size record is based on an AMS specimen from the Coral Sea (15.07°S, 149.35°E) off northern Qld. Previous WA records are *Dasyscopelus* sp. C (see **remarks** below). One recent NMV specimen 61 mm SL from a bottom trawl near Ashmore Reef (12.48°S, 123.42°E) is a male with one small and three large plates in the SCO and no ICO, typical of Coral Sea and more equatorial Pacific Ocean specimens. The specimen differs from all the Coral Sea specimens by having fewer pectoral-fin rays (13–14 vs 17–19) and more gill rakers (8+21, total 29 vs 7–8 + 17–19, total 24–27). It is now the only WA representative of the nominal form of the species. One SAM specimen from off Mozambique in the western Indian Ocean has features of both *D. brachygnathos* and the similar *D. fissunovi* (see below). The records of Nafpaktitis & Nafpaktitis (1969) from the western tropical Indian Ocean were actually *D. obtusirostris* (Nafpaktitis *et al.*, 1977). Mundy (2005: 228) listed the species as benthopelagic (as well as neritic and mesopelagic), as this WA specimen could be, although all the Coral Sea specimens were taken in midwater trawls. Kawaguchi *et al.* (1972) indicated this species does not occur nocturnally in the surface waters of the west Pacific and east Indian Oceans.

Another species in the *D. brachygnathos* – *D. obtusirostris* species group is *D. fissunovi* Becker & Borodulina (1971), described from the equatorial far western Indian Ocean and southeast of Mauritius. The species is similar to *D. brachygnathos* in having a smooth posterodorsal edge of the operculum and fine denticulations on the body scales, but differs in having a posteriorly-shifted PO_2 directly under PVO_1 (half a photophore-diameter posterior to the position

in the other species) and a broader interorbital distance approximately 1/3 of the head length. Becker & Borodulina apparently had no specimens of *D. brachygnathos* with which to compare their new species. Four AMS specimens 56–61 mm SL from off Somalia were identified as *D. fissunovi*, based on the posterior PO₂ and male and female caudal organs as in the original description, similar to those of the Coral Sea population of *D. brachygnathos*. Head length, bony interorbital width measured at the level of the pineal organ (slightly anterior to the vertical through the centre of the orbit), and eye diameter were measured and compared with those of 4 specimens each of *D. brachygnathos* and *D. obtusirostris* from the Coral Sea and 8 specimens of *D. sp. C* from off the Northwest Shelf, all part of the counted specimens in the key above. The interorbital of *D. fissunovi* is only uniquely larger than that of the other 3 taxa when compared to eye diameter, because the eye diameter is uniquely smaller in *D. fissunovi* than the other 3 taxa. Interorbital width as a % of HL is uniquely larger than only *D. obtusirostris*, overlapping those of *D. brachygnathos* and *D. sp. C*. Study of larger sample sizes will be needed to determine whether *D. fissunovi* is distinct from *D. brachygnathos*.

***D. lunatus*.** The published species distribution is limited to the original description that noted 61 specimens from the Indo-Malayan Archipelago, including 15 type specimens (Becker & Borodulina, 1978) and the world synopsis of Becker (1983). The species is also relatively common in equatorial waters between 135° and 165°W (Hulley, unpublished data), but not collected north of New Caledonia; a small cluster of 8 MCZ specimens off northeastern New Guinea at 147°–153°E, combined with the 3 AMS specimens from the Coral and Timor Seas, indicate the species is likely to be collected from Australian waters. Meristic data within {} from 2 AMS male specimens 49–50 mm SL from the Timor Sea, {*} from Becker & Borodulina (1978) type specimens from the Indo-Malayan Archipelago plus additional non-types for AO counts and Becker (1983), and {#} from the Pacific between 135° and 168°W within 1° of the equator (Hulley, unpublished data - specimens registered at MNHN).

***M. nitidulum*.** Wisner (1976) demonstrated population differences of meristics and distributional gaps across the Pacific for this species but had no specimens from the South Pacific west of 180°. Our counts of GR, SCO, and ICO in combination suggest the southwest Pacific specimens may represent a distinct population. Although Becker (1967) recorded a single specimen of the similar *M. affine* at Lord Howe Island, no other specimen of this species from Australian waters exists to our knowledge. Later Becker (1983: 127) considered the range of the species to be unclear, but limited *M. affine* to the Atlantic Ocean, as confirmed by Namiki *et al.* (2015) and figured by Rintz *et al.* (2025). Gill raker data in {} * – Indo-Pacific (PAH unpublished data, n = 269); ** – Atlantic (Hulley, 1981).

***D. obtusirostris*.** New size record based on AMS gravid ♀ from Coral Sea (14°10' S, 145°23' E).

***D. ovcharovi*.** New record for Australian waters, based on 6 AMS specimens from Coral Sea waters off north Qld (13.54–14.5°S). Only one specimen from the tropical western Pacific was included in the new species description (with 167 others recognised from the Indian Ocean), although the species was stated to occur in the equatorial region of the western Pacific (Tsarin, 1985). No detailed description of the female ICO was presented; the description given above is based on 3 AMS specimens from the Coral Sea outside Australian waters within 200 n miles of the Australian

boundary, taken in the same trawl as males of this species. Meristic data within {} are from 10 specimens outside Australian waters, 9 from the Coral Sea and 1 from off Papua New Guinea. The bluish colour of the SCO plates described in the new species description is not clear in specimens with lost or damaged overlying scales, although black pigment under the plates is thicker and more distinct than that in *D. asper*. The fewer SCO plates over a smaller portion of the caudal peduncle clearly distinguish males from those of *D. asper*. Fewer adult *D. asper* than *D. ovcharovi* have been collected in the Coral Sea (ratio 1:3). Immatures of the two species are not distinguishable at the present time, and earlier Qld records are questionable. Further study on more Pacific specimens is needed.

***D. selenops*.** New record for Qld, based on 6 specimens (5 AMS, 1 MCZ) from Coral Sea waters off north Qld (10.99–15.95°S) 12–34 mm SL, no data taken from smallest specimen, but data included from 2 specimens (24–27 mm SL), one originally recorded from NSW (Paxton *et al.*, 1989: 267) and the second unrecognised earlier from the same area. Data in {} based on 6 AMS specimens 29–67 mm SL from 115–127 n miles NE of the Australian waters boundary off Cape York. Wisner (1976) and Becker & Borodulina (1978) gave details of variation in meristics and morphometrics from different areas across the tropics. The diagnostic character of the upper opercle without a horizontal dorsal edge shown in Nakabo (2002) is not confirmed by specimen examination, or in the holotype figure by Bolin (in Wisner, 1976: p 68, fig 63).

***D. spinosus*.** Meristics between {} are a summary of all 62 specimens > 33 mm SL from the Coral Sea. Wisner (1976) summarised meristic data from central and western Pacific specimens north of Australian waters.

***D. lychnobius*.** This species, in common with *D. spinosus*, also has enlarged spines on the scales over the AO photophores. We have included it in the key because detailed examinations of the 62 Coral Sea specimens using the characters that separate *D. lychnobius* from *D. spinosus* (principally, the SAO straight vs obtusely angled, combined with the position of SAO₁ in relation to the VO₄), identified 20 *D. spinosus* and 12 *D. lychnobius*. However, 30 individuals with mixed characters were also identified: all have a straight SAO (with the SAO₁₋₂ line passing less than one photophore-diameter posterior to the SAO₃), but have the SAO₁ in the anterior position (closer to the vertical through half-way between VO₃ and VO₄ than to the vertical through VO₄) on one or both sides. The relative size of the AO₁₋₂ interspace is variable in both species, while the body depth in SL of *D. lychnobius* ranged from 3.8–4, rarely 4.1, and that of *D. spinosus* ranged from 4–4.4, rarely 3.9, with 4.6 in the smallest; the overlapping continuum could not help distinguish the ‘hybrids’. Thus, while *D. lychnobius* is regarded as a valid species, especially from waters of the eastern Pacific (Paxton, 1972; Wisner, 1976; Becker & Borodulina, 1978; Becker, 1983), it remains possible that there may be one highly variable species (i.e. *D. spinosus*) in the Coral Sea.

***Dasyscopelus* sp. A.** The apparent new species is based on four AMS specimens from southern NSW, previously misidentified as *D. orientale* (see Paxton *et al.*, 1989; Hoese *et al.*, 2006), two NMNZ specimens from New Zealand, including the only male, and one NMV immature specimen from off southern Qld (26.28°S). Although none of the specimens is fully mature and the SCO is expected to develop more with increasing size, the distinctly fewer number of total gill rakers than *D. selenops* and more slender body indicate an undescribed species. The presence of two

immature specimens with the high GR count of *D. selenops* in the same area off southern NSW suggest these seven specimens are not just another population of *D. selenops* with different meristics. Japanese specimens of *D. orientale* in NSMT (four, 50–88 mm SL) and AMS (one, 50 mm SL) have caudal luminous organs similar to both species but differ in having 19–21 total gill rakers and body depth 3.8–3.9 in SL (see also Kawaguchi & Aioi, 1972). *D. orientale* is restricted to the western North Pacific (Becker, 1983).

***Dasyscopelus* sp. B.** Two specimens from off northern WA have the deep body typical of *D. selenops* and *D. sp. A*. The major difference is the presence of both a well-developed SCO and a smaller ICO in both individuals, a rare occurrence in species of the *Myctophum*-complex, found in some female specimens *D. spinosus* and males of *D. sp. C*. Additionally, the number of gill rakers (total 20), is below the range of *D. selenops* and above the range of *D. sp. A*. Both specimens were collected in the 1980s, and neither is in good enough condition internally to determine the sex without histology. This appears to be an undescribed species, based on one AMS specimen off the Northwest Shelf, WA (18.38°S, 117.68°E) and one CSIRO specimen in the same general area (17.02°S, 120.22°E), both collected in the month of April of different years with bottom trawls between 390 and 420 m; both specimens are 62 mm SL.

***Dasyscopelus* sp. C.** AMS specimens totaling 23 (52–64 mm SL) from two benthic trawls north to northwest of Port Hedland at 300 and 400 m were in breeding condition in April, and were the basis of the previous WA records of *D. brachygnathos* (Paxton *et al.*, 1989; Hoese *et al.*, 2006) at 18°–19° S. More recent AMS and NMV specimens have

increased this range to 17°–21.5°S. All nine males have but one SCO plate, and 2 small ICO plates. No ICOs have been reported from previous male specimens of this species group, recorded from across the tropical west-central Pacific Ocean and the western Indian Ocean (see **remarks** on *D. brachygnathos* above). The presence of *D. brachygnathos* with a different pattern of caudal organs only 5° north of this population is a strong indication that these would not interbreed and represent distinct species.

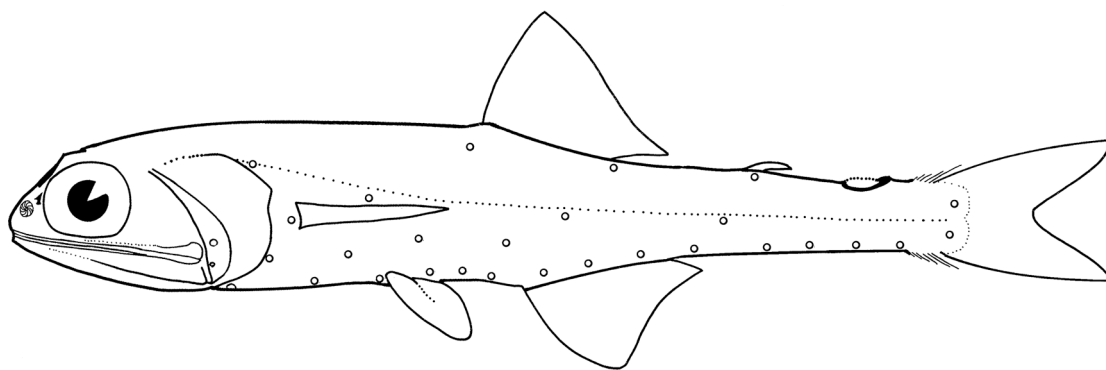
***Notolychnus* Fraser-Brunner, 1949**

This monotypic genus is unique in having the VLO, SAO₃, and PO₂ photophores far above lateral line near dorsal margin of body, and PO₄ elevated near the lateral line; as well, it has 6 pelvic-fin rays and long jaws that extend far beyond the orbit. It is also characterized by 2 Prc in a vertical line with Prc₂ notably above lateral line, and the PO₃ highly elevated. The frontal bones form a small, median dome over the pineal area; both the Vn light organ and lateral line are absent. For comments on relationships see **remarks**.

The single species is circumglobal in distribution in tropical and temperate waters, see Nafpaktitis and Nafpaktitis (1969); Wisner (1976); Nafpaktitis *et al.* (1977); Becker (1983); Hulley (1984, 1986a, 1990b); Hoese *et al.* (2006); Roberts *et al.* (2015); Hulley and Paxton (2016); Sutton *et al.* (2020); Mostarda *et al.* (2023); and Koubbi *et al.* (2025). Data from non-Australian specimens in {} are from Roberts *et al.* (2015).

Key to the genus *Notolychnus*

AO 4 + 4, total 8 {4 (rarely 5 + 4 (rarely 3), total 8}; SCO small, 1, ICO absent; GR 2 + 8 (rarely 7, 9), total 10 (rarely 9, 11) {2 + 7–8, total 9–10}; D 11 (rarely 12) {10–11}; A 13–14 (12) {12–13}; P 13 (rarely 12, 14) {12–14}; max. size 25 mm SL; n = 20; Qld, LHI, NI, NSW, Vic, Tas, WA, ChI ... *Notolychnus valdiviae* (Brauer, 1904)



37122058 Topside Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

Notolychnus remarks

In DNA studies by Denton (2014), the tribe Notolychnini (*sensu* Paxton, 1972) was recovered as a sister to the Lampanyctini clade, and has subsequently been recognized as a separate subfamily by Martin *et al.* (2018).

N. valdiviae. Oceanic, mesopelagic, generally widespread in Atlantic (56°N–52°S), Indian (17°N–44°S) and Pacific (45°N–40°S) oceans.

Notoscopelus Günther, 1864

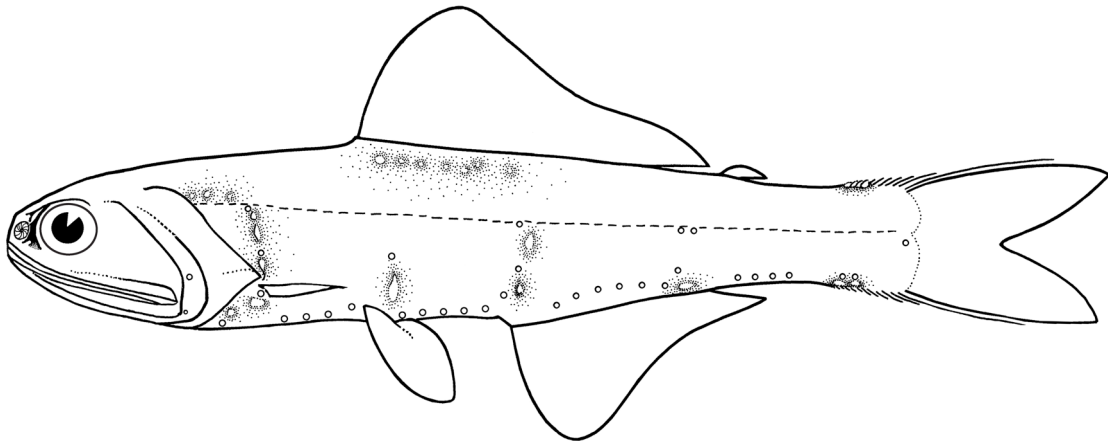
This genus is unique in having 2, very rarely 3, horizontal Pol photophores at the lateral line (*Lampichthys* has 3 Pol similar to *Notoscopelus*, but the third is below the first). The genus is also characterised by the first AOa being slightly depressed and the last distinctly elevated; it has no cheek

photophores, a Dn light organ with a small dorsal part and more elongate part along the anterior margin of eye, a small simple Vn, and scattered patches of luminous tissue on body, including on the caudal peduncle. The SCO, present only in males, is composed of coalesced luminous plates covering the dorsal surface of the body between the adipose-fin base and dorsal procurent spines; an ICO is absent in all five species of subgenus *Notoscopelus*.

The genus is circumglobal in distribution with two subgenera and six recognised world species, two are recorded from Australian waters (both in the subgenus *Notoscopelus*), see Nafpaktitis and Nafpaktitis (1969); Nafpaktitis (1975); Fujii and Uyeno (1976); Hulley (1981, 1984, 1986a, 1990a, 1990b); Becker (1983); Hoese *et al.* (2006); Roberts *et al.* (2015); Hulley and Paxton (2016); Sutton *et al.* (2020); Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Roberts *et al.* (2015).

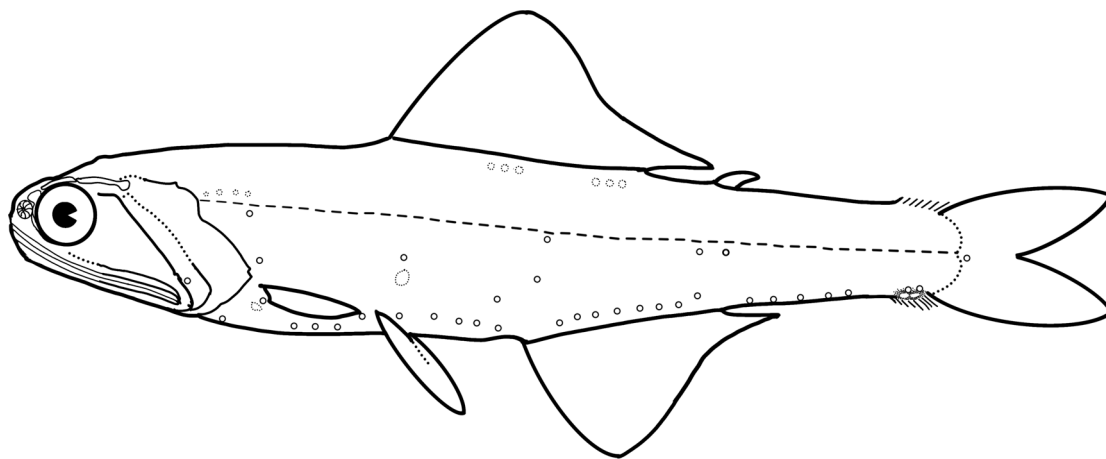
Key to the genus *Notoscopelus*

Pol₁₋₂ 1-1.5 diameters apart; SAO₁₋₃ line almost vertical, with SAO₁ midway between verticals of VO₅ and SAO₂; GR 4 + 9–11, total 13–15 {4 + 9–10, total 13–14}; D 25–27 {25–27 (rarely 24, 28)}; enlarged teeth present on posterior half of dentary; [AO 7–8 (rarely 9) + 4–5, total 13 (11–14) {6–7 (rarely 9) + 4–5}; SCO ♂ only; A 20 (rarely 19, 21) {19–21}; P 11–12 (13) {11–13}; max. size 140 mm SL]; n = 10; Qld, LHI, NI, NSW, WA *Notoscopelus caudispinosus* (Johnson, 1863)



37122070 Spinetail Lanternfish (♀, Nafpaktitis & Nafpaktitis, 1969)

—— Pol₁₋₂ 2-3 diameters apart; SAO₁₋₃ line more acute angle, with SAO₁ closer to vertical of VO₅ than that of SAO₂; GR 6 (7) + 14–15 (16, rarely 12), total 20–21 (rarely 18, 22–23) {6 + 14–15 (rarely 13), total 19–20}; D 23 (22, rarely 21, 24) {22–24}; no enlarged teeth on posterior half of dentary; [AO 8 (7–9, rarely 6) + 5 (4–6, rarely 7), total 13–14 (rarely 12, 15) {8–9 + 4–6}; SCO ♂ only, 6–8; A 19 (18–20) {18–20}; P 12 (11–13) {12–13}; max. size 95 mm SL]; n = 40; LHI, NI, NSW, Tas, SA, WA *Notoscopelus resplendens* (Richardson, 1845)



37122022 Patchwork Lanternfish (♀, Nafpaktitis & Nafpaktitis, 1969)

Notoscopelus remarks

Only two and three of the six species were included in the DNA studies of Denton (2014) and Martin *et al.* (2018), respectively. Both recovered monophyletic clades for the genus, with strong support for a sister relationship with the monotypic *Scopelopsis*.

Protomyctophum Fraser-Brunner, 1949

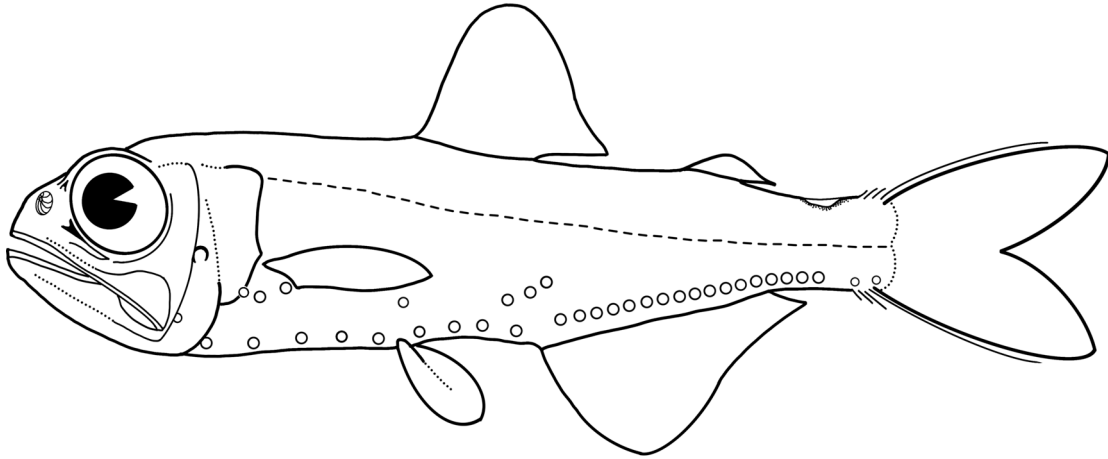
This is one of four primarily Southern Ocean genera, the species having only two Prc photophores, and the PLO below the level of the dorsal margin of the pectoral-fin base. The SCO light organ is composed of partially coalesced elements,

or is a single organ with no divisions, and is always margined with black pigment. The SCO is always present in ♂ but only in ♀ of some species. The ICO has various forms, being separate or partially coalesced elements, or a single organ; it is usually present in ♀ and sometimes in ♂. For results of recent DNA studies, see **remarks**.

The genus is anti-tropical in distribution, and has two subgenera with 14 world species; 11 species occur in the Southern Ocean south of 40°S, and nine species are recorded from Australian waters, see: Wisner (1976); Hulley (1981); McGinnis (1982); Hulley (1986a, 1990); Prokofiev (2004); Hoese *et al.* (2006); Flynn & Williams (2011); Roberts *et al.* (2023). Data from non-Australian specimens in {} are from Hulley (1990a).

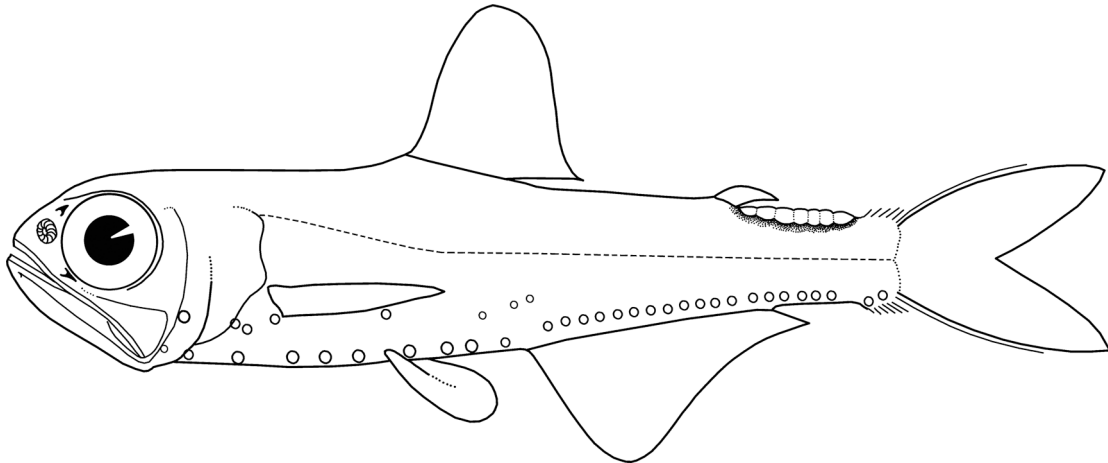
Key to the genus *Protomyctophum*

- 1 Bony interorbital wider than posterior maxillary; eye not semi-telescopic, eye-lens not displaced dorsally; anal-fin origin closer to level of posterior end than middle of dorsal-fin base subgenus *Protomyctophum* 2
- Bony interorbital narrower than posterior maxillary; eyes semi-telescopic, eye lens displaced dorsally ... subgenus *Hierops* 8
- 2 Prc_{1,2} space more than one photophore-diameter; SCO ♂ only, 1, short, less than 30% space between adipose-fin base and procurent rays, with unpigmented constriction (similar to 2 coalesced patches); [AO 17 {17 (18)}; ICO ♀ only, 1 coalesced or 3–6 separate patches; GR 5 + 16–17 (15), total 21–22 (20) {4–6 + 15–17 (rarely 18), total 21–22 (rarely 19, 20, 23)}; D 12–13 {13 (12, rarely 14)}; A 24 (23–25) {24 (23–25, rarely 26)}; P 14–16 {15 (16, rarely 14)}; max. size 67 mm SL; n = 5; MqI, HIMI *Protomyctophum* (*P.*) *bolini* (Fraser-Brunner, 1949)



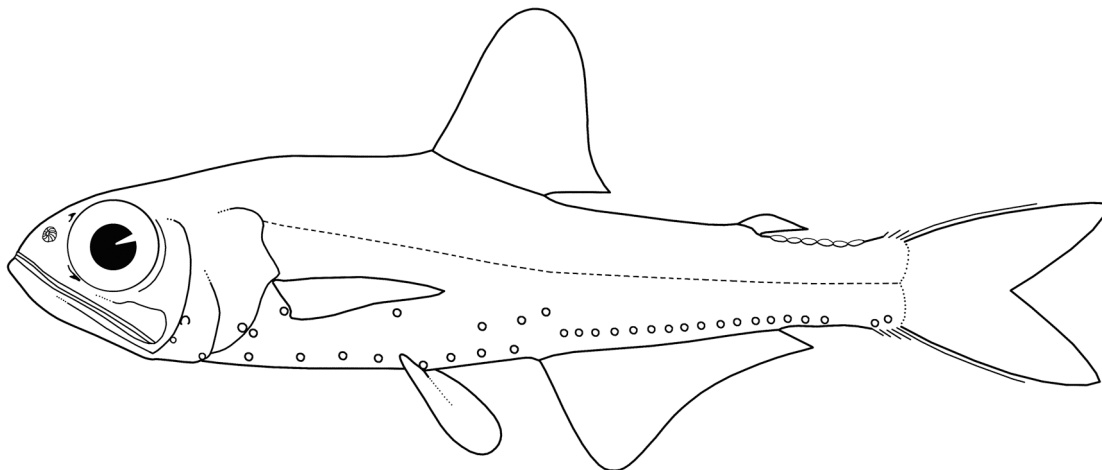
37122755 Bolin's Lanternfish (♂, Hulley, 1981)

- Prc₁₋₂ space less than one photophore-diameter; SCO usually long, more than 50% of space between adipose-fin base and precurrent rays, any constrictions with pigment ... 3
- 3 Body depth less than 25% SL, usually 21-23% ... 4
- Body depth more than 25% SL, usually 26-30% ... 5
- 4 Palatine teeth only on anterior portion of palatine; max. size 54 mm SL; SCO ♂ only, long, covering 100% of dorsal caudal peduncle at maturity, formed of 6-7 {6-8} almost coalesced rectangular elements with pigmented borders; ICO ♀ only, formed of 5 (4-6) small, separate elements; [AO 17-18 {17-18 (rarely 16, 19)}; GR 6-7 + 17-18, total 23-25 {6 (5-7) + 18 (17-19), total 24 (23-25), rarely (22, 26)}; D 12-13 {12-13 (rarely 11)}; A 23-25 {23-24 (25, rarely 22)}; P 15-16 {15 (16, rarely 14)}; max. size 54 mm SL; n= 3; MqI, MIHI *Protomyctophum (P.) tenisoni* (Norman, 1930)



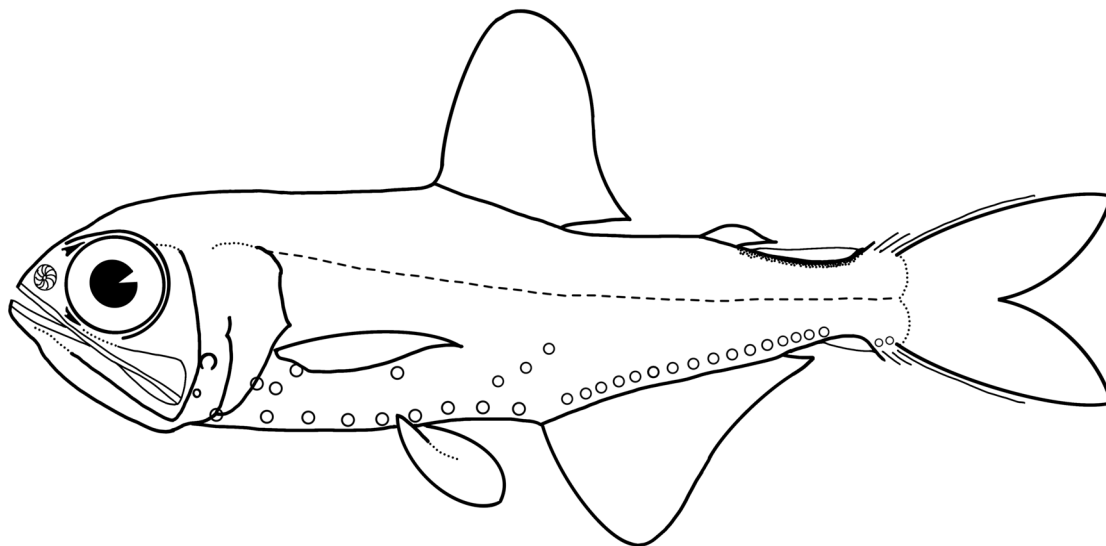
37122117 Tenison's Lanternfish (♂, Hulley, 1981)

- Palatine teeth evenly spaced along length of palatine; max. size 95 mm SL; SCO ♂ only, long, formed of 6 (5) partially coalesced diamond-shaped elements; ICO ♀ only, formed of 5–7 well-separated elements; [AO 16 (17, rarely 15); GR 6 (7–8) + 20 (19, rarely 18, 21), total 25–26 (27, rarely 24, 28, 29); D 13 (12–14); A 23–24 (rarely 22, 25); P 15 (14–16)]; max. size 95 mm SL; n = 7; HIMI *Protomyctophum (P.) choriodon* Hulley, 1981



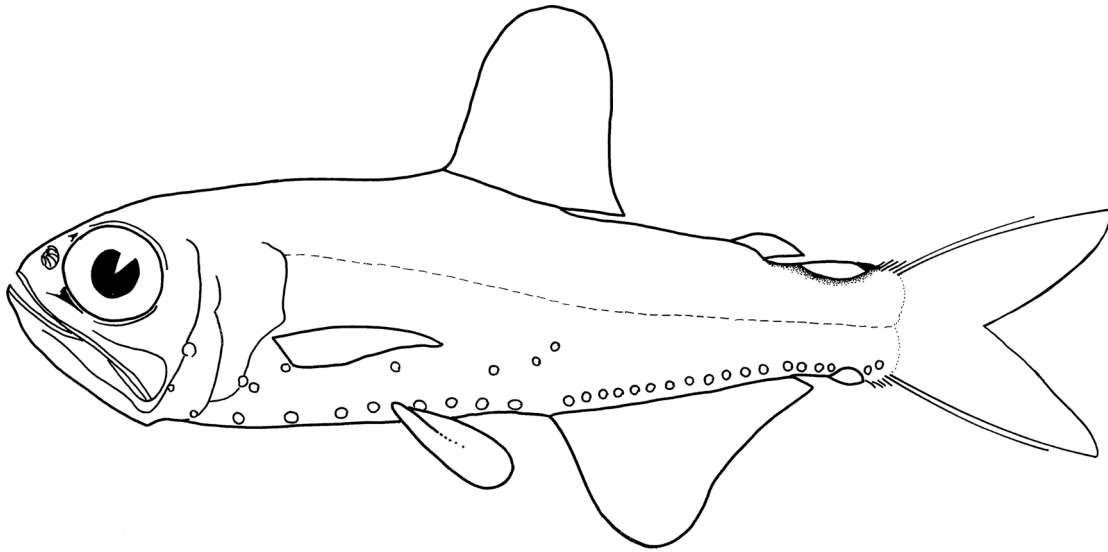
37122140 Gaptooth Lanternfish (♂, Hulley, 1981)

- 5 GR 4 (5) + 15–16, total 19–21 {4 (rarely 5) + 15 (16, rarely 14 or 17)}; ♂ with long SCO and small ICO; ♀ with tiny SCO, no ICO; [SCO: ♂ 1 coalesced, long, from procurent rays almost to adipose-fin base, ♀ 1 tiny before procurent rays; ICO: ♂ 1 small to moderate from procurent rays to last AO; AO 16–17 {16 (15–17)}; D 13–14 {14 (13)}; A 22–23 (24) {23 (22–24, rarely 25)}; P 15–17 {16 (15–17)}; max. size 60 mm SL; n = 5; HIMI, Mql *Protomyctophum (P.) andriashevi* Becker, 1963



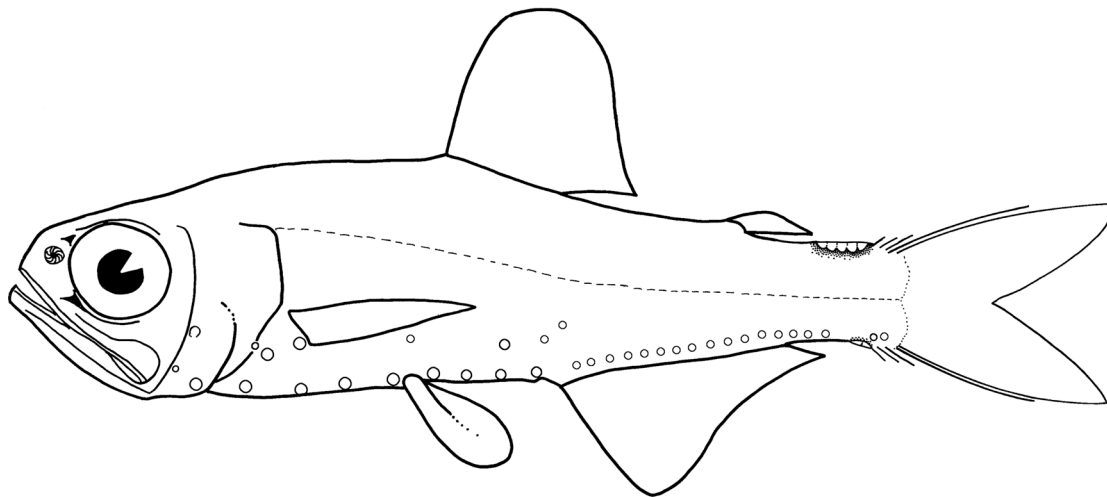
37122116 Andriashev's Lanternfish (♂, Hulley, 1981)

- GR 6 (5–7) + 18–20 (17, rarely 16–21), total 24–26 (23, rarely 22–28); ♂ with moderate to large SCO, but not close to adipose-fin base, and 1 moderate to large or 1 small and 2 tiny ICOs; ♀ with ICO only or SCO and ICO ... 6
- 6 P 17–18 {17 (16–18)}; tips of fins (especially caudal) pigmented; SCO size variable, ICO typically 50% distance from precurrent rays to adipose-fin base; ♀ from Australian waters with small oval SCO and ICO, both pigmented, SCO longer than ICO. [♂ with single SCO, extending about 70% distance from precurrent caudal-fin rays to adipose-fin base, ICO single (sometimes bifid); ♀ with single small SCO, and minute, single ICO; AO total 16 (15) {16 (15–17)}; GR 6–7 + 19–20, total 25–26 (27) {6 (rarely 5, 7) + 19 (20, rarely 18, 21), total 25 (23–27)}; D 13 {13 (12–14)}; A 24 (23–25) {23–24 (22–25)}; max. size 86 mm SL; n = 16; Tas, MqI, HIMI *Protomyctophum (P.) gemmatum* Hulley, 1981



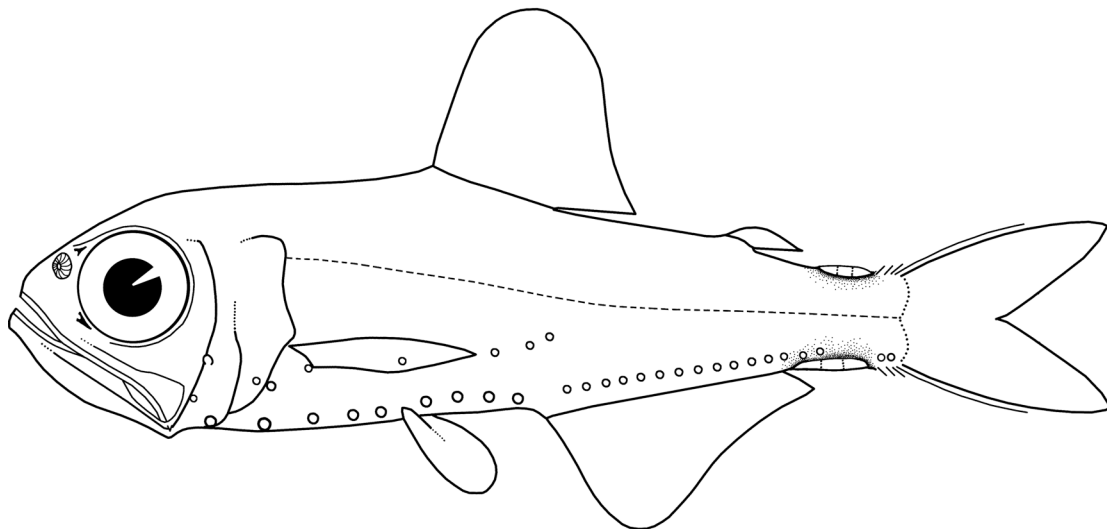
37122110 Jewelled Lanternfish (♂, Hulley, 1981)

- P 14–15; tips of fins without pigment; ♂ with 1 well developed SCO with pigmented partial divisions and ICO consisting of either 2–5 separate elements or a single large, coalesced organ with pigmented partial divisions; ♀ with either a combination of moderately long pigmented SCO and ICO consisting of 2–4 separate elements, or distinct but small globular SCO and elongate pigmented ICO ... 7
- 7 ♂ with single SCO, extending about 60% of distance from precurrent caudal-fin rays to adipose-fin base, and an ICO of 2–4 separate, indistinct patches, the most posterior being the best developed; ♀ with ICO only, consisting of 2–4 separate patches; total GR 26 (24, 25) {25 (26, rarely 24, 27 or 28)}; [AO total 16 (14) {16 (14–17)}; GR 6 + 20 (18, 19), total 26 (24, 25) {6 (rarely 5–7) + 19 (20, rarely 18 or 21), total 25 (26, rarely 24, 27 or 28)}; D 13 (14) {13 (12)}; A 22–23 (24) {23 (22–24)}; P 14–15 {14 (13–15)}; max. size 56 mm SL; n = 6; NSW, Tas *Protomyctophum (P.) normani* Tåning, 1932



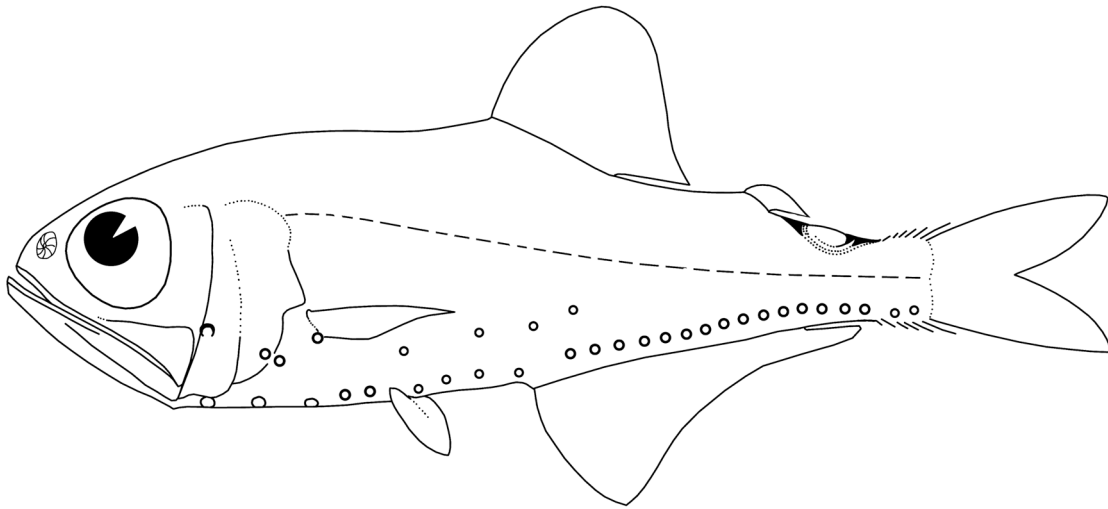
37122067 Norman's Lanternfish (♂, Hulley, 1981)

- ♂ with single SCO, extending about 50% of distance from procurent caudal-fin rays to adipose-fin base, and single, coalesced ICO, extending from procurent caudal-fin rays to anal-fin base; ♀ with single, globular SCO, and single, minute, black-edged ICO; total GR 23 {22–24 (rarely 25)}; [AO 15 {15–16 (17)}; GR 5 + 18 {5 (6) + 18 (17, rarely 16, 19), total 23 (22–24, rarely 21, 25)}; D 13 {13 (rarely 12, 14)}; A 23 {22–23 (21–24)}; P 14 {14–15 (rarely 13)}; max. size 61 mm SL]; n = 1; Tas, near HIMI *Protomyctophum (P.) luciferum* Hulley, 1981



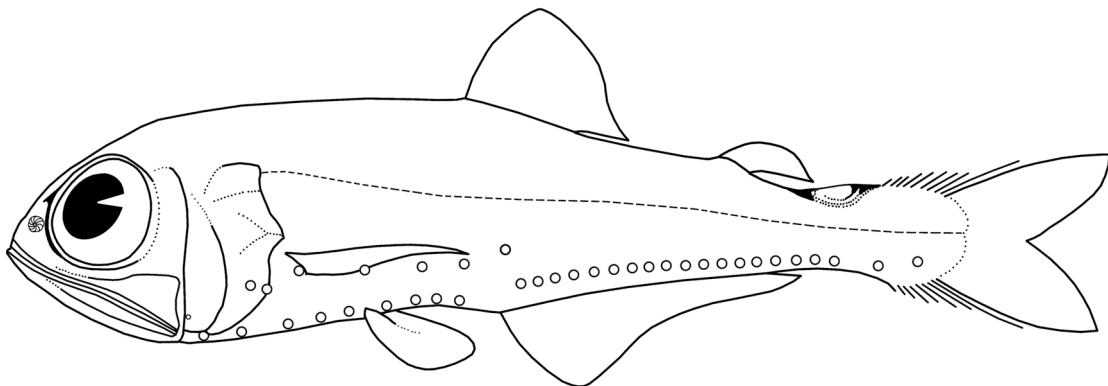
37122141 Damsel Lanternfish (♂♀, Hulley, 1981)

- 8 AO 14–15 {14}; Prc₁₋₂ space less than two photophore-diameters; SAO₁ above VO₃-VO₄ interspace, rarely above VO₃ or VO₄; [SCO ♂ only, 1 large; ICO ♀ only, 1–3, sometimes coalesced; GR 4 + 14 (13, 15), total 18 (17, 19) {4 + 15 (14), total 19 (18)}; D 11–12 {11–12}; A 21 {22 (21–23, rarely 20, 24)}; P 14–15 16 {15 (14–16)}; max. size 36 mm SL]; n = 5; NSW, Tas, HIMI, MqI, WA *Protomyctophum (H.) subparallelum* (Tåning, 1932)



37122068 Subparallel Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

— AO 18 (17–19) {18 (17–19)}; Prc_{1,2} space more than two photophore-diameters; SAO₁ above VO₂-VO₃ interspace, sometimes closer to VO₂ than VO₃ [SCO ♂ only 1 large; ICO ♀ only, 2 (1–3); GR 3 (4) + 14, total 17 (18); {3 (4) + 14 (13–15), total 17 (16–18, rarely 19)}; D 11–12 {11–12 (10, rarely 13)}; A 24–25 (26) {24–25 (23–26, rarely 27)}; P 14–15 {15 (14)}; max. size 50 mm SL; n = 5; NSW, Tas, HIMI, MI, WA *Protomyctophum (H.) parallelum* (Lönnberg, 1905)



37122102 Parallel Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

Protomyctophum remarks

The DNA study of Denton (2014), based on six species, recovered a monophyletic clade for this genus, as well as two moderately supported clades for the two subgenera. The study of Martin *et al.* (2018) did not mention the subgenera, since only one species was analysed in their study.

We found the characters used by Prokofiev (2004) to describe two new species (*Protomyctophum mcginnisi* and *P. kolaevi*) to be too variable to be useful in identifying our material. It has been suggested that they are junior synonyms of *P. bolini* and *P. choriodon* respectively (Duhamel *et al.*, 2014) – a synonymy accepted by Eschmeyer's Catalog of Fishes, and by FishBase.

P. andriashevi. Circumpolar distribution mainly in region of APF (40°S–65°S), but with juveniles found further north to STF in SE Pacific sector off Australia, and with isolated records via the cold corridor in SE Atlantic sector (29.50°S, 010.05°E;

34.78°S, 018.02°E; 34.75°S, 018.05°E) (Hulley, in prep.).

P. bolini. Circumpolar distribution between about 70°S–50°S, with isolated captures north to 42°S; a relationship with AAIW has been proposed (Hulley, in prep.).

P. choriodon. Recorded at HIMI by Hulley (1990a) (data between {} in the key above). Some specimens keying out to this species from south of Tas at 53°S have low counts for A (17) and AO (12) and need further examination. Generally circumpolar between SACCF and STF, but extending northwards to 35°S in Falkland Current off Argentina, and southwards to South Shetland Islands (Hulley, in prep.).

P. normani. Generally a circumpolar distribution between SAF and STF (36°S–43°S), with northern extension to 30°S in Benguela upwelling region (Hulley 1981, Judkins & Haedrich 2018). Occurs over mid-slope regions at Marion-Prince Edward, Kerguelen, off Tasmania and above Chatham Rise (Hulley, in prep.).

Australian specimens of the three species (*P. gemmatum*, *P. luciferum*, *P. normani*) showed a higher degree of variability in the form of the caudal organs, particularly

the SCO, than was noted and figured by Hulley (1981). For example, in moderate-sized (55–67 mm SL) male *P. gemmatum*, the SCO is smaller than the ICO. There is also an overlap of pectoral-fin ray counts, indicating that differentiating these species in other regions may be problematic, especially for sexually immature specimens. A highly variable degree of development of the SCO and ICO in species including *P. gemmatum* is possibly linked to sexual maturity but not strongly correlated with body length.

***P. gemmatum*.** Uncommon species recorded from between about 58°S and 50°S, with isolated records north to about 38°S in western South Atlantic and Indian sectors, and to about 40° in Tasman Sea; generally circumglobal between APF and STF (Hulley, in prep.).

***P. luciferum*.** Generally a circumglobal distribution between 34°S and 48°S, where species appears to be limited by 6°C and 13°C isotherms at 200 m; more common over mid-slope regions of Tasmania in summer (Hulley, in prep.).

***P. parallelum*.** Circumglobal distribution from just north of STF to APF with northern extensions to about 32°S in Australian Bight, and off Chile and west coast of South Africa (Hulley, in prep.).

***P. subparallelum*.** Mainly distributed in region of STF,

but extending south to APF in south-east Pacific sector, and north to about 32°S in south-east Atlantic and central Indian sectors of Southern Ocean. Uncommon species throughout its distributional range; more abundant in spring-summer off Tasmania (Hulley, in prep.).

***P. tenisoni*.** Recorded between 38°S–66°S, but circumglobal distribution as annular band between SAF and APF, with few records to the north of SAF and to south of APF; apparent absence between 020°E–050°E and from 080°E–110°E may be a sampling artefact (Hulley, in prep.).

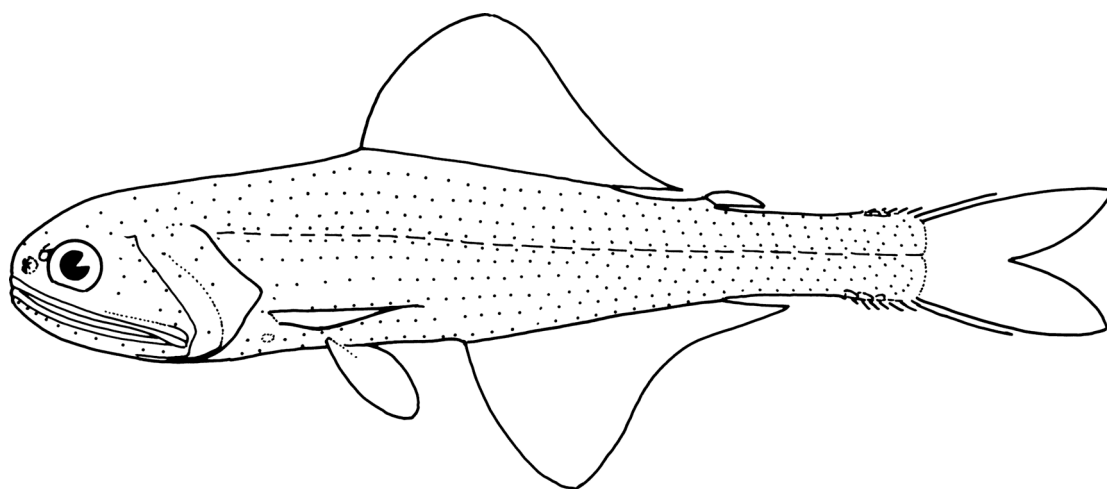
Scopelopsis Brauer, 1906

This genus is unique in the family by having the body, head, and fin membranes covered with minute secondary photophores, and the primary photophores indistinct.

The monotypic genus has a Southern Hemisphere distribution, see Legand (1967); Nafpaktitis and Nafpaktitis (1969); Moser and Ahlstrom (1972); Wisner (1976); Hulley (1981, 1986a); Becker (1983); Hoese *et al.* (2006); Roberts *et al.* (2015); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Roberts *et al.* (2015).

Key to the genus *Scopelopsis*

SCO ♂ only, ICO absent; GR 8 (9, rarely 7) + 16–17, total 24–25 (rarely 23, 26) {8 + 16–17, total 24–25}; D 22–23 (24) {21–24}; A 24–25 (26) {23–26}; P 10–11 (12) {10–12}; max. size 95 mm SL; n = 20; Qld, LHI, NI, NSW, Vic, Tas, WA *Scopelopsis multipunctatus* Brauer, 1906



37122005 Multispot Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

Scopelopsis remarks

The studies of Denton (2014) and Martin *et al.* (2018) both recovered strong support for a sister relationship with this genus and *Notoscopelus*.

***S. multipunctatus*.** Wisner (1976: fig. 208) illustrated primary photophores, based on a number of fully-scaled specimens, that included 3 cheek photophores and 3 horizontal Pol. No similar specimens have been found in Australian collections. Oceanic, mesopelagic, circumglobal in region of southern Subtropical Front, with northern extensions to 10°S between 010°W and 005°E (Atlantic sector). Recorded from just outside CCAMLR boundary limits in Atlantic sector (47.84°S, 040.01°W).

Symbolophorus Bolin & Wisner, in Bolin, 1959

Symbolophorus species have the three SAO photophores almost at right angle: the line SAO₁ – SAO₂ is almost horizontal, with SAO₁ positioned over VO₂ (although in one species, *S. rufinus*, the SAO₁ is lower and over VO₃). All scales are cycloid – in contrast to the strongly spinoid scales of species of the genus *Dasyscopelus* which also have SAO₁ near vertical of VO₃; both SCO and ICO organs are present in some individuals of some species; two species groups are recognised.

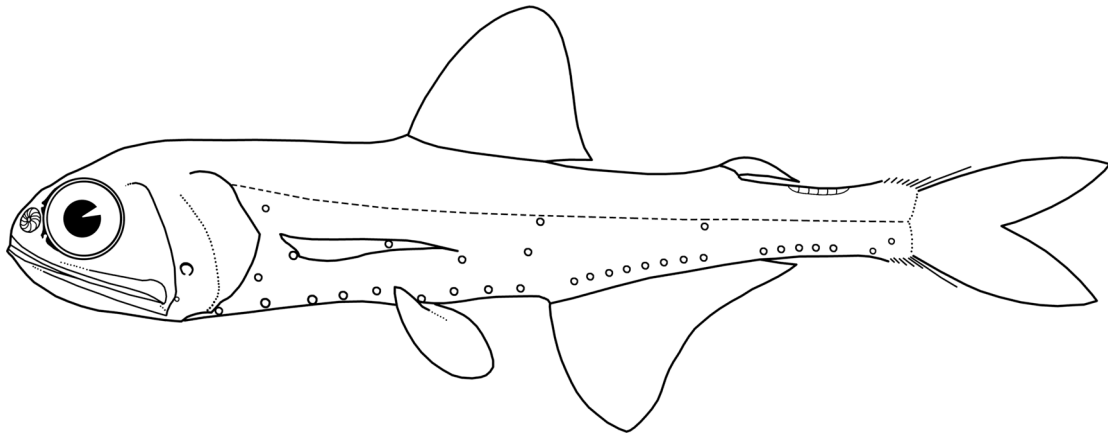
The genus is circumglobal with eight world species, four

in Australian waters, see Nafpaktitis & Nafpaktitis (1969); Hulley (1981, 1986a, 1990b); Becker (1983); Gago and Ricord (2005); Hoese *et al.* (2006); Roberts *et al.* (2015); Sutton *et al.* (2020); Mostarda *et al.* (2023). Data from non-

Australian specimens in {} are from Roberts *et al.* (2015), except *S. rufinus* (data from 10 AMS specimens from three localities off northern Papua New Guinea).

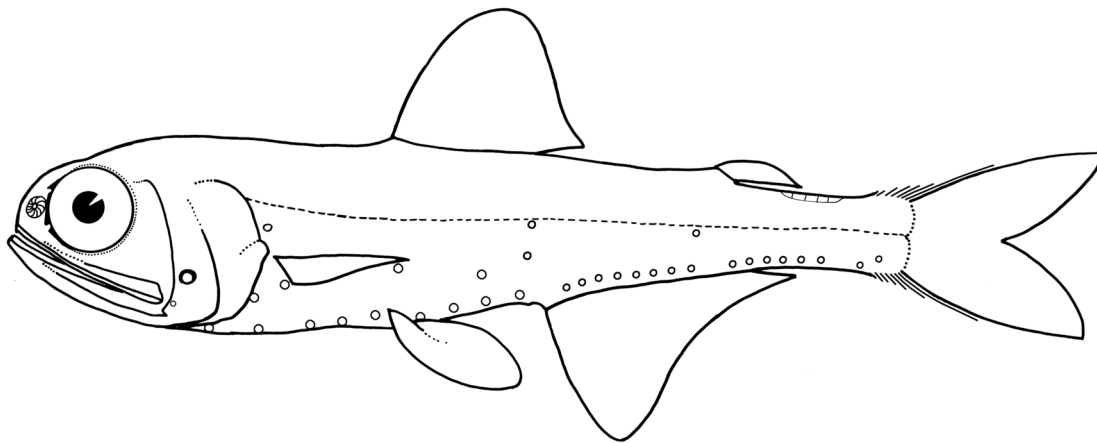
Key to the genus *Symbolophorus*

- 1 AOA level; 0–1 AOp over anal base; Pol on or slightly anterior to vertical through anterior margin of adipose fin; PLO nearer to lateral line than to upper pectoral-fin base; GR slender and lath-like; no enlarged teeth on palatine or dentary; ♂ SCO usually 5–7 contiguous plates with individual black margins on posterior half of each, ♀ ICO usually 2–4 smaller separate patches, just touching in largest specimens, rarely with slight black margins..... 2
- AOA arched; 3 AOp over anal base; Pol 3 or more photophore-diameters anterior to vertical through anterior margin of adipose fin; PLO midway between lateral line and upper pectoral-fin base; GR spatulate; outer row of palatine teeth and inner row of dentary teeth enlarged in specimens > 35 mm SL; ♂ SCO usually 2–4 overlapping plates without individual black margins, ♀ ICO usually 2–4 contiguous patches without black margins (one species with all ♀s and some ♂s with both SCO and ICO)..... 3
- 2 SAO₁ on or slightly behind vertical through VO₂ and midway between VLO and SAO₂ or slightly nearer latter; VLO slightly anterior to vertical through outer pelvic-fin base; [AO 8 (rarely 7, 9) + 5 (rarely 4, 6), total 13 (rarely 12, 14) {8–9 (rarely 7) + 5 (rarely 4, 6)}; GR 5 (6, rarely 7) + 15–16 (14–17), total 20–23 (19, rarely 24) {5–6 + 14–15, total 19–21}; D 15 (rarely 16) {14–15}; A 20–21 (19) {20–21}; P 14–15 (16, rarely 13) {14–15}; max. size 86 mm SL; n = 14; Qld, NSW, Vic, WA, ChI *Symbolophorus evermanni* (Gilbert, 1905)



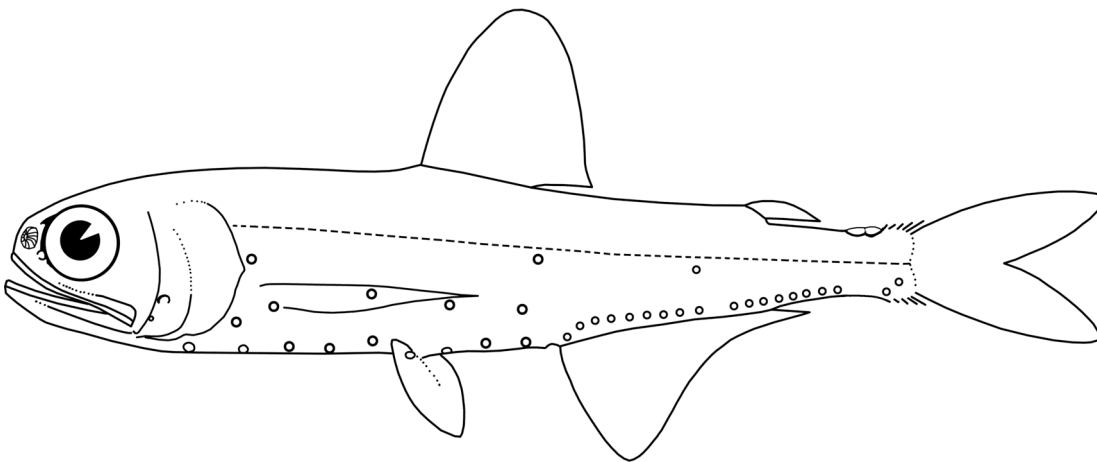
37122059 Evermann's Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

- SAO₁ on or slightly before, rarely slightly behind, vertical of VO₃ and much nearer SAO₂ than VLO; VLO on or posterior to vertical through outer pelvic-fin base; [AO 8 + 5 (6), total 13 (14) {8 (rarely 9) + 5 (rarely 4, 6), total 13 (rarely 12, 14)}; GR 6 (5) + 16 (15), total 22 (20) {6 (7) + 16 (17–18), total 22 (23, rarely 24, 25)}; D 15 (14) {15 (rarely 14)}; A 20–21 {20–21}; P 16 {16 (14–15)}; max. size 94 mm SL; n = 3; Qld *Symbolophorus rufinus* (Tåning, 1928)



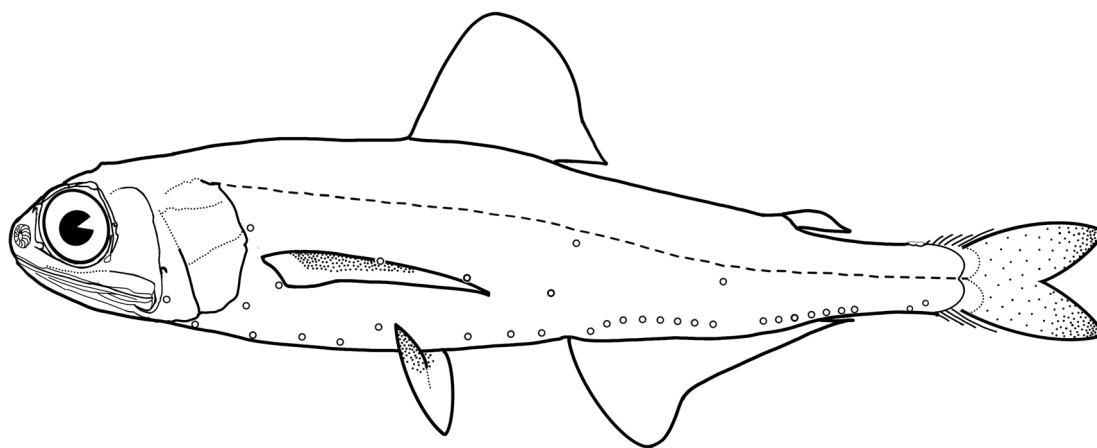
37122142 Rufous Lanternfish (♂, Nafpaktitis & Nafpaktitis, 1969)

- 3 GR 5 + 14 (15, rarely 13), total 19 (20, rarely 18) {4–5 + 14–15 (rarely 12, 13), total 16–20}; black pigment on pectoral, pelvic, and caudal-fins limited to small, widely-spaced spots, no dense patches; [AO 8 (7–9, rarely 6) + 8 (7–9), total 16 (15–17) {7–9 + 7–9 (rarely 6, 10)}; ♂ > 60 mm SL SCO 1–2 (rarely 3) coalesced plates, ICO 0 (1–2, rarely 3) small oval separate to partially coalesced plates), most with SCO larger than ICO; ♀ > 60 mm SL SCO 2 (1, rarely 3) coalesced plate, ICO 2–3 (rarely 4) partially coalesced plates, most with ICO larger than SCO; D 14 (13) {13–15}; A 21–22 (rarely 23) {20–23}; P 13 (12–14) {12–14}; max. size 116 mm SL]; n = 50; LHI, NI, NSW, Vic, Tas, SA, WA *Symbolophorus barnardi* (Tåning, 1932)



37122007 Barnard's Lanternfish (♂, Nafpaktitis, 1973)

- GR 6 (rarely 7) + 16–17, total 22–23 {6 (rarely 5, 7) + 15–17 (rarely 18), total 20–25}; patches of black pigment on pectoral-fin, pelvic-fin base and caudal-fin tips; [AO 8 (9, rarely 7) + 6–7, total 14–15 (rarely 16) {7–9 + 6–7}; mature ♂ > 65 mm SL SCO 1–3 partially to fully coalesced plates, ICO 0, ♀ > 65 mm SL SCO 0, ICO 2–4 separate to partially coalesced plates; D 14 (15) {12–13}; A 21–22 (rarely 20, 23) {20–21}; P 13–14 {13}; max. size 157 mm SL]; n = 19; NSW, Vic, Tas, MqI ... *Symbolophorus boops* (Richardson, 1845)



37122103 Spotfin Lanternfish (♂, LM)

Symbolophorus remarks

Preliminary unpublished work based on DNA sequences indicates population variation is discernable from different regions of the western Pacific. These have yet to be correlated with morphologic differences (Poulsen, pers. com., April 2015).

S. barnardi. Oceanic, mesopelagic, circumglobal in South Atlantic (27°–45°S); South Indian (37°S–45°S); off west, south and east Australia and New Zealand (32°–43°S); and off Chile (25°–33°S).

S. boops. Oceanic, mesopelagic, circumglobal in temperate waters (30°–52°S), with northern extension to 18°S in eastern South Atlantic.

S. evermanni. Two AMS specimens 75–86 mm taken from Coral Sea tuna stomachs in Feb 1996, not part of breeding aggregation.

S. rufinus. New record for Queensland and Australia based on 3 AMS specimens 19–30 mm SL from off Cape York (12.65°S, 15.13°E). It should be noted that although two diagnostic features are included in the key above, they are both based on the different position of only the SAO₁. No large specimens of this species from the Coral Sea have

been seen by us, and small specimens of this species and *S. evermanni* have been taken in the same Coral Sea trawl. Further work is suggested.

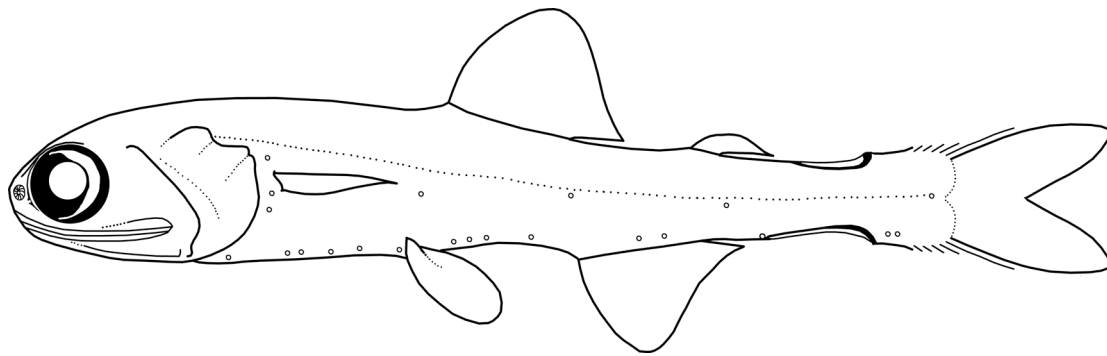
Taaningichthys Bolin, 1959

One of only two genera (with *Lampadena*) with SCO and ICO present in both sexes as a single, large, translucent organs without divisions and usually bordered by heavy black pigment; eye very large, with white crescent on posterior half of iris; Dn absent, Vn very small and poorly defined; photophores present or absent, if present, only one SAO; lateral line poorly defined or absent.

The genus has a circumglobal distribution with three world species, two in Australian waters, see Nafpaktitis and Nafpaktitis (1969); Davy (1972); Wisner (1976); Nafpaktitis *et al.* (1977); Hulley (1981, 1984, 1986a, 1990a, 1990b); Becker (1983); Hoese *et al.* (2006); Roberts *et al.* (2015); Hulley & Paxton (2016); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from Nafpaktitis *et al.* (1977).

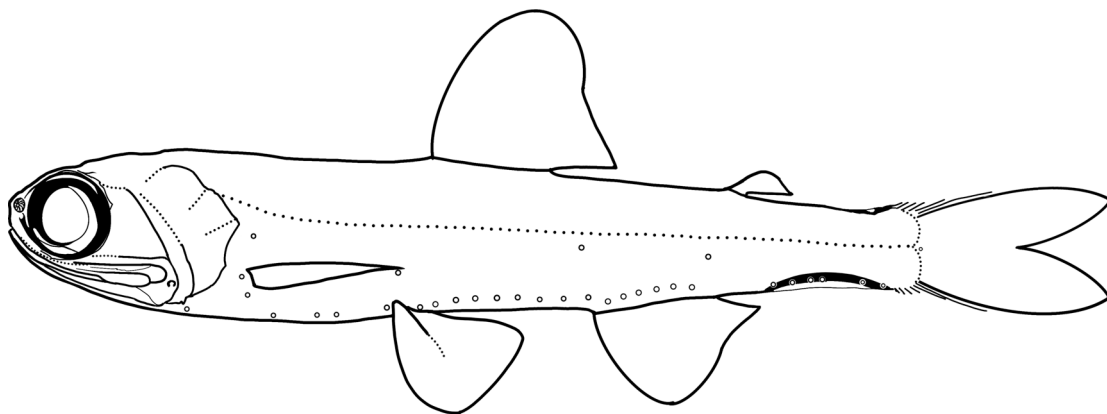
Key to the genus *Taaningichthys*

- 1 VO 4 {3–5}; AO 2–3 + 1–2, total 3–5 {1–4 + 1–2, total 2–5}; Pol well posterior to adipose-fin base; Prc₁–Prc₂ interspace equal to or less than one photophore-diameter; enlarged, broad based, posteriorly hooked teeth absent on dentaries near symphysis; GR 3 + 7–9, total 10–12, {3 (2–4) + 8–9 (6–10), total 11–12 (9–14)}; P 12–13 {12–14}; [D 12–13 (14) {12–13 (11–14)}; A 12–14 {13 (12–14)}; max. size 80 mm SL]; n = 4; Qld, LHI, NI, NSW, Tas, Vic, Col *Taaningichthys bathyphilus* (Tåning, 1928)



37122069 Deepwater Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

- VO 9 (10) {8–10}; AO 6–7 + 4–6, total 11–12 (13){5–7 + 4–6, total 9–13}; Pol on or anterior to vertical through adipose-fin origin; Prc–Prc₂ interspace equal to or more than two photophore-diameters; 1 or more enlarged, broad based, posteriorly hooked teeth present on dentaries near symphysis; GR 4 + 12–13, total 16–17 {4–5 + 12 (11–14), total 16–17 (15–18)}; P 16–17 {15–17}, [D 11–13 {11–13}; A 12–14 {12–13 (11–14)}]; max. size 65 mm SL; n = 5; NSW *Taaningichthys minimus* (Tåning, 1928)



37122143 Waistcoat Lanternfish (Nafpaktitis, 1973)

Taaningichthys remarks

The DNA study of Denton (2014) presented *Taaningichthys* as embedded within the genus *Lampadena*. Until more species of the latter genus have been sequenced, no changes in taxonomy are considered.

These species, especially *T. bathyphilus*, have a soft body that is usually trawl damaged, so that complete photophore counts are often hard to make.

Triphoturus Fraser-Brunner, 1949

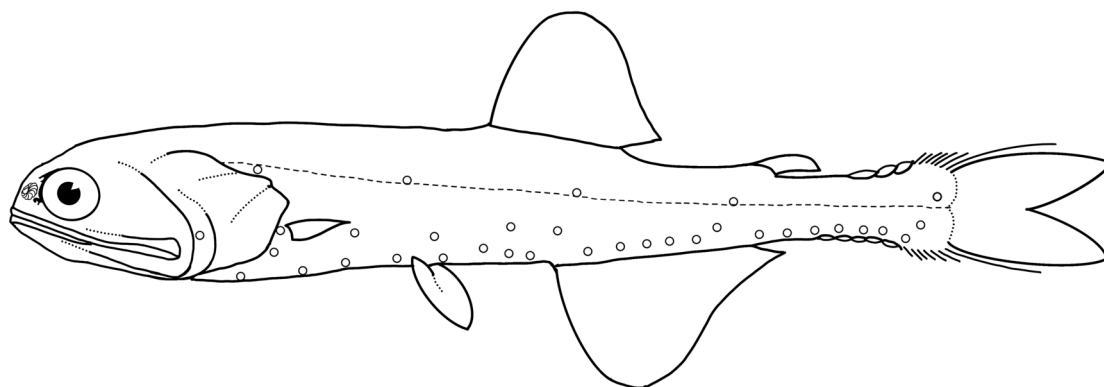
Triphoturus species are distinguished by three Prc

photophores which are continuous with AOp; the last is one photophore diameter above lateral line. There are five VO photophores with the VO₂ elevated above level of, and anterior to, VO₁; SCO and ICO are present in both sexes.

The genus has an Indo-Pacific distribution with two or more world species (see **remarks**), one recorded from Australian waters, see Nafpaktitis and Nafpaktitis (1969); Wisner (1976); Becker (1983); Hulley (1986a; 1986b); Rodriguez-Graña *et al.* (2004); Hoese *et al.* (2006); Evseenko (2006, 2008); Roberts *et al.* (2015); Rodriguez *et al.* (2016); Sutton *et al.* (2020); and Mostarda *et al.* (2023). Data from non-Australian specimens in {} are from the above sources.

Key to the genus *Triphoturus*

AO 5–6 + 5–6, total 11–12 (10) {5–6 (rarely 7) + 5–6, total 11–12 (rarely 10, 13)}; SCO 3 {3–5}, ICO 4 {4–5}; GR 3 + 9 (8), total 12 (11) {3 (rarely 4) + 9–10, total 12–14}; D 13–15 {13–15 (rarely 16)}; A 16–18 {16–18}; P 8 {8–9}; max. size 40 mm SL; n = 5; Qld, LHI, NSW, Vic, WA, Col .. *Triphoturus nigrescens* (Brauer, 1904)



37122071 Vagabond Lanternfish (Nafpaktitis & Nafpaktitis, 1969)

Triphoturus remarks

T. nigrescens. Hulley (1986b) revised the genus and recognized only the eastern Pacific *T. mexicanus* and one species in all other waters. Evseenko (2006, 2008) questioned this on the basis of larval characters, indicating two eastern Pacific species and possibly two in other waters. DNA sequencing by Rodríguez-Graña *et al.* (2004) has supported separate species status for *T. mexicanus* (North America) and *T. oculus* (Central-South America), as does the caudal-fin anatomy (Rodríguez *et al.* (2016).

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References

- Abookire, A. A., J. F. Piatt, and S. G. Speckman. 2002. A near-surface, daytime occurrence of two mesopelagic fish species (*Stenobrachius leucopsarus* and *Leuroglossus schmidtii*) in a glacial fjord. *Fishery Bulletin United States* 100: 376–380.
- Alverson, F. G., 1961. Daylight surface occurrence of myctophid fishes off the coast of Central America. *Pacific Science* 15(3): 483.
- Anderson, T. R., A. P. Martin, R. S. Lampitt, C. N. Trueman, S. A. Henson, and D. J. Mayor. 2019. Quantifying carbon fluxes from primary production to mesopelagic fish using a simple food web model. *ICES Journal of Marine Science* 76(3): 690–701. <https://doi.org/10.1093/icesjms/fsx234>
- Andresen, H., L.N. Eduardo, M. Olivar, P. D. van Denderen, J. Spitz, A.A. Maureaud, A. B. Amour, N. M. Bowlin, E. García-Seoane, T. J. Langbehn, T. T. Sutton, H. O. Fock, A. G. V. Salvanes, and M. Lindegren. 2024. Mesopelagic fish traits: Functions and trade-offs. *Fish and Fisheries* 26: 83–103. <https://doi.org/10.1111/faf.12867>
- Badcock, J. and T.M.H. Araújo. 1988. On the significance of variation in a warm water cosmopolitan species, nominally *Ceratoscopelus warmingii* (Pisces, Myctophidae). *Bulletin of Marine Science* 42 (1): 16–43.
- Becker, V. E. 1964. Stendertailed myctophids (genera *Loweina*, *Tarletonbeania*, *Gonichthys* and *Centrobranchus*) of the Pacific and Indian Oceans. *Trudy Instituta Okeanologii Imeni P. P. Shirshova* 73: 11–75. (In Russian, English summary.)
- Becker, V. E. 1965. The lantern fishes of the genus *Hygophum* (Myctophidae, Pisces). Systematics and distribution. *Trudy Instituta Okeanologii Imeni P. P. Shirshova* 80: 62–103. (In Russian, English summary.)
- Becker, V.E. 1967. The lanternfishes (Myctophidae) from the 'Petr Lebedev' Atlantic Expeditions 1961–1964. *Trudy Instituta Okeanologii Imeni P. P. Shirshova* 84: 84–124. (In Russian.)
- Becker, V.E. 1983. *Miktofovye ryby Mirovogo okeana* (Myctophids of the World Ocean). 248 p. Moskva: Akademiya nauk SSSR.
- Becker, V.E. 1985. Distribution of myctophid fishes and the position of the biogeographical border between the islands of Saint Paul and Kerguelen. *Voprosy Ikhtiologii* 25(2):348–352. [*Journal of Ichthyology*] 25(2): 159–162.]

- Becker, V. E. 1992. Benthopelagic fishes of the genera *Idiolychnus* and *Diaphus* (Myctophidae) from the southeastern Pacific, with the description of two new species. *Voprosy Ikhtiologii* 32 (6): 3–10. [In Russian. English translation in *Journal of Ichthyology* 1993, v. 33 (no. 3): 20–29.]
- Becker, V. E. and O. D. Borodulina. 1968. Lanternfishes of the genus *Ceratoscopelus* Günther: systematics and distribution. *Voprosy Ikhtiologii* 8(5):779–798. [*Journal of Ichthyology* 8(5): 625–640]
- Becker, V. E. and O. D. Borodulina. 1971. A new species of lanternfish of the genus *Myctophum* (Myctophidae, Pisces). *Voprosy Ikhtiologii* 11(3): 418–426. (In Russian.)
- Becker, V.E. and O.D. Borodulina. 1978. “*Myctophum asperum*” species group with description of a new species, and *Myctophum selenops* Tåning (Myctophidae, Osteichthyes). Taxonomy and distribution. *Trudy Instituta Okeanologii Imeni P. P. Shirshova* 111: 108–125 (In Russian.)
- Belcher, A., R. A. Saunders and G. A. Tarling. 2019. Respiration rates and active carbon flux of mesopelagic fishes (Family Myctophidae) in the Scotia Sea, Southern Ocean. *Marine Ecology Progress Series* 610: 149–162.
<https://doi.org/10.3354/meps12861>
- Bian, X. and R. Wan. 2014. Morphogenesis and taxonomic identification of larvae and juveniles in the genus *Myctophum* Rafinesque. *Journal of Fisheries of China* 38: 1731–1746.
- Bolin, R.L. 1939. A review of the myctophid fishes of the Pacific coast of the United States and of Lower California. *Stanford Ichth. Bull.* 1(4): 89–156.
- Bolin, R.L. 1959. Iniomi Myctophidae. *Report of the Scientific Results of the “Michael Sars” North Atlantic Deep Sea Expedition, 1910 4* (2,7): 1–45.
- Bourret, P. 1985. Poissons Téléostéens: Gonostomatidae, Sternoptychidae, et Myctophidae (MUSORSTOM II). *Mémoires de la Muséum National d'Histoire Naturelle, Paris. Série A (Zoologie.)* 133: 55–81.
- Braga, A. C., P. A. S. Costa, and G. W. Nunan. 2008. First record of the firebrow lanternfish *Diaphus adenomus* (Myctophiformes: Myctophidae) from the South Atlantic. *Journal of Fish Biology* 73(1): 296–301.
<https://doi.org/10.1111/j.1095-8649.2008.01915.x>
- Brandt, S.B. 1983. Temporal and spatial patterns of lanternfish (family Myctophidae) communities associated with a warm-core eddy. *Marine Biology* 74 (3): 231–244.
<https://doi.org/10.1007/BF00403447>
- Brauer, A. 1906. Die Tiefsee-Fische. 1. Systematischer Teil. *Wissenschaftliche Ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer ‘Valdivia’ 1898-1899* 15(1):1-266.
- Bussing, W. A. 1965 Studies of the midwater fishes of the Peru-Chile Trench. In: Llano, G. and A. Llano (Ed.) *Biology of the Antarctic Seas 2. Antarctic Research Series* 5: 185–227.
<https://doi.org/10.1029/AR005p0185>
- Cavan, E.L., E. C. Laurenceau-Cornec, M. Bressac, and P. W. Boyd. 2019. Exploring the ecology of the mesopelagic biological pump. *Progress in Oceanography* 176: 102–125.
<https://doi.org/10.1016/j.pocan.2019.102125>
- Clarke, T.A. 1973. Some aspects of the ecology of lanternfishes (Myctophidae) in the Pacific Ocean near Hawaii. *Fishery Bulletin United States* 71: 401–434.
- Clements, K.D. and A. L. Stewart. 2026. A new species of *Lampanyctus* (Myctophiformes: Myctophidae) from the western South Pacific Ocean. *Zootaxa* 5782 (2): 361–368.
<https://doi.org/10.11646/zootaxa.5782.2.7>
- Cotte, C., A. Ariza, A. Berne, J. Habasque, A. Lebourges-Dhaussy, G. Roudaut, B. Espinasse, B. P. V. Hunt, E. A. Pakhovov, N. Henschke, C. Peron, A. Conchon, C. Koedooder, L. Izard, and Y. Cherel. 2022. Macrozooplankton and micronekton diversity and associated carbon vertical patterns and fluxes under distinct productive conditions around the Kerguelen Islands. *Journal of Marine Systems* 226: 103650.
<https://doi.org/10.1016/j.jmarsys.2021.103650>
- Davy, B. 1972. A review of the lanternfish genus *Taaningichthys* (Family Myctophidae) with a description of a new species. *Fishery Bulletin United States* 70: 67–78.
- Denton, J. S. S. 2013. Lanternfish (Teleostei, Myctophiformes, Myctophidae) body fossils from the Modelo Formation (upper Miocene) of Los Angeles County, California. *Journal of Vertebrate Paleontology* 33(4): 786–793.
<https://doi.org/10.1080/02724634.2013.751919>
- Denton, J. S. S. 2014. Seven-locus molecular phylogeny of Myctophiformes (Teleostei; Scopelomorpha) highlights the utility of the order for studies of deep-sea evolution. *Molecular Phylogenetics and Evolution* 76: 270–292.
<https://doi.org/10.1016/j.ympev.2014.02.009>
- Donnelly, J., T. T. Sutton, and J. J. Torres. 2006. Distribution and abundance of micronekton and macrozooplankton in the NW Weddell Sea: Relation to a spring ice-edge bloom. *Polar Biology* 29: 280–293.
<https://doi.org/10.1007/s00300-005-0051-z>
- Donnelly, J. and J. J. Torres. 2008. Pelagic fishes in the Marguerite Bay region of the West Antarctic Peninsula continental shelf. *Deep-sea Research II* 55: 523–539.
<https://doi.org/10.1016/j.dsr2.2007.11.015>
- Duhamel, G., N. Gasco, and P. Davaine. 2005. Poissons des îles Kerguelen et Crozet. Guide régional de l’océan Austral. *Patrimoines Naturels* 63: 1–419.
- Duhamel, G., P.A. Hulley, R. Causse, P. Koubbi, M. Vacchi, P. Pruvost, S. Vigetta, J.-O. Irisson, S. Mormede, M. Belchier, A. Dettai, H. W. Detrich, J. Gutt, C. D. Jones, K. H. Kock, L.J. Lopez-Abellan, and A. Van de Putte. 2014. Biogeographic Patterns of Fish. In *Biogeographic Atlas of the Southern Ocean*, eds. C. De Broyer, P. Koubbi, H. J. Griffiths, B. Raymond, C. d. Udekem d’Acoz, A. an de Putte, B. Danis, B. David, S. Grant, J. Gutt, C. Held, G. Hosie, F. Huetemann, A. Post, and Y. Ropert-Coudert, pp. 328–362. Cambridge: Scientific Committee of Antarctic Research.
- Dypvik, E. and S. Kaartvedt. 2013. Vertical migration and diel feeding periodicity of the skinnycheek lanternfish (*Benthosema pterotum*) in the Red Sea. *Deep Sea Research Part I: Oceanographic Research Papers*, 72: 9–16.
<https://doi.org/10.1016/j.dsr.2012.10.012>
- Dypvik, E., T. A. Klevjer, and S. Kaartvedt. 2012. Inverse vertical migration and feeding in glacier lanternfish (*Benthosema glaciale*). *Marine Biology* 159: 443–453.
<https://doi.org/10.1007/s00227-011-1822-4>
- Eduardo, L. N., A. Bertrand, M. M. Mincarone, J. R. Martins, T. Fredou, R. Assunção, R. S. Lima, F. Ménard, F. Le Loc’h, and F. Lucena-Frédou. 2021. Distribution, vertical migration, and trophic ecology of lanternfishes (Myctophidae) in the Southwestern Tropical Atlantic. *Progress in Oceanography* 199: 102695.
<https://doi.org/10.1016/j.pocan.2021.102695>
- Evseenko, S. A. 2006. On species composition and distribution of lanternfish larvae (Myctophidae) in the eastern South Pacific. *Journal of Ichthyology* 46 (Suppl. 1): S110–S115.
<https://doi.org/10.1134/S0032945206100080>
- Evseenko, S. A. 2008. On the morphology of the early life history stages of lanternfish genus *Triphoturus* (Myctophidae) and distribution of *T. oculeum* larvae in southeastern waters of the Pacific Ocean. *Journal of Ichthyology* 48(2): 162–176.
<https://doi.org/10.1134/S0032945208020033>
- Florence, W.K., M.J. Gibbons, P.A. Hulley, and B.A. Stewart. 2002. Genetic and morphological variation of the lanternfish *Lampanyctodes hectoris* (Myctophiformes: Myctophidae) off Southern Africa. *African Journal of Marine Science* 24: 193–203.
<https://doi.org/10.2989/025776102784528466>
- Flynn, A.J. and A. Williams. 2011. Lanternfish (Pisces: Myctophidae) biomass distribution and oceanographic-topographic associations at Macquarie Island, Southern Ocean. *Marine and Freshwater Research* 63 (3): 251–263.
<https://doi.org/10.1071/MF11163>
- Flynn, A. J. and R. J. Kloser. 2012. Cross-basin heterogeneity in lanternfish (family Myctophidae) assemblages and isotopic niches (δ13C and δ15N) in the southern Tasman Sea abyssal basin. *Deep-Sea Research Part I: Oceanographic Research Papers* 69: 113–127.
<https://doi.org/10.1016/j.dsr.2012.07.007>

- Flynn, A.J. and J.R. Paxton, 2012. Spawning aggregation of the lanternfish *Diaphus danae* (family Myctophidae) in the north-western Coral Sea and associations with tuna aggregations. *Marine and Freshwater Research* 63: 1255–1271.
<https://doi.org/10.1071/MF12185>
- Flynn, A. J. and J. J. Pogonoski. 2012. *Guide to Mesopelagic Fishes of the Southern Tasman Sea*. CSIRO Marine and Atmospheric Research, Hobart, i–v + 221 pp.
- Flynn, A.J. and N.J. Marshall. 2013. Lanternfish (Myctophidae) Zoogeography off Eastern Australia: A Comparison with Physicochemical Biogeography. *PLoS ONE* 8(12): e80950.
<https://doi.org/10.1371/journal.pone.0080950>
- Fraser-Brunner, A. 1949. A classification of the fishes of the family Myctophidae. *Proceedings of the Zoological Society of London* 118 (4): 1019–1107.
<https://doi.org/10.1111/j.1096-3642.1949.tb00418.x>
- Fricke, R., W. N. Eschmeyer, and J. D. Fong. eds. 2026. Eschmeyer's catalog of fishes: genera, species, references. [Accessed 7 July 2026]
<http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp>
- Fujii, E. and T. Uyeno. 1976. On three species of the myctophid genus *Notoscopelus* found in the western North Pacific. *Japanese Journal of Ichthyology* 22(4): 227–233. [in Japanese; English abstract]
- Fujii, E. 1984. Myctophidae. In *Fishes of the Kyushu-Palau Ridge and Tosa Bay*, ed. O. Okamura, K. Amaoka, and F. Mitani, pp. 64–75. Tokyo: Japan Fisheries Resource Conservation Association. [in Japanese and English]
- Gago, F. J. and R. C. Ricord, 2005. *Symbolophorus reversus*: a new species of lanternfish from the eastern Pacific (Myctophiformes: Myctophidae). *Copeia* 2005 (1): 138–145.
<https://doi.org/10.1643/CI-04-033R2>
- Gago, F. J. and R. J. Lavenberg. 1992. Systematics of the lanternfish genus *Centrobranchus* (Pisces, Myctophidae). *Copeia* 1992: 154–161.
<https://doi.org/10.2307/1446547>
- Gartner, J.V. 1993. Patterns of reproduction in the dominant lanternfish species (Pisces: Myctophidae) of the eastern Gulf of Mexico. *Bulletin of Marine Science* 52(2): 721–750.
- Gascuel, D., L. Morissette, M. L. D. Palomares, and V. Christensen. 2008. Trophic flow kinetics in marine ecosystems: Toward a theoretical approach to ecosystem functioning. *Ecological Modelling* 217: 33–47.
<https://doi.org/10.1016/j.ecolmodel.2008.05.012>
- Gatti, M. 1903. Ricerche sugli organi luminosi dei pesci. *Annali di Agricoltura, Roma* 233: 7–126.
- Gjøsaeter, J. and K. Kawaguchi. 1980. *A Review of the World Resources of Mesopelagic Fish*; Food & Agriculture Organization: Rome, Italy.
- Gjøsaeter, J. 1981. Abundance and production of lanternfish (Myctophidae) in the western and northern Arabian Sea. *Fiskeridirektoratets Skrifter (Havundersøkelser)* 17 (6): 215–251.
- Gjøsaeter, J. 1984. Mesopelagic fish, a large potential resource in the Arabian Sea. *Deep Sea Research. Part A Oceanographic Research Papers* 31: 1019–1035.
[https://doi.org/10.1016/0198-0149\(84\)90054-2](https://doi.org/10.1016/0198-0149(84)90054-2)
- Go, Y. B. 1980. Horizontal distribution and diel migration of a mesopelagic nektonic fish, *Diaphus suborbitalis*, in Suruga Bay. *Journal of the Oceanographic Society of Korea* 15: 79–88.
- Goode, G. B. and T. H. Bean. 1896. Oceanic ichthyology, a treatise on the deep-sea and pelagic fishes of the world, based chiefly upon the collections made by the steamers *Blake*, *Albatross* and *Fish Hawk* in the northwestern Atlantic. *Memoirs of the Museum of Comparative Zoology at Harvard University* 1: 1–553.
<https://doi.org/10.5962/bhl.title.48521>
- Greely, T. M., J. V. Gartner Jr., and J. J. Torres. 1999. Age and growth of *Electrona antarctica* (Pisces: Myctophidae), the dominant mesopelagic fish of the Southern Ocean. *Marine Biology* 133: 145–158.
<https://doi.org/10.1007/s002270050453>
- Greze, E. V. and L. P. Salekhova. 1988. The feeding of subsurface myctophids and exocoetids. In: *Tropical Atlantic Macroplankton and Nekton*, ed. T. L. Gorban, pp. 104–112. Kiev: Naukova Dumka.
- Hidaka, K., K. M. Kawaguchi, M. Murakami, and M. Takahashi. 2001. Downward transport of organic carbon by diel migratory micronekton in the western equatorial Pacific: Its quantitative and qualitative importance. *Deep Sea Research Part I: Oceanographic Research Papers* 48(8): 1923–1939.
[https://doi.org/10.1016/S0967-0637\(01\)00003-6](https://doi.org/10.1016/S0967-0637(01)00003-6)
- Hoese, D. F., D. J. Bray, J. R. Paxton, and G.R. Allen. 2006. Fishes. In *Zoological Catalogue of Australia. Volume 35*. Eds. O. L. Beasley and A. Wells. Canberra: ABRIS & CSIRO Publishing, pp 2178.
- Hudson, J. M., D. K. Steinberg, T. T. Sutton, J. E. Graves, and R. J. Latour. 2014. Myctophid feeding ecology and carbon transport along the northern Mid-Atlantic Ridge. *Deep Sea Research Part I: Oceanographic Research Papers* 93:104–116.
<https://doi.org/10.1016/j.dsr.2014.07.002>
- Hulley, P. A. 1981. Results of the research cruises of FRV 'Walther Herwig' to South America. LVIII. Family Myctophidae (Osteichthyes, Myctophiformes). *Archiv für Fischereiwissenschaft* 31 (1): 1–300.
- Hulley P. A. 1984. Myctophidae. In: *Fishes of the North-eastern Atlantic and the Mediterranean. Volume 1*, eds. P. J. P Whitehead, M. L. Bauchot, J. C. Hureau, J. N. Nielsen, and E. Tortonese, pp. 429–483. Paris: UNESCO.
- Hulley, P. A. 1986a. Family No. 86: Myctophidae. In *Smiths' Sea Fishes*, ed. M. M. Smith and P. C. Heemstra, pp. 282–321. Johannesburg: Macmillan South Africa.
- Hulley, P. A., 1986b. A taxonomic review of the lanternfish genus *Triphoturus* Fraser-Brunner, 1949 (Myctophidae, Osteichthyes). *Annals of the South African Museum* 97 (4): 71–95.
- Hulley, P. A. 1990a. Family Myctophidae. In *Fishes of the Southern Ocean*, eds O. Gon and P. Heemstra, pp. 146–178. Grahamstown: J.L.B. Smith Institute of Ichthyology.
- Hulley, P. A. 1990b. Myctophidae. In *Check-list of fishes of the eastern tropical Atlantic. Volume 1*, eds J. C. Quéro, J. C. Hureau, C. Karrer, A. Post, and L. Saldanha, pp. 398–467. Paris: UNESCO.
- Hulley, P. A. 1998. Preliminary investigations on the evolution of the Tribe Electronini (Myctophiformes, Myctophidae). In *Fishes of Antarctica. A Biological Overview*, eds. G. di Prisco, E. Pisano, and A. E. Clarke, pp. 75–85. Milan: Springer.
https://doi.org/10.1007/978-88-470-2157-0_6
- Hulley, P.A. In Preparation. Family Myctophidae. In *Fishes of the Southern Ocean*, Revised Edition, ed. O. Gon, pp. XX–XX. City: Publisher.
- Hulley, P. A. and R. Prosch. 1987. Mesopelagic fish derivatives in the southern Benguela upwelling region. *African Journal of Marine Science* 5: 597–611.
<https://doi.org/10.2989/025776187784522289>
- Hulley, P. A. and G. Duhamel. 2009. A revision of the lanternfish genus *Bolinichthys* Paxton, 1972 (Myctophidae). *Cybiu* 33 (4): 259–304.
- Hulley, P. A. and G. Duhamel. 2011. Aspects of lanternfish distribution in the Kerguelen Plateau Region. In *The Kerguelen Plateau: Marine Ecosystems and Fisheries*, eds G. Duhamel and D. Welsford, pp. 183–195. Paris: Société Française d'Ichtyologie.
- Hulley, P. A. and J. R. Paxton. 2016. Myctophidae. In: Volume 3. Bony Fishes, Part 1 (Elopiformes - Scorpaeniformes). The Living Marine Resources of the Eastern Central Atlantic, K. Carpenter and N. De Angelis, pp. 1860–1928. Rome: FAO.
- Irigoin, X., T. A. Klevjer, A. Rostad, U. Martinez, G. Boyra, J. L. Acuna, A. Bode, F. Echevarria, J. I. Gonzalez-Gordillo, S. Hernandez-Leon, S. Agusti, D. L. Aksnes, C. M. Duarte, and S. Kaartvedt. 2014. Large mesopelagic fishes biomass and trophic efficiency in the open ocean. *Nature Communications* 5: 3271.
<https://doi.org/10.1038/ncomms4271>
- Jennings, S. and K. Collingridge. 2015. Predicting consumer biomass, size-structure, production, catch potential, responses to fishing and associated uncertainties in the world's marine ecosystems. *PLoS ONE* 10: e0133794.
<https://doi.org/10.1371/journal.pone.0133794>

- Judkins, D.C. and R. L. Haedrich. 2018. The deep scattering layer micronektonic fish faunas of the Atlantic mesopelagic ecoregions with comparison of the corresponding decapod shrimp faunas. *Deep-sea Research I* 136: 1–30.
<https://doi.org/10.1016/j.dsr.2018.04.008>
- Kawaguchi, K. and K. Aioi. 1972. Myctophid fishes of the genus *Myctophum* (Myctophidae) in the Pacific and Indian Oceans. *Journal of the Oceanographical Society of Japan* 28: 161–175.
<https://doi.org/10.1007/BF02108760>
- Kawaguchi, K., H. Ikeda, M. Tamura, and S. Ueyanagi. 1972. Geographic distribution of surface-migrating myctophid fishes (genus *Myctophum*) in the tropical and subtropical Pacific and Indian Oceans. *Bulletin of the Far Seas Fisheries Research Laboratory* 6: 23–37.
- Kawaguchi, K. and H. Shimizu. 1978. Taxonomy and distribution of the lanternfishes, genus *Diaphus* (Pisces, Myctophidae) in the western Pacific, eastern Indian Oceans and the southeast Asian seas. *Bulletin of the Ocean Research Institute University of Tokyo* 10: 1–145.
- Kawaguchi, K. and A. Kawamura. 1981. A rare myctophid fish, *Diaphus bertelseni*, from the stomach of Bryde's whale captured in the subtropical western North Pacific. *Japanese Journal of Ichthyology* 28 (2): 169–70.
- Kobyliansky, S. G. 2016. Anatomy of fishes of genus *Lampanyctus* (sensu lato), its taxonomic structure, and status in the Lampanyctini (Myctophidae) tribe system. *Journal of Ichthyology* 56: 181–199.
<https://doi.org/10.1134/S0032945216020053>
- Koubbi, P., C. Ozouf-Costaz, A. Goarant, M. Moteki, P. A. Hulley, R. Causse, A. Dettai, G. Duhamel, P. Pruvost, E. Tavernier, A. L. Post, R. J. Beaman, S. R. Rintoul, T. Hirawake, D. Hirano, T. Ishimaru, M. Riddle, M., and G. Hose. 2010. Estimating the Biodiversity of the East Antarctic Shelf and Oceanic Zone for Ecoregionalisation: Example of the Ichthyofauna of the CEAMARC. Collaborative East Antarctic Marine Census) CAML Surveys. *Polar Science* 4: 115–133.
<https://doi.org/10.1016/j.polar.2010.04.012>
- Koubbi, P., M. Moteki, G. Duhamel, A. Goarant, P. A. Hulley, R. O'Driscoll, T. Ishimaru, P. Provost, E. Tavernier, and G. Hosie. 2011. Ecoregionalization of myctophid fish in the Indian sector of the Southern Ocean: Results from generalized dissimilarity models. *Deep Sea Research Part II: Topical Studies in Oceanography* 58, no. 1: 170–180.
<https://doi.org/10.1016/j.dsr2.2010.09.007>
- Koubbi, P., Vacchi, M., Djian, V., Walters, A., Serandour, B., and E. Tavernier. 2025. Atlas of myctophids from the southern Indian Ocean and around the subantarctic islands of Crozet and Kerguelen. *CCAMLR Science* 25: 57–72.
<https://doi.org/10.1016/j.polar.2010.04.012>
- Kotthaus, A. 1972. Fische des Indischen Ozeans. Ergebnisse der ichthyologischen Untersuchungen während der Expedition des Forschungsschiffes "Meteor" in den indischen Ocean, Oktober 1964 bis Mai 1965. A. Systematischer Teil, IX. Inimi (Nachtrag: Fam. Myctophidae). *Meteor Forschungsergebnisse D 12*: 12–35.
- Krefft, G. 1970. Zur Systematik und Verbreitung der Gattung *Lampadena* Goode & Bean, 1896 (Osteichthyes, Myctophidae) im Atlantischen Ozean, mit Beschreibung einer neuen Art. *Berichte der Deutschen Wissenschaftlichen Kommission für Meeresforschung* 1–4: 271–289.
- Larson, H.K., R. S. Williams, and M. P. Hammer. 2013. An annotated checklist of the fishes of the Northern Territory, Australia. *Zootaxa*, 3696(1): 1–293.
<https://doi.org/10.11646/zootaxa.3696.1.1>
- Legand, M. 1967. Cycles biologiques des poissons mésopelagiques dans l'est de l'Océan Indien. Première note. *Scopelopsimultipunctatus* Brauer, *Gonostoma* sp., *Notolychnus valdiviae* Brauer. *Cahiers ORSTOM (Série Océanographie)* 5: 47–71.
- Lin, C.H. and A. O'Dea. 2025. Remarkable dominance of myctophid otoliths in Upper Miocene Chagres Formation, Caribbean Panama. *PeerJ* 13: e20155.
<http://doi.org/10.7717/PeerJ.20155>
- Linkowski, T. B. 1985. A new species of lanternfish (Osteichthyes. Myctophidae) from the South Atlantic. *Zoologica Scripta* 14 (4): 319–324.
<https://doi.org/10.1111/j.1463-6409.1985.tb00202.x>
- Linkowski, T. B. 1997. Morphological variation, systematics and speciation of the *Ceratoscopelus townsendi* – *C. warmingii* species complex (Osteichthyes: Myctophidae) based on the studies on the morphology and microstructure of otoliths. Gdynia: Morski Instytut Rybacki, pp 197. [In Polish, with English summary]
- Liu, S., Q. Liu, H. Wang, A. Li, C. An, R. Wan, and Z. Zhuang. 2024. Taxonomy and morphological comparison of larva and juvenile stages in the genera of *Lobianchia* and *Idiolychnus*. *Journal of Fisheries of China* 48 (9): 1–14.
<https://doi.org/10.11964/jfc.20230914147>
- Lütken, C. F. 1892a. Korte Bidrag til nordisk Ichthyographi. VIII. Nogle nordiske Laxesild (Scopeliner). *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening* 1891 53: 203–233.
- Lütken, C. F. 1892b. Spolia Atlantica. Scopelini Museu Zoologici Universitatis Haiensis. Bidrag til Kundskab om det aabne Havs Laxesild eller Scopeliner. *Det Kongelige Danske videnskabernes selskabs skrifter. Naturvidenskabelig og matematisk afdeling* (6) 7: 221–297.
- Martin, R. P. and M.P. Davis. 2016. Patterns of phenotypic variation in the mouth size of lanternfishes (Teleostei: Myctophiformes). *Copeia* 104 (4): 795–802.
<https://doi.org/10.1643/Ci-15-345>
- Martin, R.P., E.E. Olsen, D. M. G. Girard, W. L. Smith, and M. P. Davis. 2018. Light in the darkness: New perspective on lanternfish relationships and classification using genomic and morphological data. *Molecular Phylogenetics and Evolution* 121: 71–85.
<https://doi.org/10.1016/j.ympev.2017.12.029>
- Matsuura, T., K. Uchikawa, and K. Sawada. 2012. Relationship between light and diel vertical migration of *Diaphus theta* and *Euphausia pacifica* off eastern Hokkaido. *Fisheries Science* 78: 503–513.
<https://doi.org/10.1007/s12562-012-0481-9>
- McGinnis, R. F. 1982. Biogeography of lanternfishes (Myctophidae) south of 30°S. *Antarctic Research Series* 35: 1–110.
<https://doi.org/10.1029/AR035>
- McPherson, G. R. 1988. A possible mechanism for the aggregation of yellowfin and bigeye tuna in the north-western Coral Sea. *Queensland Fisheries Research Branch Technical Report FRB88/8*: 1–11.
- Moser, H.G. and E.H. Ahlstrom. 1970. Development of lanternfishes (family Myctophidae) in the California Current. Part I. Species with narrow-eyed larvae. *Bulletin of the Los Angeles County Museum of Natural History* 7: 1–145.
<https://doi.org/10.2307/1442344>
- Moser, H.G. and E.H. Ahlstrom. 1972. Development of the lanternfish, *Scopelopsis multipunctatus* Brauer 1906, with a discussion of its phylogenetic position in the family Myctophidae and its role in a proposed mechanism for the evolution of photophore patterns in lanternfishes. *Fishery Bulletin* 70 (3): 541–564.
- Moser, H.G. and E.H. Ahlstrom. 1974. Role of larval stages in systematic investigations of marine teleosts: the Myctophidae, a case study. *Fishery Bulletin* 72 (2): 391–413.
https://doi.org/10.1007/978-3-642-65852-5_48
- Moser, H.G., E.H. Ahlstrom, and J.R. Paxton. 1984. Myctophidae: Development. In *Ontogeny and systematics of fishes, based on an International Symposium dedicated to the memory of Elbert Halvor Ahlstrom*, ed. H.G. Moser, W.J. Richards, D.M. Cohen, M.P. Fahay, A.W. Kendall Jr, and S.L. Richardson. *Special Publication. American Society of Ichthyologists and Herpetologists* 1 (1): 218–239.
<https://doi.org/10.5962/bhl.title.4434>

- Mostarda, E., Harold, A.S., Sutton, T.T., and P.A. Hulley. 2023. *Identification Guide to the Mesopelagic Fishes of the Western Indian Ocean*. 321 p. Rome: Food and Agriculture Organization of the United Nations.
- Mundy, B.C. 2005. Checklist of the fishes of the Hawaiian Archipelago. *Bishop Museum Bulletin in Zoology* 6: 1–704.
- Munro, I.S.R. 1959. *Handbook of Australian Fishes*. Sydney: Publicity Press.
- Nafpaktitis, B. G., 1966. Two new species from the myctophid genus *Diaphus* from the Atlantic Ocean. *Bulletin of the Museum of Comparative Zoology at Harvard University* 133: 401–424.
- Nafpaktitis, B. G. 1968. Taxonomy and distribution of the lanternfishes, genera *Lobianchia* and *Diaphus*, in the North Atlantic. *Dana Report* 73: 1–131.
- Nafpaktitis, B. G., 1973. A review of the lanternfishes (family Myctophidae) described by Å. Vedel Tåning. *Dana-Report* 83: 1–46.
<https://doi.org/10.1163/9789004630017>
- Nafpaktitis, B. G. 1974. A new record and a new species of lanternfish, genus *Diaphus* (family Myctophidae), from the North Atlantic Ocean. *Contributions in Science, Los Angeles County Museum of Natural History* 254: 1–6.
<https://doi.org/10.5962/p.241237>
- Nafpaktitis, B. G. 1975. Review of the lanternfish genus *Notoscopelus* (family Myctophidae) in the North Atlantic and the Mediterranean. *Bulletin of Marine Science* 25 (1): 75–87.
<https://doi.org/10.5962/p.241237>
- Nafpaktitis, B. G. 1978. Systematics and distribution of lanternfishes of the genera *Lobianchia* and *Diaphus* (Myctophidae) in the Indian Ocean. *Science Bulletin, Los Angeles County Museum of Natural History* 30: 1–92.
<https://doi.org/10.2307/1443616>
- Nafpaktitis, B. G., R. H. Backus, J. E. Craddock, R. L. Haedrich, B. H. Robison, and C. Karnella. 1977. Family Myctophidae. In *Fishes of the Western North Atlantic*, eds R. H. Gibbs Jr, F. H. Berry, J. E. Böhlke, D. M. Cohen, B. B. Collette, W. N. Eschmeyer, G. W. Mead, D. Merriman, and T.W. Pietsch. *Memoir Sears Foundation for Marine Research* 1(7): 13–265.
<https://doi.org/10.12987/9781933789309-003>
- Nafpaktitis, B.G., and M. Nafpaktitis 1969. Lanternfishes (family Myctophidae) collected during cruises 3 and 6 of the R/V ANTON BRUUN in the Indian Ocean. *Science Bulletin, Los Angeles County Natural History Museum* 5: 1–79.
- Nafpaktitis, B.G. and J.R. Paxton, 1968. Review of the lanternfish genus *Lampadena* with a description of a new species. *Contributions in Science, Los Angeles County Museum of Natural History* 138: 1–29.
<https://doi.org/10.5962/p.241127>
- Nafpaktitis, B. G. and J. R. Paxton. 1978. *Idiolychnus*, a new genus of Myctophidae based on *Diaphus urolampus*. *Copeia* 1978 (3): 492–497.
<https://doi.org/10.2307/1443616>
- Nafpaktitis, B. G., D. A. Robertson, and J. R. Paxton. 1995. Four new species of the lanternfish genus *Diaphus* (Myctophidae) from the Indo-Pacific. *New Zealand Journal of Marine and Freshwater Research* 29: 335–344.
<https://doi.org/10.1080/00288330.1995.9516668>
- Nakabo, T. 2002. Myctophidae, lanternfishes. In *Fishes of Japan, With Pictorial Keys to the Species*. English edition, ed. T. Nakabo. Tokai University Press, Tokyo. Pp 378–399.
- Namiki, C., M. Katsuragawa, and M. L. Zani-Teixeira. 2015. Growth and mortality of larval *Myctophum affine* (Myctophidae, Teleostei). *Journal of Fish Biology*, 86(4): 1335–1347.
<https://doi.org/10.1111/jfb.12643>
- Niass, F. and T. Ozawa. 2000. Morphological differences between North Pacific and Atlantic specimens of *Lampadena anomala* (Family Myctophidae). *Ichthyological Research* 47: 299.
<https://doi.org/10.1007/BF02674254>
- Nishimura, A., K. Nagasawa, T. Asanuma, H. Aoki, and T. Kubota. 1997. Age, growth, and feeding habits of lanternfish, *Stenobranchius leucopsarus* (Myctophidae), collected from the near-surface layer in the Bering Sea. *Fisheries Science* 65: 11–15.
<https://doi.org/10.2331/fishsci.65.11>
- Olivar, M. P., C. Lopez-Perez, A. Sabates, and A. N. Sarmiento-Lezcano. 2025. Surface swarms of the lanternfish *Myctophum punctatum* associated to dolphin presence. *Journal of Sea Research* 206: 102597.
<https://doi.org/10.1016/j.seares.2025.102597>
- Ovcharov, O. P. 1983. Distribution of epipelagic lanternfishes (Myctophidae) in the northwestern Indian Ocean. In Russian. English translation in *Journal of Ichthyology* 23(4): 157–160.
- Ovcharov, O. P., E. V. Greze and V. N. Nikolskiy. 1985. Features of the quantitative distribution of lanternfishes (Myctophidae) near the surface. *Voprosy Ikhtiologii* 4: 682–685.
- Parin, N.V., V. E. Becker, D. O. D. Borodulina, B. L. Fedoryako, J. N. Shcherbachev, G. N. Pokhilskaia, and V. M. Tchuvasov. 1977. Midwater fishes in the western tropical Pacific Ocean and the seas of the Indo-Australian archipelago. *Trudy Instituta Okeanologii Imeni P. P. Shirshova* 107: 68–188. (In Russian.)
- Paxton, J. R. 1968. Evolution in the oceanic midwaters: comparative osteology and relationships of the lanternfishes (Myctophidae). PhD. thesis. City: University of Southern California.
- Paxton, J. R. 1972. Osteology and relationships of the lanternfishes (Family Myctophidae). *Bulletin of the Natural History Museum of Los Angeles County. Science* 13: 1–82.
- Paxton, J. R. 1979. Nominal genera and species of lanternfishes (family Myctophidae). *Contributions in Science. Los Angeles County. Museum of Natural History* 322: 1–28.
<https://doi.org/10.5962/p.226854>
- Paxton, J. R. and D. J. Bray 2008. Family Myctophidae. In *Fishes of Australia's Southern Coast*, eds M. Gomon, D. Bray, and R. Kuiter, pp. 270–294. Melbourne: New Holland Publishers.
- Paxton J. R., D. F. Hoese, G. R. Allen, and J. E. Hanley. 1989. Myctophidae. In *Zoological Catalogue of Australia. 7. Pisces: Petromyzontidae to Carangidae*, eds J. R. Paxton, D.F. Hoese, G.R. Allen, and J.E. Hanley, pp. 253–270. Canberra: Australian Government Publishing Service.
- Paxton, J. R. and P. A. Hulley. 1999. Family Myctophidae. In: *The Living Marine Resources of the Western Central Pacific. Volume 3. Batoid Fishes, Chimaeras and Bony Fishes Part 1 (Elopidae to Linophrynidae)*, eds K. E. Carpenter and V. H. Niem, pp. 1957–1963. Rome: Food & Agriculture Organization of the United Nations
- Payne, S. and P.A. Hoagland. 2022. Twilight Zone Episode: Historical Expansion of the Soviet Union's Fishing Fleet and the Exploitation of Mesopelagic Fisheries in the Southern Ocean. *Ocean Yearbook Online* 36: 526–549.
<https://doi.org/10.1163/22116001-03601018>
- Poulsen, J.Y., I. Byrkjedal, E. Willassen, D. Rees, H. Takeshima, T. P. Satoh, G. Shinohara, M. Nishida, and M. Miya. 2013. Mitogenomic sequences and evidence from unique gene rearrangements corroborate evolutionary relationships of Myctophiformes (Neoteleostei). *BMC Evolutionary Biology* 13: 111.
<https://doi.org/10.1186/1471-2148-13-111>
- Prokofiev, A. M., 2004. Two new species of *Protomyctophum* (Pisces, Teleostei, Myctophidae) from the Southern Ocean. *Beaufortia* 54 (4): 67–74.
- Proud, R., N. O. Handegard, R. J. Kloser, M. J. Cox, and A. S. Brierley 2019. From siphonophores to deep scattering layers: Uncertainty ranges for the estimation of global mesopelagic fish biomass. *Ices Journal of Marine Science* 76: 718–733.
<https://doi.org/10.1093/icesjms/fsy037>
- Richardson, J. 1845 [1844–1848]. Ichthyology of the voyage of H.M.S. In The Zoology of the Voyage of HMS Erebus and Terror, under the Command of Captain Sir James Clark Ross, N.N., F.R.S., during the years 1839 to 1843. Volume 2, Title of volume, eds J. Richardson and J. E. Gray, 17–52. E. W. Janson, London, 139 pp.
- Rintz, C.L., P. Koubbi, B. Ramiro-Sánchez, C. Azarian, J. A. Caccavo, C. Cotté, E. Goverville, C. Godet, P. A. Hulley, R. Le Goff, F. Leprieur, M. Robuchon, B. Serandour, and B. Leroy. 2025. Biogeographical regions and climate change: Lanternfishes shed light on the role of climatic barriers in the Southern Ocean. *Global Change Biology* 31: e70256.
<https://doi.org/10.1111/gcb.70256>
- Rivatón, J. and P. Bourret. 1999. Les Otolithes des Poissons de l'IndoPacifique. *Nouméa: Institut de Recherche pour le Développement* 2: 1–378.

- Roberts, C. D., A. L. Stewart, and C. D. Struthers. 2015. *The Fishes of New Zealand. Volume 3*. Te Papa Press, Wellington, New Zealand.
- Roberts, C. D., A. L. Stewart, J. J. Barker, and S. Kortet. 2023. *Checklist of the Fishes of New Zealand*. Online version 2.0. 282 p. Wellington, New Zealand: Museum of New Zealand Te Papa Tongarewa.
- Robinson, C., D. K. Steinberg, T. R. Anderson, J. Aristegui, C. A. Carlson, J. R. Frost, J. F. Ghiglione, S. Hernandez-Leon, G. A. Jackson, R. Koppelman, B. Qyguiner, O. Ragueneau, F. Rassoulzadegan, B. H. Robison, K. F. Wishner, T. Tanaka, and J. Zhang. 2010. Mesopelagic zone ecology and biogeochemistry—A synthesis. *Deep Sea Research. Part II Topical Studies in Oceanography* 57: 1504–1518.
<https://doi.org/10.1016/j.dsr2.2010.02.018>
- Rodriguez-Grana, L., G. Herrera, L. Herrera, and L. R. Castro. 2004. Divergence of two forms of *Triphoturus* in the eastern Pacific based on mtDNA cytochrome b gene sequences and larval morphology. *Journal of Fish Biology* 64: 1455–1461.
<https://doi.org/10.1111/j.0022-1112.2004.00413.x>
- Rodriguez, U. R., A. F. G. Acosta, and H. Villalobos. 2016. Comparative anatomy of the caudal skeleton of lantern fishes of the genus *Triphoturus* Fraser-Brunner, 1949 (Teleostei). *Revista de Biología Marina y Oceanografía* 51: 713–718.
<https://doi.org/10.4067/S0718-19572016000300025>
- Rubiés, P. 1985. Zoogeography of the lanternfishes (Osteichthyes, Myctophidae) of southwest Africa. In *Internacional sobre las Areas de Aloramiento mas importantes del Oeste Africano. Volume 1*, eds C. Bas, R. Margalef, and P. Rubies, pp. 573–586. Barcelona: Cabo Blanco y Benguela.
- Sarenas, A. M., 1954. A revision of the Philippine Myctophidae. *Philippine Journal of Science* 82: 375–427.
- Saunders, R. A., M. A., Collins, E. Foster, R. Shreeve, G. Stowasser, P. Ward, and G. A. Tarling. 2014. The trophodynamics of Southern Ocean *Electrona* (Myctophidae) in the Scotia Sea. *Polar Biology* 37: 789–807.
<https://doi.org/10.1007/s00300-014-1480-3>
- Saunders, R. A., M. A. Collins, P. Ward, G. Stowasser, R. Shreeve, and G. A. Tarling. 2015. Distribution, population structure and trophodynamics of Southern Ocean *Gymnoscopelus* (Myctophidae) in the Scotia Sea. *Polar Biology* 38: 287–308.
<https://doi.org/10.1007/s00300-014-1584-9>
- Saunders, R., S. Hill, G. Tarling, and E. Murphy. 2019. Myctophid Fish (Family Myctophidae) Are Central Consumers in the Food Web of the Scotia Sea (Southern Ocean). *Frontiers in Marine Science* 6: 1–22.
<https://doi.org/10.3389/fmars.2019.00530>
- Schwarzans, W. 2013. A comparative morphological study of the Recent otoliths of the genera *Diaphus*, *Idiolychnus* and *Lobianchia* (Myctophidae). *Palaeo Ichthyologica* 13: 41–82.
- Stiassny, M. L. J. 1996. Basal ctenosquamate relationships and the interrelationships of the myctophiform (scopelomorph) fishes. In *Interrelationships of Fishes*, eds M. L. J. Stiassny, L. R. Parenti, and G. D. San Diego, pp. 405–426. London, Academic Press.
<https://doi.org/10.1016/B978-012670950-6/50016-3>
- Sutton, T. T., P. A. Hulley, R. M. Wienerroither, D. Zaera-Perez, and J. R. Paxton. 2020. *Identification Guide to the Mesopelagic Fishes of the Central and South East Atlantic Ocean*. FAO Species Identification Guide for Fishery Purposes. Rome: FAO. 327 pp.
- Tarling, G., G. Stowasser, P. Ward, A. J. Poulton, M. Zhou, H. J. Venables, R. A. R. McGill, and E. J. Murphy. 2012. Seasonal trophic structure of the Scotia Sea pelagic ecosystem considered through biomass spectra and stable isotope analysis. *Deep Sea Research Part II: Topical Studies in Oceanography* 59–60: 222–236.
<https://doi.org/10.1016/j.dsr2.2011.07.002>
- Tsarin, S. A. 1985. New data on the distribution of species of the *Myctophum asperum* group (Myctophidae) in the equatorial waters of the western part of the Indian Ocean. *Journal of Ichthyology* 25: 132–135. [translation of *Voprosy ikhtiologii* 25: 680–682]
- Wan, R. and X. Bian. 2018. Categories identification and morphological characteristics on larvae and juveniles in the genus *Diogenichthys* Bolin, 1939 and their classification retrieval. *Journal of Fisheries of China* 37 (8): 1129–1139.
<https://doi.org/10.3724/SP.J.1231.2013.38470>
- Ward, P., A. Atkinson, H. J. Venables, G. Tarling, M. Whitehouse, S. Fielding, M. A. Collins, R. Korb, A. Black, G. Stowasser, K. Schmidt, S. Thorpe, and P. Enderlein. 2012. Food web structure and bioregions in the Scotia Sea: a seasonal synthesis. *Deep Sea Research Part II: Topical Studies in Oceanography* 59–60: 253–266.
<https://doi.org/10.1016/j.dsr2.2011.08.005>
- Watanabe, H., M. Moku, K. Kawaguchi, K. Ishimaru and A. Ohno. 1999. Diel vertical migration of myctophid fishes (family Myctophidae) in the transitional waters of the western North Pacific. *Fisheries Oceanography* 8: 115–127.
<https://doi.org/10.1046/j.1365-2419.1999.00103.x>
- Whitley, G. P. 1964. A survey of Australian ichthyology. *Proceedings of the Linnean Society of New South Wales* 89(1): 11–127.
- Williams, A. and J. A. Koslow. 1997. Species composition, biomass and vertical distribution of micronekton over the mid-slope region off southern Tasmania. *Marine Biology* 130: 259–276.
<https://doi.org/10.1007/s002270050246>
- Williams, A., J. A. Koslow, A. Terauds, and K. Haskard. 2001. Feeding ecology of five fishes from the mid-slope micronekton community off southern Tasmania, Australia. *Marine Biology* 139: 1177–1192.
<https://doi.org/10.1007/s002270100671>
- Wisner, R. L. 1970. A re-identification of the myctophid fishes originally determined by Lütken as *Scopelus spinosus*. *Copeia* 1970: 362–366.
<https://doi.org/10.2307/1441662>
- Wisner, R. L. 1976. The taxonomy and distribution of lanternfishes (family Myctophidae) of the eastern Pacific Ocean. *Navy Ocean Research and Development Activity Report* 3: 1–229.
<https://doi.org/10.21236/ADA041654>
- Yamaguchi, M. 2000. Phylogenetic analyses of myctophid fishes using morphological characters: progress, problems, and future perspectives. *Japanese Journal of Ichthyology* 47 (2): 87–107. (In Japanese.)
- Zahuranec, B. J. 2000. Zoogeography and systematics of the lanternfishes of the genus *Nannobranchium* (Myctophidae: Lampanyctini). *Smithsonian Contributions to Zoology* 607: 1–69.
<https://doi.org/10.5479/si.00810282.607>
- Zahuranec, B., P. K. Karuppasamy, T. Valinassab, S. Kidwal, J. Bernardi, and G. Bernardi. 2012. Cryptic speciation in the mesopelagic environment: molecular phylogenetics of the lanternfish genus *Benthosema*. *Marine Genomics* 7: 7–10.
<https://doi.org/10.1016/j.margen.2012.05.001>
- Zhang, B., H. Pethybridge, P. Virtue, P. D. Nichols, K. Swadling, A. Williams, and K. L. Chang. 2023. Evaluating alternative and sustainable food resources: A review of the nutritional composition of myctophid fishes. *Sustainability* 15(15): 12039.
<https://doi.org/10.3390/su151512039>
- Zhang, B., P. Virtue, P. D. Nichols, and K. J. L. Chang. 2026. Mesopelagic fish as a promising new source of omega-3 fatty acids in comparison with Australian commercial seafood. *Journal of the American Oil Chemists' Society* 103(5): 489–494.
<https://doi.org/10.1002/aocs.70075>