

**A REVIEW OF THE GENUS *AETHOTAXIS*
(PISCES: NOTOTHENIIDAE), ITS PHYLOGENETIC STATUS,
PHYSIOLOGY AND DISPERSAL**

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With 6 figures, 1 table and 1 plate

ABSTRACT. The Antarctic Percomorph family Nototheniidae is represented in pelagic waters by a very few fish genera. The two of these considered here attain weight loss of bone and muscle, and with large deposits of lipids, are buoyant in midwaters or near the benthos. This departure from the heritage of a shore and benthic life mode has placed them as the most derived fishes of the family. The genus *Aethotaxis* is composed of one species and its two subspecies, each still poorly represented in collections. They are redefined here and compared, and the relationship of the genus with its 'sister', *Pleuragramma* is seen now as a case of convergence or parallel evolution. The subfamily Pleuragramminae is now occupied solely by its namesake genus. Not closely related, the new subfamily Aethotaxinae is established as new in the Nototheniidae.

RESUMO. A família Nototheniidae do Antártico está representada no ambiente pelágico por um número reduzido de géneros. Os dois géneros considerados no presente trabalho apresentam uma perda de peso de músculo e osso e grandes depósitos lipídicos, tendo portanto flutuabilidade no domínio mesopelágico e epibêntico. Este abandono de uma forma de vida originalmente costeira e bentónica, colocou-os na posição mais afastada dentro da família. O género *Aethotaxis* é constituído por uma só espécie, com duas subespécies, muito pouco representadas em colecções museológicas. Estas subespécies são aqui redefinidas e comparadas e a relação entre este género e o género *Pleuragramma* é aqui considerada como um caso de convergência ou evolução paralela. A subfamília Pleuragramminae contém apenas o género que lhe dá o nome. Não proximamente relacionada a nova subfamília Aethotaxinae é erigida dentro da família Nototheniidae.

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INTRODUCTION

Nototheniidae, Endemism and relationships in the Antarctic Ocean Fish Fauna

The genus *Aethotaxis* appears near the end of the phylogenetic list of genera of the Nototheniidae (Order Perciformes, Suborder Notothenioidei), (BALUSHKIN, 1984; de WITT *et al.*, 1990; ESCHMEYER, 1990; MILLER, 1993) This family of fishes that predominates in the ichthyofauna of the Antarctic Ocean, is one of a few families that have originated and survived in the evolving frigid Antarctic Ocean waters since the Miocene. These are largely bottom-dwelling shore and shelf species featuring physical, physiological and behavioral characters that set them apart, being endemic as well as unique in the South Polar seas.

Without the competition of the earlier, less adaptive fishes, that were largely eradicated as Earth's southern seas became colder and ancient marine forms dropped out, the surviving fauna by now has colonized many differing habitats of those depopulated waters. But cold, alone, with lowering water temperatures of the Miocene seas, *per se*, was not the sole cause of loss of habitats and migrations, for the early teleost fauna. Rather, the descent of the continental ice sheet, extending over the marginal seas, covering and obliterating the favorable shallows (MILLER, 1997; WOEHRMANN, 1997) and the isostatic depressing of the continent mass, with deepening of its shelf and those habitats caused the ancient fishes to disappear. That may be seen also as the driving force in the dispersal and diversification of the surviving species.

Of the 17 or 18 genera presently composing the nototheniid family, one or another [especially the genus *Aethotaxis*, of this discussion] has derived from the basic nototheniid form and has adapted to utilize a special habitat. The fundamental feature that binds the species in one family, developing and persisting in their phylogenetic history, is a fold of the branchiostegal membrane at the isthmus. This is the only consistent character yet known for the family (HASTINGS, 1993). In addition, the notothenioid characters common to the suborder are present: a low, rather squat substrate-related body, large lateral pectoral fins, the scapulas broad and flat, with fenestra. Most notable of all is the lack of hydrostatic swim bladder, a feature of many actinopterygii that enables a ready depth adjustment in the water column. This lack, compensated by evolving physiologic adaptations reducing body weight in some species, is discussed below where we find species of *Aethotaxis* well advanced in adaptation to mesopelagic life.

Although the family characters dictate a benthic, bottom-feeding mode of a wait-and-ambush predator among the benthic and epibenthic prey organisms, each species seems to have found its special feeding, breeding and sheltering areas, - to have established a niche. Fish of the genus *Notothenia* dwell variously in the moderately

cold littoral and shelf waters; *Trematomus* members frequent the coldest, most southern bottom waters. *Pagothenia* species are adapted to avoiding predators by finding shelter among the ice crystals close under the sea ice cover. *Cryothenia* habitat extends into the more open ice areas, and *Dissostichus*, is adapted to range widely in the strong circumpolar current that sweeps the Antarctic Ocean, one species confined to the zero to minus 2.4 degree Celsius water south of the Antarctic Convergence and another in the subantarctic waters north of that polar front. Another nototheniid, though less bound to shores and bottoms is *Gvozdarus*.

Two additional notothenids have taken to the open seas as secondarily pelagic fishes. In the process, these have taken on a pelagic compressed body form, a chemistry and life mode in ways of special interest in this report. These are *Pleuragramma* and *Aethotaxis*, distinctive in the physiologic decrease in their body weights and a resulting positive buoyancy (EASTMAN, 1993). Though having different modes of lipid distribution they have been grouped in a subfamily, Pleuragramminae (BALUSHKIN, 1984; de WITT *et al.*, 1990; MILLER, 1993). In their pelagic existence and ecology we find overtones of the workings of adaptation that place them at the uppermost level of nototheniid development and evolution. *Aethotaxis* is the most peculiar in the family Nototheniidae according to ANDRIASHEV (1986).

For further buoyancy the body tissues of the Pleuragramminae are well invested with lipid deposits (EASTMAN, 1993). These and other autapomorphic characters climax the array of evolved features that one finds in the family Nototheniidae (IWAMI & ABE, 1982; BALUSHKIN, 1984, 1992; ANDRIASHEV, 1986; MILLER, 1987, 1993; VOSKOBOINIKOVA & KELLERMANN, 1997). The nominal species, *Pleuragramma antarcticum* is a well-known, wide-ranging Antarctic Ocean fish, and has been well studied in such works as TOTTEN (1914), EASTMAN & de VRIES (1978, 1981), and VOSKOBOINIKOVA *et al.* (1994). *Aethotaxis*, however, is a more recently discovered genus (FISCHER & HUREAU, 1985). The first specimen for science was reported in 1962 by H. H. de WITT, a specialist on the Antarctic fish fauna. Later a like specimen was found among the few fishes brought back by David L. Pawson, U. S. National Museum of Natural History, as bycatch of his collection of invertebrate marine organisms. These fishes were examined by the present author (MILLER, 1993). Meanwhile other examples of *Aethotaxis* are noted from later cruises by ichthyologists in Russia, Japan, Germany, Australia, South Africa and America. These are included in Table 1.

THE GENUS *AETHOTAXIS*

Aethotaxis de Witt, 1962 is comprised of fishes elongate and somewhat compressed, with the typical nototheniid shoulder structure, the scapula enclosing the pectoral foramen. Size moderate, with snout long and profile variously convex or depressed. Mouth large, oblique, the maxillary extending to below mid-eye or beyond;

the mandible protruded before the snout; with a small knob above and below at the symphysis. Pores of sensory canals enlarged as pits on head, the coronal commissure broad, with supratemporal canal divided into four, the supraorbital with four pores, the preopercular and mandibular separated, and infraorbital not interrupted. Two lateral lines of tubed scales, the upper line coursing upward from the temporals to follow near the dorsal fin base to below the last rays. The second line extends from mid rays of dorsal to caudal peduncle. Branchiostegal rays, 7, the membrane joined at the isthmus. Caudal fin truncate to rounded, with 12 branched rays. Hypural bones 3, 4, 5 fused, bones 1 & 2 not so. Scales small on cheek and upper half or part of opercle. Lower area of opercle, top of head, preorbital and snout naked. Vertebra 16 + 36 = 52 (de WITT *et al.*, 1990).

Remarks:

Two or more species or subspecies. With three other genera (above) considered a tribe, Pleuragrammiini, in subfamily Pleuragramminae, or believed rather to possess characters denoting parallel or convergent evolution (de WITT *et al.*, 1990; HASTINGS, pers. comm., 1998). Differs from Pleuragramma, the adipose lipid deposits nearly enclosing the body (EASTMAN, 1993), the supraorbital canal interrupted over the eye and the canal segment before pore 3 shallow and broad, and visually different in lacking the herring-like silvery aspect.

Diagnosis:

Aethotaxis mitopteryx mitopteryx, de Witt, 1962 (Fig. 1a)

Threadfin pithead, Ice devil. Holotype: CAS 59634, 357 mm SL. McMurdo Sound, Ross Sea. Dead in ice of seal hole (Fig. 1).

Description is essentially as given for the genus (above. See also de WITT, 1962).

Summary diagnosis:

In per cent of SL: Depth of body 21%. Head length (HL) 29.4%; snout (preorbit) (SnL) 8.6%; eye 6.3%; IO 6.8%; maxillary (M x L) 14.4%; mandible (MnL) 6.5%.

In percent of Head length: eye 21.5%; IO 23.2%; M x L 48.9%; SnL 29.2%; postorb (PO) 51.1%.

GR 51 n; Dorsal fin VII-32-34; Anal 30; Pectoral 27-28; Pelvic I, 5; (seen here as 6 rays, but note Fig. 2a-e). Caudal 34; ULL 49-54; MLL 30; Vertebrae 16 + 36 (de WITT *et al.*, 1990).

Dorsal fin with greatly extended first and second spines, the tips reaching to 12th and 16th dorsal ray, when pressed to dorsum. The third pelvic fin ray long, extending to tenth anal ray base, the second ray shorter, extending to preanal area, rays 4, 5, 6 successively shorter. Anal ray tips frayed, but otherwise apparently not adapted for bracing or stiling on the substrate or in sediments. (KUNZMANN & ZIMMERMANN, 1992). [See Table 1 and Fig. 1 for comparisons.]

TABLE 1 - Morphometric characters of *Aethotaxis* species.

| Collection | De Witt (1962) | Miller (1993) | Gerasemchuk <i>et al.</i> (1980) | Kotlyar (1978) | Fischer & Hureau (1985) | Kunzmann & Zimmermann (1992) | Efremenko (1983) * |
|-----------------------------|-----------------|---------------|----------------------------------|----------------|-------------------------|------------------------------|--------------------|
| Total Length | x | 215 mm | 304 mm | 193 mm | 230 | 09 - 480 | 38.5 |
| Standard Length (SL) | 357 mm | 185 | 206 | 170, 102 | 202 | 07 - 420 | x |
| % of Standard Length | | | | | | | |
| Body Depth (BD) | 21.0 | 20.0 | 19.2 | 21.2 | 21 | x | 4.2 - 5.3 |
| Head Length (HL) | 29.4 | 27.5 | 26.8 | 28.3 | 31 | x | 18.6 - 21.3 |
| Head width (HW) | 13.4 | 12.3 | x | x | x | x | x |
| Snout Length (Sn) | 8.6 | 8.1 | x | x | x | x | 33.6 - 35.5 |
| Eye (orbit - O) | 6.3 | 7.5 | x | x | x | x | 20.5 - 21.8 |
| Interorbital (I O) | 6.8 | 7.5 | x | x | x | x | x |
| Maxillary | 14.4 | 15.3 | x | x | x | x | x |
| Mandible | 6.5 | 5.8 | x | x | x | x | x |
| % of HL | | | | | | | |
| Eye | 21.5 | 27.4 | 23.9 | 25.0 | 25.0 | x | x |
| IO | 23.2 | 37.4 | 23.9 | 22.9 | x | x | x |
| Maxillary | 48.9 | x | 43.7 | x | x | x | x |
| Mandible | x | x | 40.1 | 47.9 | x | x | x |
| Snout | 29.2 | 24.0 | 29.6 | 27.1 | x | x | x |
| Postorbital | 51.1 | x | 49.3 | 43.7 | x | x | x |
| Gill Raker (GR) | 51 n | 46 n | 48 (= 12 + 1 + 35) | 51 (= 15 + 36) | x | x | x |
| Dorsal Fin | VII - 32 | VI = 34 | VII - 33 | VII - 32 | VII, VIII - 32, 34 | x | VII, VIII - 32, 33 |
| Anal Fin | 30 | 30 | 30 | 31 | 30, 31 | x | 31-32 |
| Pectoral fin | 27, 28 | 27, 28 | 25, 24 | 28 | 24, 28 | x | 27 - 28 |
| Pelvic fin | 1.5 | 1.5 | 6 | 6 | 6 | x | x |
| Caudal Fin | 34 | 32 | 36 | 38 | x | x | x |
| Scale Series | x | 83 - 92 | x | x | x | x | x |
| Upper Lateral Line | 54 | 39 | 54 | x | x | x | x |
| Mid Lateral Line | x | 14 - 15 | 30 | x | 30 | x | x |
| Vertebrae | x | 54 (53?) | x | 52 | x | x | [52, 53 Myotomes] |
| Sex | F | x | M | M | x | x | x |
| In Water Depth | 00 m (ice hole) | 536 - 514 m | 670 - 700 | 750 - 850 m | x | 118 - 1422 m | x |
| Collecting Method | Hand " | Blake trawl | Bottom Trawl | x | x | GSN, AGT | BR - 80 x 113 |

* Larval ages. See references for column authors and acronyms.

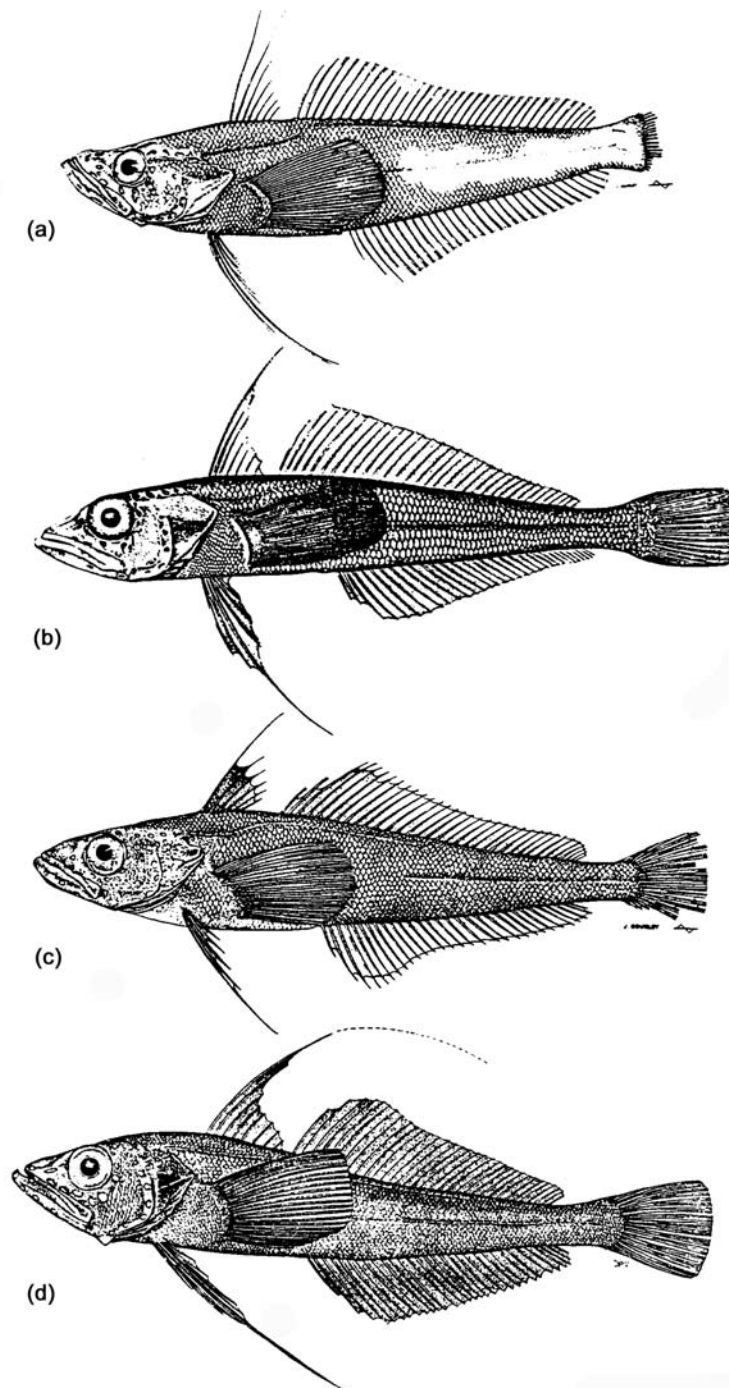


Fig. 1

- (a) *Aethotaxis mitopteryx mitopteryx* de Witt, 1962. Holotype (from MILLER, 1993, Plate 44).
 (b) *Aethotaxis mitopteryx* ssp. figure by A. B. BALUSHKINA (ANDRIASHEV, 1986, Fig. 2).
 (c) *Aethotaxis mitopteryx pawsoni* Miller, 1993 (from MILLER, 1993, Plate 45).
 (d) *Aethotaxis mitopteryx* ssp. ADH S870387 (from de WITT *et al.*, 1990; Australian Col., Prydz Bay, 182 mm SL).



Fig. 2 - *Aethotaxis mitopteryx pawsoni*. (radiograph courtesy of D. Catania, Calif. Acad. Sci.).

Life colors grey with violet hues; lighter below with metallic luster; fins dusky with some whitish margin suggested. Linings of opercular, gill opening and mouth dusky.

Remarks:

Pelagic; Circumantarctic occurrences, the holotype found at nearshore surface, at a fishing (seal) hole. Later specimens were taken in depths to 850 m over deep water, or less, but above the benthos. May be phylogenetically distinct from the Ross Sea population. (de WITT *et al.*, 1990; MILLER, 1993; also see below).

Diagnosis:

Aethotaxis mitopteryx pawsoni, Miller, 1993 (Fig. 1c)

USNM 214688, a single example, taken in a Blake trawl, fished at 544-521 m, in The Antarctic Ocean (trawled from 62° 43, 8' S; 62° 21' W to 62° 44' S; 62° 26' W). 215 mm TL, 185 mm SL, (MILLER, 1993). In percent of SL: Body depth 20.0%; head length 27.5%; head width 12.3%; snout 8.1%; eye 7.5%; IO 7.5%; max. 15.3%; mand. 5.8%. In per cent of HL: eye 27.4%; I O 27.4%; snout 24%.

GR 46 n; Dorsal fin VI-34; Anal 30; Pectoral 27-28; Pelvic I, 5; Caudal 32; Scale series 83-94; ULL 39; MLL 14-1; Vertebrae 54 (53?).

The actual measures in mm of the *A. m. pawsoni* Type is: Head length 51; head width 23; snout 15; eye 14, interorbital 14; jaw 23; postorbital head 25; lower jaw protrusion (difference from upper jaw tip) 03.0 (MILLER, 1993). [In a recheck, 9 July, 1998, I have added: snout (to-eye) 13.7 mm; GR length 57 mm; maxillary length 23.5 mm; long ray of Pelvics 45.4 mm]. (Further confirmation was discontinued because of the fragile state of the specimen. See, however comparative data in Table 1).

Description (see de WITT (1962), for comparing text for two subspecies):

A moderate to small fish of a midwater, spindle-shaped, somewhat compressed body, with an acute head profile (unlike the obtuse, blunted head of many of its relative

notothenioids). The anterodorsal aspect is moderately convex, the snout not flexed upward, as in the holotype. First rays of first dorsal and pelvic fins extended threadlike; the inter-ray membrane short or lacking. Head pores large; lateral lines (LL) with tubular scales, the upper LL and mid-line LL extended, but in *Aethotaxis* have undergone less reduction and fusion than in sister subspecies; no third LL. Eye large, lateral; about equal to snout length. Snout preceded by point of lower jaw. [Proportional divisions: * Depth of body 5 times into SL; head 3.5 in SL, (not as depressed above orbits as in Fig. 2a (de WITT, 1962, Fig. 3). Eye diameter 3.8 into HL, snout and IO 3.8, about equally in HL]. Lower jaw protrudes (3 mm), the maxillary extending from below mid-pupil of eye. Occiput, preorbital and snout areas naked. Cheek, preopercle, nape and trunk scaled, except for bare zones at the base (inferior) of the pectoral fins. Only the scales on posterior body areas ctenoid, the denticles in single rows on the margins; scales 92 R, and 83 L. (ca) in longitudinal series. (In our specimen badly stripped from above base of the pectoral fins). Upper lateral line (ULL) approximates 39 tube scales; mid-line (MLL) is peduncular, of 14-15 slits or pits. A lower line (LLL) does not appear. Dorsal (D1 + D2) VI - 34, the spines soft and long, extending beyond the membrane, the first greatly lengthened, threadlike. Anal (A) 30 rays; pectorals (P 1) 28 R, 27 L. Pelvic fins I, 5, the splinted second ray extended, half a length longer than the second, with 3, 4, and 5 progressively much shorter, each extended, threadlike, beyond the membrane, (to 46 & 43 mm); when pressed to abdomen the tips of the pelvics reaching to point of origin of anal fin. Gill rakers (GR) fine, 46 on the first gill arch, 34 on its lower limb. Branchiostegals 7. Upper LL curved up sharply at a point below the mid rays of the first dorsal fin, to below the anterior rays of the second dorsal fin. Height of first dorsal ray and first ray of pelvic fin each equal to one-third of SL. Caudal fin of 14 strong rays, truncate, abutted above by one support ray, which is shorter by half a length, and by 9 very short supporting rays; below, preceded similarly by 8 small rays. Vertebrae unconstricted, ringlike, the notocord continuous. Bone and muscle systems infused with lipid deposits (de VRIES & EASTMAN, 1978). Scales weakly ctenoid, weakly mineralized, deciduous. Skin texture delicate in preserved specimen. Body surface oily. Color of body more or less uniformly purplish brown above, with six dusky bars; tips of the spines and rays blackish. Opercular lining dusky, somewhat silvery, as are the ventral head, trunk and pelvic areas. Head with peppery pigmentation, silvery to post-opercular and dusky on snout. Supporting rays of caudal fin, above and below, relatively devoid of pigment. The lower caudal ray tips indicate they have a whitish margin in life. Larvae (Fig. 3a) with pigment extensive dorsally, distinctive for each growth stage, larvae through juvenile (EFREMENKO, 1983; KELLERMANN, 1990).

* Morph units of SL, commonly used in early field ichthyology (HUBBS & LAGLER, 1958), were enabled aboard ship where proportional dividers might be borrowed from the navigator's chart table, to step off lengths into the SL.

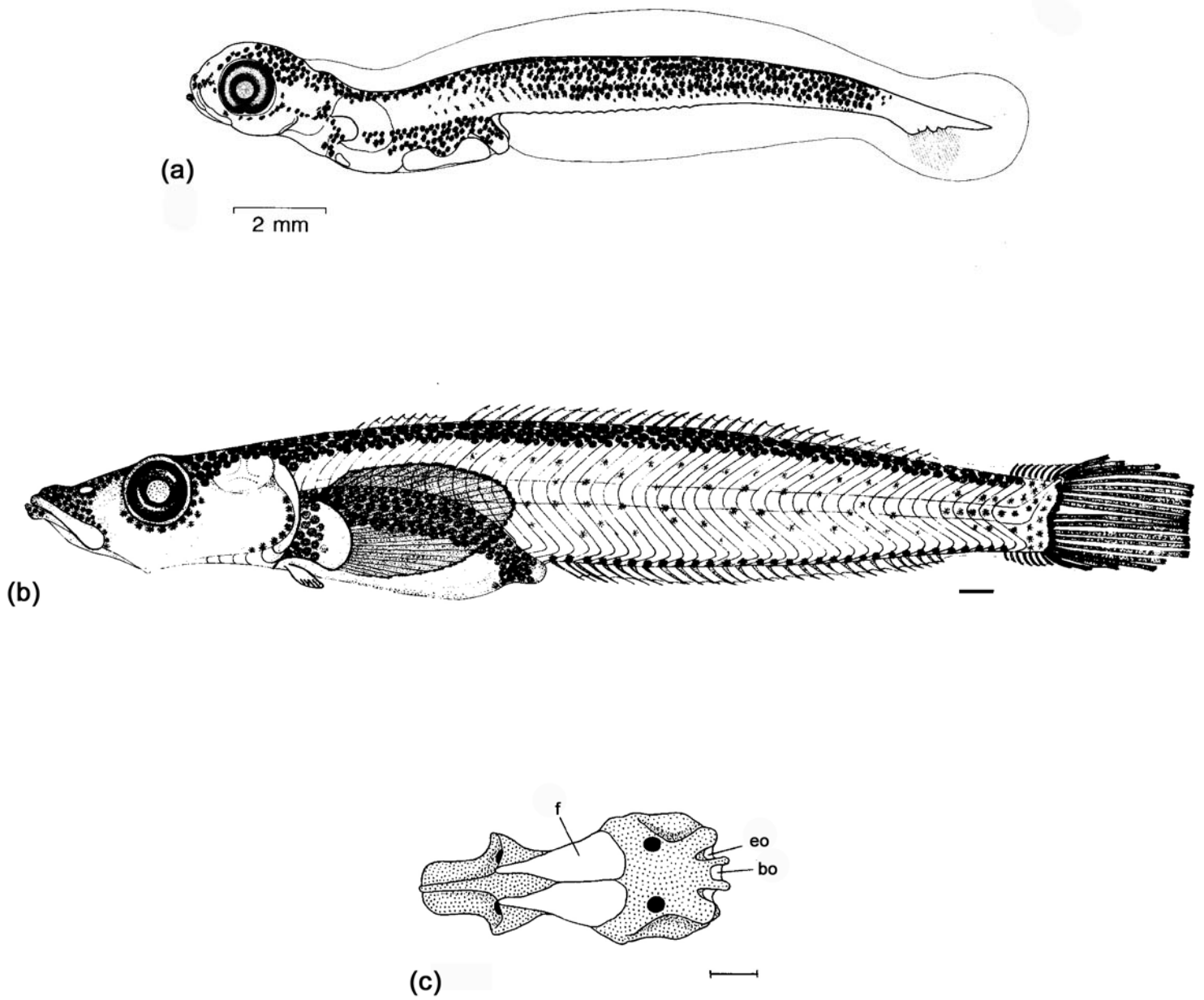


Fig. 3

(a) *Aethotaxis* larva of 17mm (from KELLERMANN, 1990).

(b) Juvenile of 38.5mm, showing early pigmentation (from EFREMENKO, 1983).

(c) Neurocranium of developing juvenile *Aethotaxis* (from VOSKOBOINIKOVA & KELLERMANN, 1997). 21 mm. SL: bo - basioccipital, eo - exoccipital, f - frontal bone.

DISCUSSION

At the time of catch, 1 Febr. 1966, this was the second occurrence of the genus, but a taxonomic recognition was not made until examination of the *Eastwind* Collection, 28 Aug. 1978. Meanwhile an occurrence was reported by PERMITIN, (1966), of two specimens from the South Orkney area, and another from South Sandwich Islands. Then a South Sandwich specimen of KOTLYAR, (1978), from the 1975 cruise of *Professor Mesyatsev* in South Shetland waters added to the meager diagnostic material. Since then, further material is reported from Japan, Poland, Germany, Australia and South Africa Antarctic cruises. The few available diagnoses of those examples are noted in Table 1. With few differences and wide geographic distribution, these examples appear to fall in with *A. m. pawsoni*. No additional examples of the genus have been reported from East or West Antarctic waters. (The lot of some 43 from the 1976 cruise of ARA *Islas Orcadas* remaining in storage, will be reported in a following paper).

Comparison of *A. m. mitopteryx* and *A. m. pawsoni*:

Differences in the subject subspecies may best be noted in Table 1 and in Fig. 1a-d, re: the position, scales and shape of the upper lateral line (39 vs. 54). The lengths (scales) of the mid lateral line; The contour and length of the head, snout, eye, and interorbital width, the sizes of cephalic pores, insertion and length of first and second dorsal rays (first or third pelvic ray longest ?) comparative fin formulas, scale number, shape and position of the lateral lines, gill rakers 51 vs 46, vertebrae 52 vs. 54. Some of these aspects, along with those of adjoining figures may be attributed to age and growth, but they are substantial enough to warrant further study. Elevation to species level identification as collections grow is anticipated.

Depths:

Depth distributions from midwater trawl records place *Aethotaxids* at 350-1000 m or more, where low water temperatures require a strong endowment of antifreeze, as well as remarkable adaptations to weightlessness. Few have been taken in bottom trawls. That these species have become well adjusted to existing environs may be assumed from ages attained of more than 30 years, shown in otoliths from Weddell Sea examples (HUBOLD & EKAU, 1987; EKAU, 1988).

Physiology:

As with other polar fishes, the two genera of the subfamily Pleuragramminae, *Aethotaxis* and *Pleuragramma*, show reduced counts of erythrocytes, haemoglobin and myoglobin cells and, these being the lowest, such fish are believed to be the most sluggish of the nototheniids. (KUNZMANN, 1991). Also *Aethotaxis*, lacks a developed

choroid *rete mirabile*, supplying the ocular system, to allow freeze avoidance for exposed eye tissue (KUNZMANN, 1991).

These two genera do produce levels of antifreeze glycopeptides (AFPG) higher than in other known cold-dwelling fish, and *Aethotaxis* exceeds all species of Nototheniidae in having the highest lipid content (EASTMAN, 1993). WOEHRMANN (1997) plots these two genera as highest in his graph of thermal hysteresis (to weight) in polar fishes, meaning that they are high in amino acid composition (60% alanine in *Pleuragramma*). Glycopeptides are synthesized in the liver in cold water fishes and are circulated into the blood stream. The kidneys are aglomerular in this group, an adaptation considered essential for fish to survive in the most frigid waters (EASTMAN, 1993). The loss of the flushing function of the glomerules is seen as a probable metabolic energy conservation provision, saving the "cost" of reconverting fluid from the urine. Saving ions and molecules from being filtered from the plasma means that energy is not needed to resorb them. By contrast, the bovicthiid fishes of the less cold Subantarctic, have a pleisiomorphic, unmodified kidney and the best developed glomeruli (EASTMAN & de VRIES, 1982; EASTMAN, 1993).

Osteology:

Adding to other modifications for buoyancy, the bones of this subfamily, especially of *Aethotaxis*, have undergone reduction and fusion, notable in much of the skeleton (EASTMAN, 1993). Contrasting with features of more phylogenetically primitive notothenioid ancestors, the palatine bones are most strongly elongate, the mesopterygoids have become long and slender, the frontal shortened. (VOSKOBOINIKOVA, 1982; BALUSHKIN, 1992; WOEHRMANN, 1997). These, with other reductions and adaptations, characterize this as an apomorphic subfamily. Phylogenetic history is supported by osteologic studies of adults with a series of 13 mm-36 mm juveniles by VOSKOBOINIKOVA & KELLERMANN (1997). These authors suggest also that some further differences, not explained, warrant placing *P. antarcticum* in a separate subfamily. This is now advisable, for even without further evidence we have been shown, above, that in association with advanced physiology, morphologic differences exist, the pleuragrammids carrying their lipids in connective tissue sacs, while aethotaxids acquire buoyancy from adipose cell deposits. This suggests a definite case of parallel or convergent evolution rather than a close relationship (de WITT *et al.*, 1990; EAKIN, pers. comm.). Thus we have a subfamily Aethotaxinae followed by Pleuragramminae. (The affinity of the other members of the tribe Pleuragrammiini is yet to be established). This is not the only instance of convergent adaptation toward reduced body weight. That buoyancy is attained in similar adaptations among other secondarily pelagic species that are not related has been known, and recently noted for fishes of the Lake Baikal family Comephoridae, as well as Antarctic Ocean examples, by PRIRODINA *et al.* (1998).



Fig. 4 - Infraorbital canal of the cephalic sensory system of a. *Aethotaxis*, b. *Pleuragramma* (from ANDERSEN, 1984).

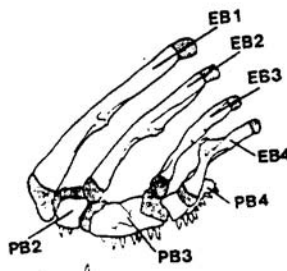


Fig. 5 - Gill arch of an *Aethotaxis* with cartilaginous - tipped epibranchials (EB 1-4; PBs are pharyngobranchials). (from IWAMI & ABE, 1984).

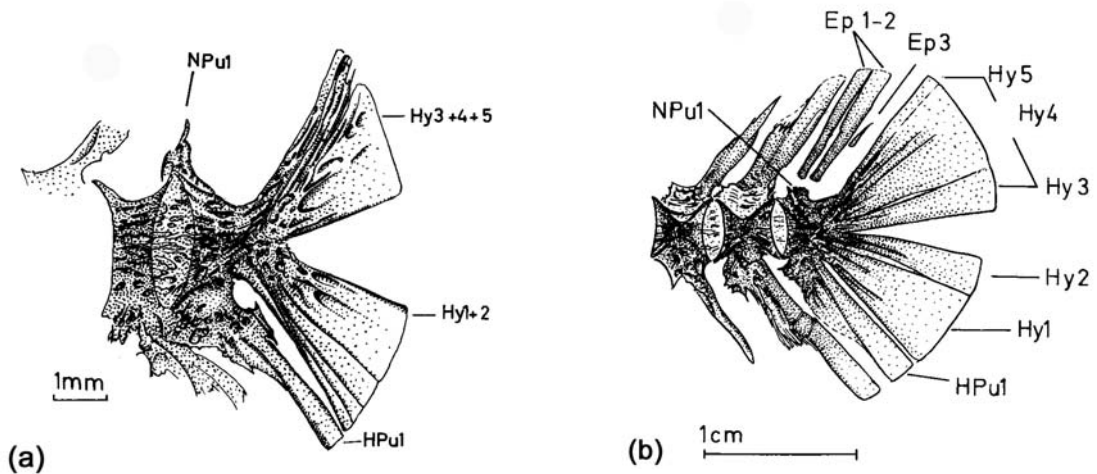


Fig. 6 - Caudal skeleton differences of *Pleuragramma antarcticum* and *Aethotaxis mitopteryx*. Hy, hypural. Ep, epural. Un, uroneural. Pu, preural. Npu, neural spine of preural centra, Hpu, haemal spine of preural centra (from ANDERSEN, 1984). Note the reduction - fusion extreme for members of the family Nototheniidae.

Phylogenetic status:

The subfamily Pleuragramminae has been considered more phylogenetically advanced than other nototheniids (ANDRIASHEV, 1965; ANDERSEN & HUREAU, 1979; ANDERSEN, 1984). In addition to showing the derived nature in larval bone development VOSKOBOYNIKOVA & KELLERMANN (1997) show a series of contrasting characters among the nototheniids and establish strong evidence for the bovicthids and earlier genera to have a plesiomorphic form while the pleuragrammin autapomorphies are seen as the most recent in the family emergence. Advances show in the longer neurocranium, the longer and lower ethmoid region, a broad interocular space, the prominent skull profile and numerous reductions in the skeleton. Gill arches are more elongate than in comparable nototheniids, with the tips cartilaginous, as in the subsequent, more highly derived Artedidraconidae and other notothenioid families, but like none other in its own family (Fig. 4a, from IWAMI & ABE, 1984). Further differences show that *P. antarcticum* could be assigned to a subfamily of its own, separate from *Aethotaxis* (VOSKOBOYNIKOVA & KELLERMANN, 1997). Evidence reviewed here constitutes a case for *Aethotaxis* to be placed alone (or with other pelagic nototheniids) in a next-highly evolved nototheniid subfamily. Larger collections will help in this determination, as well and may provide evidence on distribution and ecology.

CONCLUSION

Two subspecies of *Aethotaxis mitopteryx* are valid. Also the evidence reviewed here and the existence of further differences indicate that the genus *Aethotaxis*, must now be seen separated from the subfamily Pleuragramminae, where the nominal genus remains, and placed by itself or perhaps with other pelagic nototheniids in a next-highly evolved nototheniid subfamily, AETHOTAXINAE. Larger collections are expected to support this determination, as well as provide evidence on species distribution and ecology.

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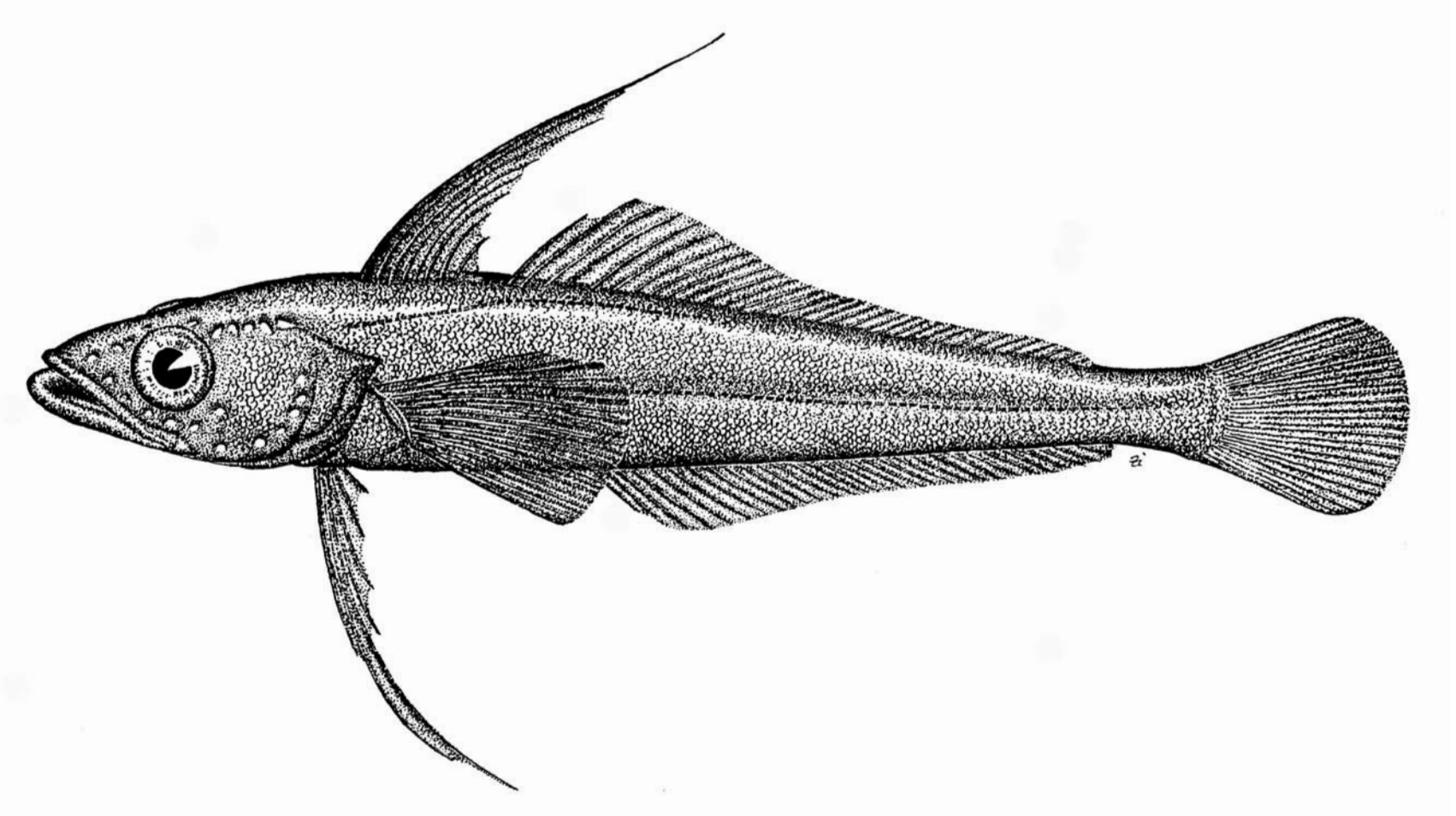


Plate I:
Aethotaxis mitopteryx de Witt, 1962. Drawn from life, KUNZMANN & ZIMMERMANN, 1992.

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