A REVIEW OF THE GENUS *PSEDNOS* (PISCES, LIPARIDAE) WITH DESCRIPTION OF TEN NEW SPECIES FROM THE NORTH ATLANTIC AND SOUTHWESTERN INDIAN OCEAN

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ABSTRACT. A review of *Psednos* material examined since the study of Andriashev in 1992, who recognized two valid species, shows the existence of 12 species of which 10 are new: 8 in the North Atlantic and 2 in the southwestern Indian Ocean. The genus *Psednos* is rediagnosed and *P. micrurus* Barnard, 1927, and *P. christinae* Andriashev, 1992, are redescribed. The new species, *P. andriashevi* sp. nov. from off Ireland; *P. gelatinosus* sp. nov. and *P. micruroides* sp. nov., both from southeast of Greenland; *P. groenlandicus* sp. nov. from Davis Strait; *P. harteli* sp. nov.; *P. mirabilis* sp. nov., and *P. barnardi* sp. nov., all three from the western North Atlantic; and *P. sargassicus* sp. nov. from the northern Sargasso Sea, *P. steini* sp. nov. and *P. microps* sp. nov., both from the southwestern Indian Ocean, are described. A key to the identification of all known species is included. Based on numbers of vertebrae and sensory pores, two groups of *Psednos* can be recognized. Group 1 (vertebrae 41–43, coronal pore present, postorbital pore absent) contains *P. micrurus*, *P. mirabilis*, *P. micruroides*, *P. microps*, *P. sargassicus*, *P. steini*, and *Psednos* sp. 1. Group 2 (vertebrae 47, coronal pore absent, postorbital pore present) includes six species that occur in the North Atlantic: *P. christinae*, *P. andriashevi*, *P. barnadi*, *P. groenlandicus*, *P. harteli*, and *P. gelatinosus*.

INTRODUCTION

The then monotypic genus *Psednos* Barnard, 1927, was based on *P. micrurus* Barnard, 1927, which was described from two specimens caught off South Africa (Barnard, 1927a,b). The description and figure of the type specimens were poor and the holotype was thought to be lost for many years. *Psednos* was later included in the synonymy of the genus *Paraliparis* Collett by Stein (1979). Specimens of *Psednos* are extremely rare in museum collections. Stein (1979) described two specimens from the Indian Ocean, the first since Barnard, for which he gave a detailed description using the name *Paraliparis micrurus.* Andriashev (1992) found three more *Psednos* specimens from the eastern North Atlantic and studied the sensory system, cranium, and the anterior part of vertebral column and discovered some characters unique within the family Liparidae. The same characters were noted in the holotype of *P. micrurus* that by then had been found. As a result, the genus *Psednos* was validated and a new species *P. cristinae* Andriashev, 1992, was described (Andriashev, 1992, 1993a). The presence of two other undescribed species of *Psednos*, one from the eastern North Pacific (Andriashev, 1992; Stein, 1986a,b), and another from the eastern North Atlantic (Andriashev, 1992) have been noted. Thus, the discovery of a few additional specimens of *Psednos* in the collections of the Museum of Comparative Zoology, the United States National Museum, and the Zoological Museum, University of Copenhagen, is of great interest.

Study of the morphology of the new specimens shows that the material includes 10 undescribed species. Five of them (with vertebrae 41–43, coronal pore present, postorbital pore absent), described below as *P. micruroides* sp. nov., *P. mirabilis* sp. nov., *P. sargassicus* sp. nov., *P. steini* sp. nov., and *P. microps* sp. nov., are close to *P. micrurus* Barnard, 1927, whereas five others (with vertebrae 47,

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coronal pore absent, postorbital pore present) described below as *P. andriashevi* sp. nov., *P. harteli* sp. nov., *P. groenlandicus* sp. nov., *P. barnardi* sp. nov., and *P. gelatinosus* sp. nov., are closer to *P. cristinae* Andriashev, 1992. Comparison of the new material and the types of *P. micrurus* and *P. cristinae* allows a detailed analysis of the species and expanded diagnosis of the genus *Psednos*.

As noted above, *Psednos* material is very rare in museum collections. In this paper 12 species, 10 of which are previously unnamed, are reviewed based on 16 specimens, and one of the new species is entirely based on a previous literature account of a specimen that was incorrectly identified. Virtually no information is available on variation within a species. But the morphologic characters of the specimens are so different that no doubt exists that they are separate species.

MATERIALS AND METHODS

The methods used in this study follow Andriashev (1986, 1992) and Andriashev and Stein (1998). All proportions are in percent of standard length (SL) except those given in parentheses, which are in percent of head length (HL). Some proportions are explicitly specified as percent of the upper pectoral lobe (UPL). Counts were made from radiographs. Vertebral counts include the urostyle. The 1st caudal vertebra has a hemal spine aligned with the 1st anal ray. Subocular distance is measured on a line from the lower margin of the eye to the level of the posterior end of the mouth. Postocular distance is from the posterior margin of the eye to the end of the opercular flap. The diastema is the gap between the tooth bands of the premaxilla. The posterior tip of the lower jaw forms a distinct and prominent ventrally directed angle that is herein termed the retroarticular process (Fig. 1). The symphyseal knob is a short projection at the symphysis of the lower jaw. The trunk is the abdominal part of body from tip of snout to anal-fin origin. Color is described from specimens stored in alcohol.

The arrangement of cephalic pores and canals (Figs. 1–3) follows Andriashev (1992). The term "chin pores" is used for the symphyseal mandibular pores (anterior pores of the right and left preoperculomandibular canal).

Andriashev (1986) and Andriashev and Stein (1998) demonstrated the importance of the pectoral girdle in distinguishing among species and in explainng relationships in Liparidae. The number and shape of radials, whether notched or unnotched, their arrangement, and the presence or absence of interradial fenestrae are important. The shape of the coracoid or scapula and the associated lamellar struts or lateral ribs is also notable. The coracoid is usually shaped somewhat like a double-bladed axe and has a handlelike projection of variable length, and the length of the handle and the size of the lamellar plates are often species specific.

The following abbreviations for counts and measurements have been used.

Counts: a, anal-fin rays; C, caudal-fin rays; D, dorsal-fin rays; P, pectoral-fin rays; Radials, radials of pectoral girdle; V, vertebrae (abdominal + caudal).

Sensory Pores: cor, coronal; io, infraorbital; n, nasal; pm, preoperculo-mandibular; t, temporal.

Measurements: anusA, distance from center of anus to anal-fin origin; bd, maximum body depth (in *Psednos* at occiput); bdA, depth at anal-fin origin; eye, eye diameter horizontally; gsl, length of gill slit; HL, head length; HW, head width; io, interorbital width (between upper margins of eyes); LPL, greatest length of lower lobe of pectoral fin; mand-anus, length from mandibular symphysis to center of anus; notch, length of shortest notch ray of pectoral fin; postoc, postocular length; preA, preanal length; preD, predorsal length; snout, length from tip of snout to anterior margin of eye; SL, standard length; upj, upper jaw length; UPL, greatest length of upper lobe of pectoral fin.

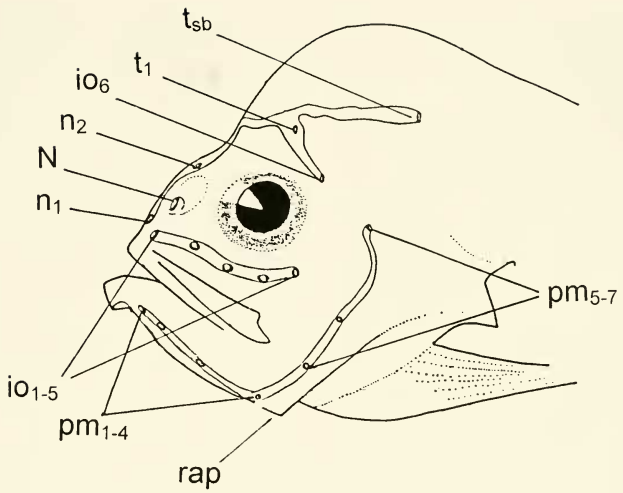

Figure 1. Diagram of cephalic sensory canals and pores (*Psednos christinae*) (from Andriashev, 1992). io_{1-5}, 1st to 5th infraorbital pores; io_6, separated upper infraorbital pore; N, nostril, n_1, lower nasal pore; n_2, upper nasal pore; pm_{1-4}, pm_{5-7}, 1st to 7th preoperculo-mandibular pores; t_1, 1st temporal pore; t_{sb}, suprabranchial temporal pore; rap, retroarticular process.

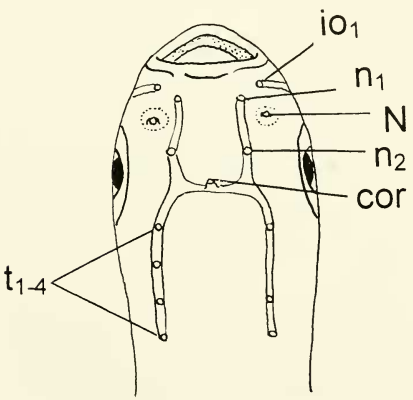

Figure 2. Sensory pores of *Psednos micruroides* sp. nov. Holotype. Head from above. Cor, coronal pore in the coronal commissura; t_{1-4}, 4 temporal pores; io_1, 1st infraorbital pore. Other abbreviations as in Figure 1.

Collection abbreviations follow Leviton et al. (1985) and Eschmeyer (1998) and Andriashev and Stein (1998) for ZISP (Zoological Institute of St. Petersburg, Russian Academy of Sciences).

All figures are drawn by the author.

SYSTEMATICS

Genus *Psednos* Barnard, 1927

Dwarf Snailfishes

Psednos Barnard, 1927a: 76; 1927b: 927 (type species *P. micrurus* Barnard, 1927, by monotypy).—Smith, 1953: 359 (sec. Barnard).—Stein, 1979: 5 (synonym of *Paraliparis* Collett).—Andriashev, 1992: 1 (valid; redescription).

Paraliparis (part): Stein, 1979: 6; 1986b: 493.—Andriashev, 1986: 14.

Diagnosis. Ventral disk absent. One pair of nostrils. No pseudobranchiae. Pleural ribs absent. Hypural plate single, unslit. Vertebrae 41–47, D 34–42, A 28–35. Body distinctly humpbacked at occiput. Anterior abdominal vertebrae and base of skull form an arch at almost a right angle.

Mouth oblique, superior or terminal. Teeth simple. Three radials in pectoral girdle, equally spaced, the lower radial largest. The upper nasal pore (n2) opens behind a vertical through or above nostril. Infraorbital sensory canal widely interrupted behind eye; infraorbital pores 6(5+1) or 5(5+0). Length to 53 mm SL.

Description. Body strongly humpbacked, its upper profile rises abruptly from short snout to high rounded occiput, then tapers more gently posteriorly (Fig. 4). Vertebral column in a S-shaped curve (Fig. 5). Base of skull (basioccipital in line with parasphenoid) almost forms a right angle with vertebral column; top of arch formed by 3 or 4 anterior vertebrae with neural spines that support the hump and are stronger and longer than others. Parapophyses of 2 or 3 posterior abdominal vertebrae obviously joined together forming gradually elongate hemal spines, the long hemal spine of 1st caudal vertebra fits to 1st anal ray. Upper pharyngeal teeth clearly seen on radiographs but lower ones not visible. Snout slanted and blunt, not projecting, rostral fold (a fold of skin forming part of ventral surface of snout immediately anterior to upper lip) not developed. Olfactory rosette visible through transparent skin. Suborbital bones usually extend anteriorly to form distinct projections above snout on either side of upper jaw. Retroarticular process at posterior tip of lower jaw distinct, with prominent ventrally directed angle (Fig. 1). Disastema present between anterior upper jaws. Operculum (Fig. 3C) very long, equal to or slightly exceeding ½ of head length. Lower jaw with or without symphyseal knob.

Morphology of sensory canals and pores of head unique within Liparidae, with nasal pores located high and infraorbital canal interrupted (Fig. 1). Because snout is short and slanted, 2 nasal pores of supraorbital canal located high, upper nasal pore n_2 opens behind vertical of nostril or above nostril. Coronal commissure with or without coronal pore (Fig. 2). Suprabranchial pore usually single, situated extremely high and forward, distance from it to dorsal end of gill slit 42–52% HL; 2 suprabranchial pores rarely present (Fig. 3B). Temporal pores usually 1+1, rarely 1+2, 0+1, or 3–4 pores in a row. Infraorbital canal widely interrupted behind eye, with 6(5+1) pores (Fig. 3B) or 5(5+0) (Figs. 3A, C); io6 pore, if present, opens at end of short canal directed down from beginning of temporal canal. Preoperculomandibular pores usually 6, rarely 7.

The 12 species of the genus *Psednos* reflect a bipolar (terminology of Berg, 1933) or antitropical distribution (Andriashev, 1991, 1993a; Hubbs, 1952) in pelagic or mesopelagic habitats of the temperate, subarctic and subtropical parts of the Northern and Southern hemispheres.

KEY TO SPECIES OF *PSEDNOS*

1a) Pectoral fin notched, with short intermedial notch rays, clearly bilobed. P 13–15 2

1b) Pectoral fin unnotched, without short notch rays, P 17. (Head small, about 22% SL, and much compressed, its width about ½ of head length; lower jaw teeth in double row; preanal 50% SL; coracoid with a handlelike projection; color grayish-brown. Off South Africa) ..... *P. micrurus* Barnard

2a) Coronal pore present. V 41–43, D 34–38, A 28–31 3

2b) Coronal pore absent. V 47, D 38–42, A 33–35 8

3a) Gill slit completely above pectoral base; preanal not less than 40% SL (except *P. sargassicus* with preanal of 38.5% SL) 4

3b) Gill slit extending ventrally in front of 2–3 pectoral rays; preanal less than 40% SL. (Lower pectoral lobe longer than upper lobe; coracoid and scapula with handlelike projections. Eastern North Atlantic) ..... *Psednos* sp. 1 (*sensu* Andriashev, 1992)

4a) Eye greater than 20% HL 5

4b) Eye 13–15% HL 7

5a) Head large, greater than 28% SL; color pale (western North Atlantic) 6

5b) Head about 25% SL. Color tan (southwestern Indian Ocean) ..... *P. steini* sp. nov.

6a) Temporal pores 3–4; gill slit equal to eye; P 13(7+1+5) with 1 ray in pectoral notch (southeast of Greenland) ..... *P. micruroides* sp. nov.

6b) Temporal pores 1+1; gill slit 2 times eye diameter; P 13(8+0+5) without notch

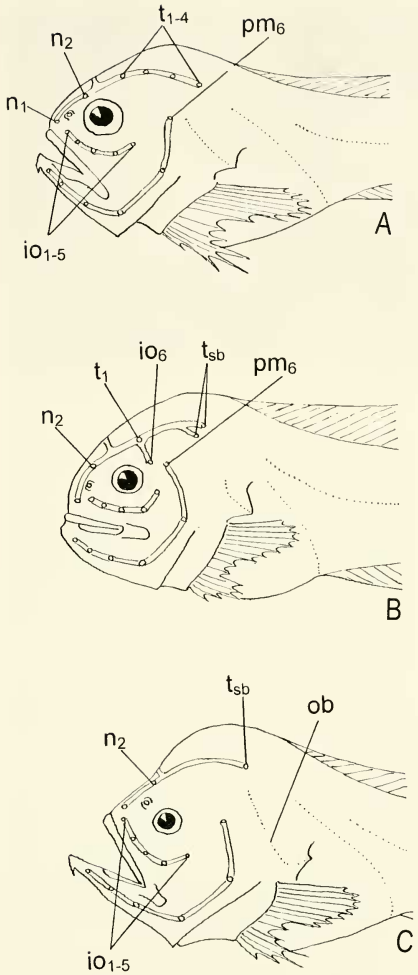

Figure 3. Sensory pores in three new species of *Psednos* in lateral view. (A) *P. micruroides* sp. nov., temporal pores 4, t_{1-4}; io_6 absent, infraorbital pores 5(5+0). (B) *P. gelatinosus* sp. nov.; temporal pores t 1+2 including 2 suprabranchial pores, t_{sb}; infraorbital pores io 6(5+1), io_6 present; preoperculo-mandibular pores 6, pm_6 close to io_6 and level with it. (C) *P. microps* sp. nov.; 1st temporal pore absent, t 0+1; io 5(5+0); ob, opercular bone. Other abbreviations as in Figures 2, 3A,B.

ray (off New England) ..... *P. mirabilis* sp. nov.

7a) First temporal pore absent, t 0+1; head 29.4% SL (southwestern Indian Ocean) ..... *P. microps* sp. nov.

7b) Temporal pores 1+1; head 25% SL (northern Sargasso Sea) ..... *P. sargassicus* sp. nov.

8a) Preoperculo-mandibular pores 7 (eastern North Atlantic) 9

8b) Preoperculo-mandibular pores 6 (western North Atlantic) 10

9a) Opercular flap small and triangular, its tip clearly below the level of eye; gill slit small, 20.4–21.5% HL or less than eye diameter (0.8–0.9); P 15(8+1+6) with 1 notch ray; head 24–25% SL; eye 24–26% HL ..... *P. christinae* Andriashev

9b) Opercular flap long and winglike, its tip level with pupil; gill slit large, ca. 28% HL or 1.3 times eye diameter; P 15(8+2+5) with 2 notch rays; head 27% SL; eye 21% HL ..... *P. andriashevi* sp. nov.

10a) One suprabranchial pore; pm_6 pore below level of io_6 pore; caudal part of body entirely pale or its end only slightly pigmented; dorsal and anal fins overlap ⅓ of caudal fin 11

10b) Two suprabranchial pores; pm_6 pore level with io_6 pore; margins of D and A blackish only at their middle portion; dorsal and anal fins overlap ⅔ of caudal fin. (Eye 17.4% HL; body very gelatinous. Off Greenland) ..... *P. gelatinosus* sp. nov.

11a) Gill slit about equal to eye diameter; eye 20–21% HL 12

11b) Gill slit 1.7 times eye diameter; eye smaller, 18% HL ..... *P. barnardi* sp. nov.

12a) Lower pectoral lobe wide and thick, handlike (Fig. 6A), pectoral notch with only 1 ray; gill slit distinctly oblique; mouth cleft reaching to below pupil; upper jaw 13.5% SL; caudal part of body and vertebrae unpigmented ..... *P. harteli* sp. nov.

12b) Lower pectoral lobe with thin and elongate rays (Fig. 6B), pectoral notch with 2 rays; gill slit almost vertical; mouth cleft reaching to below anterior margin of eye; upper jaw 10.6–12.6% SL; slight dark pigmentation present on caudal part of body and along posterior vertebrae ..... *P. groenlandicus* sp. nov.

Psednos andriashevi new species

Andriashev's Dwarf Snailfish (Fig. 7A)

Psednos christinae (non Andriashev, 1992): Andriashev, 1992: 10, figs. 3b, 7; 1993a: 9, figs. 2A, 6 (ex parte: only specimen ISH 574-1986, SL 53 mm).

Material. Holotype. ISH 574-1986, adult male 53 mm SL. RV *Walter Herwig*, Sta. 419/86. West of

Ireland, 54°21′N, 17°59′W, 4 Jul. 1986, depth 800 m. Midwater trawl. Coll. A. Post. This specimen was designated as 1 of 2 paratypes of *P. christinae* by Andriashev (1992: 10, fig. 3b—radiograph, fig. 7—pectoral girdle).

Diagnosis. A *Psednos* from the North Atlantic with V 47, D 42, coronal pore absent, 7 preoperculo-mandibular pores. Head large (27% SL) and very compressed (40% HL); gill slit large (28% HL or 1.3 eye diameter), opercular flap long, winglike, reaching behind midpectoral length and level with pupil. Pectoral fin short (45% HL), with 2 notch rays.

Description. Dorsal outline sloping gently from high occiput caudally. Ends of first 3 neural spines clearly prominent above dorsal contour of body. Maximum depth at occiput 4.1 in SL or 1.7 times depth at anal-fin origin; trunk short, preanal 35% SL. Dorsal and anal fins low. Caudal fin rays missing. Anus on vertical through ⅗ of postocular distance and just in front of ventral end of gill slit. Pyloric caeca 6.

Head large, 3.7 times in SL, very compressed (40% HL or 2.2 times in head depth). Depth at occiput less than head length (90% HL). Anterior profile of head slopes straight down to tip of short snout with a slight concavity in front of eye. Snout length equal to eye diameter. Nostril level with eye center. Eye not large (4.8 in HL), pupil ca. ¾ of eye diameter. Interorbital 1.6 eye diameter. Suborbital distance about equal to eye diameter. Mouth oblique, terminal, forming an angle of about 45° to the horizontal, symphysis of upper jaw level with lower margin of eye. Mouth cleft reaching vertical to anterior margin of pupil, maxillary to vertical of posterior margin of pupil. Teeth sharp, in oblique rows, 5 teeth per row near symphysis of upper and lower jaws. Diastema of upper jaw narrow. Lower jaw slightly projecting. Chin not deep, lower jaw not massive. Symphyseal knob present. Prominent tip of lower jaw (retroarticular process) is on vertical with posterior margin of eye.

Gill slit entirely above pectoral fin base, long (28% HL and 1.3 eye diameter) and located high: dorsal end level with upper margin of pupil, ventral end level with ⅔ of subocular distance. Gill slit oblique, its dorsal end distinctly behind the vertical of its ventral end. Opercular flap long, its shape unique in *Psednos*, with a prominent, winglike end reaching posteriorly to behind middle of pectoral fin. Operculum directed posterodorsally, its end level with upper half of pupil. Gill rakers 9, with small prickles on top.

Pectoral fin 15(8+2+5) with 2 notch rays. Upper pectoral lobe short, only 45% HL, reaching almost to anal-fin origin. Uppermost pectoral ray level with lower third of subocular space. Lowermost pectoral ray based approximately on a vertical through middle of postocular distance. Lower pectoral lobe almost reaching to vertical through end of upper lobe. Radials 3, rounded, lowermost largest. Fenestrae in cartilaginous basal lamina absent (see Andriashev, 1992, fig. 7). Scapula small, with short upward-directed handlelike projection. Coracoid large, half-moon in shape, without handlelike projection.

Vertebrae 47(10+37), parapophyses of 3 posterior abdominal vertebrae forming short hemal spines. Interneural of 1st dorsal ray fits between 4th and 5th neural spines.

Sensory System. Coronal pore absent. Nasal pores 2, upper as small as nostril and level with upper margin of pupil. Temporal pores 1+1, infraorbital 6(5+1), preoperculo-mandibular 7. Distance between chin pores (pm_1–pm_1) slightly larger than distances between pm_1 and pm_2.

Measurements and Counts: HL 27.2, HW 10.9 (40.3), bd 24.5 (90), bdA 14.7 (54), preD 28.3 preA 34.9, mand-anus 19.8, anusA 15.3, UPL 12.3 (45), LPL 13.2 (107% UPL), snout 5.7 (20.8), eye 5.7 (20.8), postoc 15.1 (56), io 9.1 (33.3), gsl 7.5 (27.8), upj 11.9 (44). V 47(10+37), D 42, A 36, P 15(8+2+5), C 6. Radials 3, rounded.

Color. Skin uniformly pale, caudal part

Figure 4. *Psednos barnardi* sp. nov. Male, 34-mm standard length. Holotype (right side). Photograph by K. E. Hartel.

of body without pigmentation. Head and belly appear dark because of the color of peritoneum, mouth, and gill cavity. Peritoneum brownish-black, stomach lighter but also blackish, pyloric ceca light brownish-black, intestine slightly pigmented. Gill arches brownish. Mouth light brownish-gray. Gill cavity dark brown. Ventral surface of head unpigmented.

Distribution. Known only from the holotype taken in the eastern North Atlantic, west of Ireland, in midwater at a depth of 800 m.

Etymology. This species is named for the well-known Russian ichthyologist Anatole P. Andriashev who, in particular, made the definitive morphologic study of the genus *Psednos*.

Taxonomic Notes. This specimen was designated as a paratype of *P. christinae* by Andriashev (1992, 1993a), but during the preparation of his work the specimen was on loan in the USA and was not studied in detail, with the exception of its radiograph and pectoral girdle (Andriashev, 1992: 15).

Comparative Notes. Psednos andriashevi belongs to a species group with 47 vertebrae, no coronal pore, 6(5+1) io pores, and 7 preoperculo-mandibular pores. Its long winglike opercular flap reaching behind the middle of pectoral length is unique among *Psednos*. It is also distinguished by the following: the head is large (27% SL) and compressed (its width 40% HL), long gill slit (28% HL or 1.3 eye diameter) and located high (end of operculum level with pupil), the pectoral fin short (45% HL) and has 2 notch rays. It is most similar to the sympatric *P. christinae*, which differs in having a small triangular opercular flap, a smaller gill slit (20.4% HL or 0.8–0.9 eye diameter), a lower opercular end that is clearly below eye, a smaller (24% SL) and wider head (50% HL), a longer pectoral fin (66% HL), and only 1 notch ray. Differs from *Psednos* sp. 1 (*sensu* Andriashev, 1992) from the eastern North Atlantic by vertebral number (47 vs 43) and absence of coronal pore (vs presence).

Psednos barnardi new species

Blackchin Dwarf Snailfish (Figs. 4, 7B)

Material. Holotype. MCZ 155422, subadult male 34 mm SL. R/V *Delaware II*, Cr. 99-02, Sta. 14, WN Atlantic, 39°49′N, 70°39′W, 04 Feb. 1999, over bottom at 1042–1368 m. Paratype. MCZ 63036, juv. 15 mm SL. R/V *Oceanus*, Cr. 125. 39°11′24″N, 70°59′6″W, 22 Aug. 1982. Multiple opening closing net MOC 20-054,1, depth 1001–750 m.

Diagnosis. A *Psednos* from the North

Atlantic with V 47, D 39–41, no coronal pore, 6 preoperculo-mandibular pores, a small eye (18% HL), gill slit 1.6 eye diameter, and a short mouth (its cleft reaching to below anterior margin of eye). Caudal part of body unpigmented, skin on chin and lower jaw black.

Description. Maximum depth at occiput 3.5 in SL and 1.9 times greater than depth above anal-fin origin. Trunk rather long, preanal distance 38% SL. Dorsal and anal fins low and long, overlaping 40% of caudal fin. Anus on vertical at about middle of postocular distance. Skin semitransparent. Subcutaneous gelatinous tissue weakly developed.

Head not large, 3.8 in SL, but compressed (width 56% HL) or 2 times in depth. Depth at occiput greater than HL (110%). Anterodorsal profile abruptly rounded to tip of snout. Snout 1.9 times larger than eye. Nostril small, porelike, level with eye center. Eye small, 6 times in HL, pupil ca. ¾ of eye diameter. Interorbital 3.3 eye diameter. Subocular distance 1.6 eye diameter. Mouth superior, oblique, forming an angle of about 35° to the horizontal. Symphysis of upper jaw in line with upper ⅕ of subocular distance. Mouth short, its cleft reaching at vertical from anterior margin of eye, upper jaw reaching to vertical from posterior margin of eye. Lower jaw projecting. Lips thin, lower lip with lateral lobe. Symphyseal knob present. Prominent tip of lower jaw (retroarticular process) just behind vertical at posterior margin of eye. Teeth sharp and large in both jaws, 4 and 5 in 1st full row near symphysis of upper and lower jaw. Upper jaw with narrow diastema.

Gill slit slightly oblique, 1.6 larger than eye, completely above pectoral base and placed high; its dorsal end level with lower margin of pupil, ventral end almost level with end of mouth cleft. Opercular flap triangular. Operculum directed backward, its end level with middle of subocular space.

Pectoral fin P 14(8+1+5), with 1 notch ray that is clearly separate from other rays. Uppermost pectoral ray level with posterior end of oblique mouth, lowermost pectoral ray based on vertical of ca. ⅕ of postocular space. Upper lobe almost reaching to anal-fin origin. Lower lobe rays thin, elongate.

Vertebrae 47(10+37), parapophysis of 10th vertebrae form a short hemal spine, not reaching 1st interhemal. Interneural of 1st dorsal ray fits between neural spines of 5th and 6th vertebrae.

Sensory System. Coronal pore absent. Nasal pores 2, n_2 pore level with upper margin of eye. Infraorbital 6(5+1), io_6 pore placed behind upper margin of eye. Temporal 1+1, 1st temporal pore (t_1) slightly larger than io_6; suprabranchial pore located at a distance of 44% HL from dorsal end of gill slit. Preoperculo-mandibular 6, chin pores (pm_1–pm_1) spaced at a distance equal to pm_1–pm_2.

Measurements and Counts. HL 26.4, HW 14.7 (56), bd 28.8 (109), bdA 15.3 (58), preD 31.5, preA 38.2, mand-anus 20.3, anusA 22.1, UPL 17.9 (68), LPL 11.2 (63% UPL), snout 8.2 (31.1), eye 4.7 (17.8), postoc 17.6 (67), io 15.3 (58), gsl 7.4 (27.8), upj 13.5 (51.1). V 47(10+37), D 39–41, A 33–35, P 14(8+1+5), C 6. Radials unknown.

In the 15-mm-SL juvenile, the number and location of sensory pores and relative position of nostril, eye, gill slit, mouth, and pectoral fin are the same as the holotype. Proportions of head and body are also similar with the exception of head, which is larger (31.3 vs 26.4% SL), and the eye, which is much smaller (14.6 vs 17.8% HL). D ca. 41, A 35, C 6.

Color. Skin light, unpigmented; caudal part of body milky-pale. Head and belly appear bluish-black because of color of peritoneum, mouth, and gill cavity, which can be clearly seen externally. Margin of opercular flap and gill slit area black. Skin on chin, lower jaw, mouth, and lips black; lateral lobe of lower lip whitish. Pectoral fin light but its lowermost ray blackish. Anal area blackish.

Etymology. This species is named after Keppel Harcourt Barnard, the South Af-

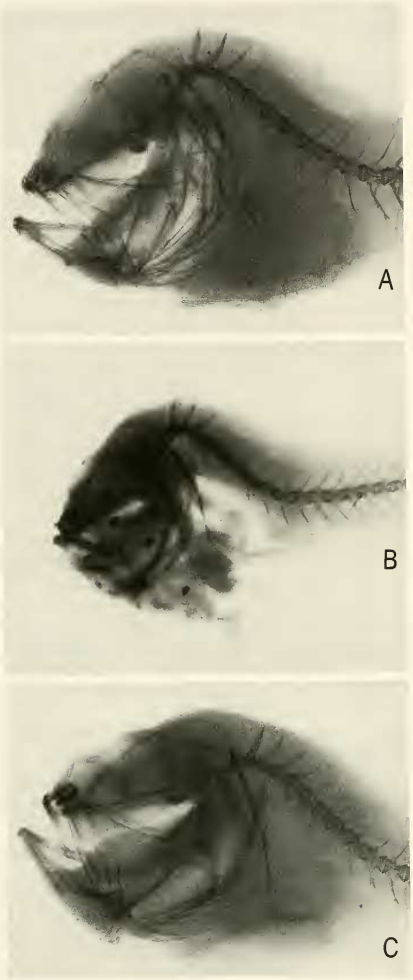

Figure 5. Radiographs of *Psednos*. (A) *P. harteli* sp. nov., holotype. (B) *P. groenlandicus* sp. nov., holotype. (C) *P. micruroides* sp. nov., holotype.

rican ichthyologist, who first described the genus *Psednos*.

Distribution. This species is known only from the western North Atlantic near the

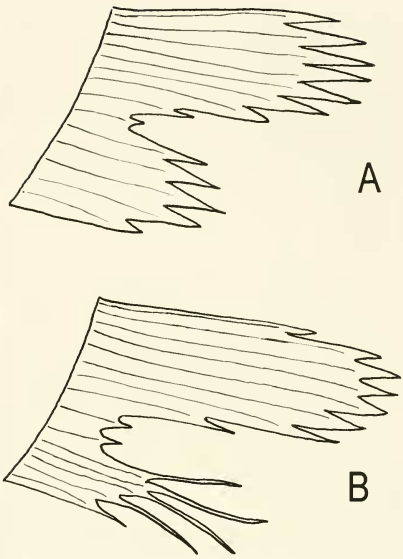

Figure 6. Right pectoral fins of two *Psednos*. (A) *P. harteli* sp. nov., holotype. (B) *P. groenlandicus* sp. nov., holotype.

southeast slope off New England (about 40°N), at a depth of 1042–1368 m for the adult and between 750 and 1001 m for the juvenile.

Comparative Notes. Psednos barnadi belongs to a group of *Psednos* with 47 vertebrae, no coronal pore, 6(5+1) io pores, and 6 preoperculo-mandibular pores. It is distinguished by a small eye (18% HL), a gill slit that is 1.6 eye diameters, a short mouth cleft, an unpigmented caudal part of body, and black skin on chin. It is most similar to *P. groenlandicus* but differs from it by a smaller eye (18 vs 20–23% HL), a larger gill slit (1.6 vs about equal to eye) that is more highly located (its dorsal end level with eye center vs below the level of eye), a shorter mouth cleft reaching to below anterior margin of eye (vs eye center), a smaller subocular space (1.7 times eye vs about equal to eye), pectoral fins with 1 notch ray (vs 2 notch rays), milky-pale caudal part of body (vs with black pigmenta-

tion), and the skin on chin and lower jaw black (vs strictly unpigmented). The head and belly look much blacker than in *P. groenlandicus*, the caudal part looks more low and elegant, and the subcutaneous gelatinous tissue is less developed.

Psednos christinae Andriashev, 1992

European Dwarf Snailfish (Figs. 1, 7C)

Psednos christinae Andriashev, 1992: 10, figs. 4, 5a, 6; 1993a: 9, figs. 3–5 (ex parte: the holotype ISH 741-82 and 1 of 2 paratypes, ZISP 49982).

Psednos christinae (non Andriashev, 1992): Andriashev, 1992: 10, figs. 3b, 7; 1993a: 9, figs. 2A, 6 (ex parte: 1 of 2 paratypes of *P. christinae*, ISH 574-86, 53 mm SL = holotype of *P. andriashevi* sp. nov., see above).—Kido et Yabe in Okamura et al., 1995: 185, fig. 128 (1 sp. SL 58 mm, East Greenland = undescribed species).

Material. Holotype. ISH 741-1982, adult male 45.5 mm. RV *Walter Herwig*, Sta. 392/82. East slope of the northernmost part of the Mid-Atlantic Ridge, 49°48′N, 25°55′W, 16 Jun. 1982. Depth 1000 m. Coll. C. Karrer. Paratype. ZISP 49982, adult male 45 mm. RV *Walter Herwig*, Sta. 321/83. West of Scotland, 56°22′N, 11°55′W, 18 May 1983. Depth 1500 m. Coll. N. Merrett.

Diagnosis. A North Atlantic *Psednos* with V 47, D 41, coronal pore absent, 7 preoperculo-mandibular pores, a short head (24–25% SL), small gill slit (20.4–21.5% HL or 0.8–0.9 eye diameter) that is low (end of operculum below level of eye), opercular flap small, triangular; pectoral fin long (66% HL) with 1 notch ray and uppermost ray level with posterior end of mouth cleft.

Description. Maximum depth (at occiput) 3.8 in SL, about 2 times greater than depth at anal-fin origin. Trunk not long, preanal 34% SL. Dorsal and anal fins low. Anus on vertical with ½ of postocular distance.

Head 4.0 times in SL, compressed, its width about 53% HL or 2 times in head depth. Depth at occiput greater than head length, 106 (116)% HL. Anterodorsal profile straight, sloping to tip of snout, but slightly concave above eye. Snout 1.1 times eye. Nostril small, level with eye center. Eye 4.2 in HL, pupil ⅔ of eye diameter. Interorbital 1.5 times eye. Suborbital distance about equal to eye. Mouth superior, oblique, forming an angle of about 40–45° to horizontal. Symphysis of upper jaw level with lower margin of eye. Mouth cleft reaching to anterior ½ of pupil, end of upper jaw to posterior margin of eye. Lower jaw projecting. Symphyseal knob large. Chin low, lower jaw not massive. Prominent tip of lower jaw (retroarticular process) on vertical with posterior margin of pupil, angled at about 90°. Teeth sharp, 5–7 and 6–7 teeth in each row near symphysis of upper and lower jaw. Diastema of upper jaw narrow.

Gill slit small (0.8–0.9 of eye diameter), almost vertical, entirely above pectoral base; located low, its dorsal end level with lower margin of eye, ventral end level with posterior end of oblique mouth. Opercular flap short, triangular, reaching posteriorly to point not more than a vertical of 1/5 of pectoral fin length. Operculum directed ventroposteriorly; its end level with lower ⅓ of subocular distance. Gill rakers 11, with tiny, dorsal prickles.

Pectoral fin located low, its uppermost ray level with posterior end of oblique maxilla. Pectoral notch with 1 ray, P 15(8+1+6), in paratype 15(9+1+5). Upper pectoral lobe long, 66% HL, almost reaching anal-fin origin. Lowermost ray inserted in vertical at third of postocular space. Rays of lower lobe thin and elongate, their length about 90% of upper lobe length. Pectoral girdle radials 3, rounded, equally spaced. Lowermost radial about twice as large as upper. Fenestrae in basal cartilaginous lamina absent. Scapula with short, stout, anteriorly directed handlelike process. Coracoid large, half-moon shaped (Fig. 8A).

Vertebrae 47(47): abdominal 10(10), caudal 37(37). Interneural of 1st dorsal ray fits between 4th and 5th vertebrae.

Sensory System. Coronal pore absent. Nasal pores 2, n_2 pore level with upper margin of eye. Infraorbital 6(5+1), temporal 1+1, preoperculo-mandibular 7.

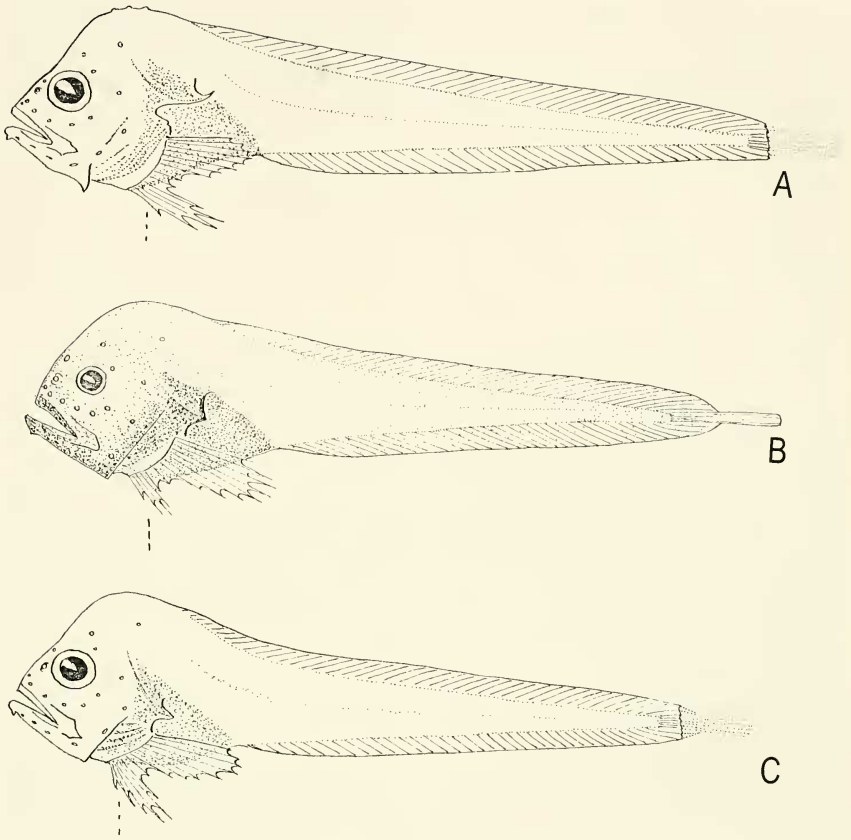

Figure 7. Three species of *Psednos*. (A) *P. andriashevi* sp. nov. Male, 53 mm. Holotype ISH 574-1986. West of Ireland, 800 m. (B) *P. barnardi* sp. nov. Male, 34-mm standard length (SL). Holotype MCZ 155422. Western North Atlantic, 1042–1368 m. (C) *P. christinae* Andriashev, 1992. Male, 45.5-mm SL. Holotype ISH 741-1982. Northernmost part of the Mid-Atlantic Ridge, eastern slope, 1000 m.

Chin pores (pm_1–pm_1) spaced at a distance equal to pm_1–pm_2.

Measurements and Counts. In percentage of SL (data for 45-mm-SL paratype in parentheses): HL 24.9 (23.8), HW 13.2 (12.7), bd 26.4 (27.8), bdA 14.9(—), preD 27.0 (27.8), preA 34.1 (34.9), mand-anus 19.8 (18.9), anusA 18.3 (18.9), UPL 16.5 (16.8), notch ray 5.5 (5.7), LPL 13.2 (14.2), eye 5.9 (6.2), snout 6.8 (—), io 8.8 (9.3), postoc 14.2 (—), upj 10.6 (11.1), gsl 5.1 (5.1), as percentage of HL: HW 53.0 (53.4), bd 106 (116), bdA 60, UPL 66.3 (—), eye 26.2 (23.9), snout 26.6 (25.3), io 35.4 (39.3), postoc 57 (—), upj 42.5 (46.8), gsl 20.4 (21.5). V 47(10+37), D 41, A 35, P 15(8–9+1+5–6), C 6. Radials 3, rounded.

Color. Skin uniformly pale but head and belly look dark because dark color of mouth and peritoneum, which can be seen externally. Mouth black, gill arches and rakers dark gray, gill cavity and peritoneum blackish-brown. Skin on ventral surface of head unpigmented. Stomach brownish-black. Pyloryc ceca brownish, melanophores few but arranged more densely near base of appendages. Intestine pale.

Distribution. Holotype caught on the east slope of northernmost part of the Mid-Atlantic Ridge at 1000 m; paratype taken in midwater, west of Ireland at a depth of 1500 m, over a great depth.

Comparative Notes. Psednos christinae belongs to a species group with 47 vertebrae, no coronal pore, 6(5+1) io pores, and 7 preoperculo-mandibular pores. It is distinguished by an unusually short gill slit (20.4–21.5% HL or 0.8–0.9 eye diameter) that is located low (its dorsal end level with lower margin of eye), a small triangular opercular flap with its tip below the level of eye, and a long pectoral (66% HL) with 1 notch ray that is placed low. It is most similar to the sympatric *P. andriashevi* (see comparative notes for that species).

Psednos christinae differs from *P. micrurus* because it has more vertebrae (47 vs 43) and fin rays (D 41 vs 37, A 35 vs 30), a shorter preanal distance (34 vs ca. 50% SL), a clearly notched pectoral fin (vs obviously unnotched), 5–7 teeth in a row near symphysis of lower jaw (vs in double row), and by the color of the gill cavity and peritoneum (black vs dark brown). In *P. christinae*, the coracoid is half-moon in shape (with a short stout handle in *P. micrurus*).

Psednos gelatinosus new species

Gelatinous Dwarf Snailfish (Figs. 3B, 9A)

Material. Holotype. MCZ 64537, juvenile male, 30 mm SL, 34.5 mm TL. R/V *Endeavor*, Cr. 133. SE of Greenland, 63°05′54″N, 39°39′54″W, 14 Aug. 1985. EN 133-19. 1330 mwo, depth 0–650 m. Coll. David Backus.

Diagnosis. A North Atlantic *Psednos* with D 38, A 35, no coronal pore, 6 preoperculo-mandibular and 2 suprabranchial pores; head large (29% SL), eye small (17.4% HL), mouth slightly oblique and short (its cleft reaching to below anterior margin of eye); dorsal and anal fins overlap ⅔ of caudal fin; body greatly gelatinous; color pale with dark margins near middle of dorsal and anal fins.

Description. Body moderately humpbacked, depth at occiput 3.7 times in SL and 1.5 times depth at anal-fin origin. Trunk rather large, preanal 38% SL. Dorsal and anal fins deep and overlap ⅔ of caudal fin. Anus on vertical at ¾ of postocular distance. Pyloric ceca not studied because belly not dissected. Skin semitransparent. Subcutaneous gelatinous tissue well developed, so much so that body seems to be inserted in gelatinous sack.

Head large, 3.5 times in SL, and wide (about 70% HL). Depth at occiput about equal to head (105% HL). Anterodorsal profile rounded to tip of snout. Nostril small, level with lower margin of eye. Eye round, small, 5.7 times in HL. Pupil about ¾ of eye diameter. Mouth terminal, only slightly oblique, forming an angle 15–20° to horizontal. Symphysis of upper jaw below level of lower margin of eye. Mouth cleft reaching to below anterior margin of eye, maxilla reaching to its posterior margin. Lower jaw slightly projecting. Symphyseal knob present. Lips thins, lower lip with a lateral lobe. Chin deep, lower jaw massive. Retroarticular process on a vertical at ⅕ of postocular distance. Teeth sharp, in numerous oblique rows, containing 5–6 teeth in both lower and upper jaws near symphysis.

Gill slit slightly oblique and 1.5 times larger than eye diameter, completely above pectoral base; its dorsal end level with eye center. Opercular flap triangular. End of operculum posteroventrally directed and level with middle of suborbital distance.

Pectoral fin 15(8+1+6), upper lobe about 64% HL, not reaching anal-fin origin. One notch ray, its length about 38% of upper lobe. Uppermost pectoral ray lev-

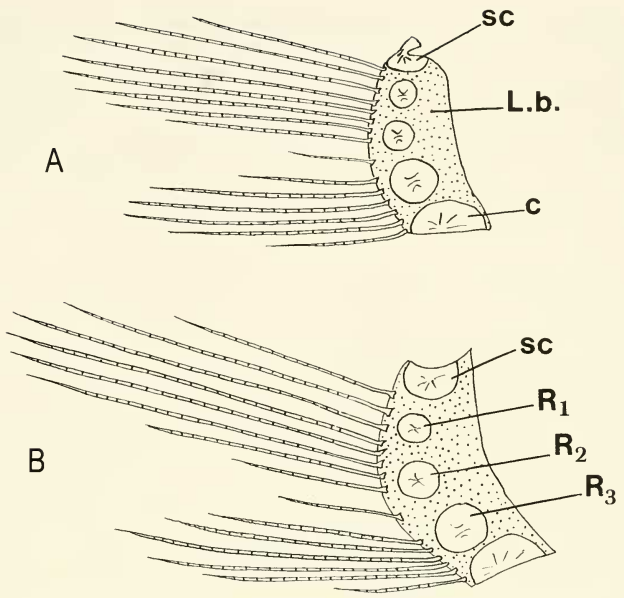

Figure 8. Right pectoral girdle and fin (right from outside) of two *Psednos*. (A) *P. christinae* Andriashev, 1992, holotype. (B) *P. groenlandicus* sp. nov., holotype. c, coracoid; L.b., basal cartilaginous lamina; R_1, R_2, and R_3, radials; sc, scapula.

el with symphysis of upper jaw. Lowermost pectoral ray inserted an eye diameter behind prominent posterior tip (retroarticular process) of lower jaw and on a vertical to about ⅔ of postocular distance.

Radiograph does not show vertebrae or fin rays, possibly because of lack of ossification as species of *Psednos* of same size show distinct vertebrae and fin rays.

Sensory System (Fig. 3B). No coronal pore. Two nasal pores, about twice as large as nostril diameter, n_2 pore level with upper margin of eye and distinctly above nostril. Infraorbital 6(5+1); io_{1-5} pores situated in semicircle below eye, gradually increasing in diameter from 1st to 4th, with 5th smaller than 4th and 6th situated just behind posterodorsal margin of eye. Temporal pores 1+2, t_1 round, about 1.5 times larger than io_6; suprabranchial pores 2, each at end of its own tube, situated one above another, lower pore at 52% HL from dorsal end of gill slit. Preoperculomandibular 6, position of the pm_6 unique to this species of *Psednos*: situated high, level with io_6 pore, and very close to latter. Chin pores (pm_1–pm_1) spaced at a distance equal to pm_1–pm_2.

Measurements and Counts. HL 28.6, HW 20.7 (72.1), bd 30.0 (105), bdA 20.3 (70), preD 34.0, preA 38.3, mand-anus 23.3, anusA 23.3, UPL 18.3 (64.0), notch 7.0, LPL 10.7 (60% UPL), eye 5.0 (17.4), snout 10.0 (34.9), io 17.3 (60.5), postoc 17.3 (60.0), upj 16.0 (55.8), gsl 8.0 (27.9). V unknown, D ca. 38, A ca. 35, P 15(8+1+6), C 6.

Color. Skin uniformly light, caudal part of body unpigmented. Margins of dorsal and anal fins black at midlength of fins. Margin of opercular flap also black. Head and belly appear dark because of dark

mouth and peritoneum that is visible externally. Skin on head light, only the lips are slightly pigmented but not black. Mouth and gill cavity brownish-black. Peritoneum dark.

Distribution. Known only from one specimen collected off southeast Greenland, in midwater at a depth of 0–650 m.

Etymology. The name "gelatinosus" reflects the great development of subcutaneous gelatinous tissue in this species.

Comparative Notes. Psednos gelatinosus belongs to a species group with about 47 vertebrae, 38–42 D rays, no coronal pore, 6(5+1) io pores, and 6 preoperculo-mandibular pores. It is unique because of presence of 2 suprabranchial pores; all other known species of *Psednos* have only 1 suprabranchial pore. Position of pm_6 pore (close to io_6 and level with it) is also very unusual as is very gelatinous body and black margins at midlength of dorsal and anal fins. Mouth only slightly oblique with short cleft only reaching to below anterior margin of eye. Dorsal and anal fins are deep and overlap ⅔ of the length of the caudal fin. Most similar to *P. harteli* sp. nov. and *P. groenlandicus* sp. nov. but differs by above characters.

Psednos groenlandicus new species

Greenland Dwarf Snailfish (Figs. 5B, 6B, 8B, 9B)

Material. Holotype. ZMUC P 82660, adult male, 39.5 mm SL, 46 mm TL. R/V *Paamiut*, Trawl 12. Davis Strait, 64°30′N, 56°17′W, 27 Sep. 1997, depth 930 m, bottom temperature 3.5°C. Coll. P. R. Møller. Pectoral girdle preparation No 744. Paratype. ZMUC P 82763, adult male, 53 mm SL, 62 mm TL. R/V *Shinkai Maru*, Trawl 3, 63°26.7N, 53°54.7W, 5 Aug. 1991, depth 1055 m, bottom trawl. Coll. P. R. Møller. Additional material: ZMUC P 82519, dry specimen ca. 45 mm SL. R/V *Shinkai Maru*, trawl 64, 65°09′N, 56°07′W, 23 Aug. 1992. Coll. P. R. Møller.

Diagnosis. A North Atlantic *Psednos* with V 47, D 41, coronal pore absent, 6 preoperculo-mandibular pores, 1 suprabranchial pore, short mouth cleft (reaching to below anterior margin of eye), upper jaw short 10.6–12.6% SL; vertical gill slit about equal to eye diameter and placed low, pectoral notch with usually 2 rays, and with slight blackish pigmentation at end of caudal part of body and along vertebrae.

Description. Depth at occiput 4 times in SL and 1.7 (1.8) times depth at anal-fin origin. Trunk not long, preanal 38 (36)% SL. Dorsal and anal fins not deep and overlap ⅓ of caudal fin. Anus on vertical near middle of postocular space. Pyloric ceca 5, short and paddlelike with roundish tips (not fingerlike with sharp tips as in *P. christinae*). Skin semitransparent, subcutaneous gelatinous tissue comparatively well developed.

Head 4 (4.3) times in SL, quite compressed, its width 60 (51)% HL and 2.3 times in head depth. Head deep at occiput, depth greater than head length (115% HL). Anterodorsal profile abruptly rounded to tip of snout. Snout 1.4 times larger than eye. Nostril small and porelike, level with lower ½ of eye. Eye round, 4.9 (4.4) times in HL, pupil about ½ of eye diameter. Mouth cleft terminal, oblique, forming an angle of about 30 (35)° to horizontal. Symphysis of upper jaw slightly below level of lower margin of eye. Mouth cleft reaching posteriorly to a vertical with anterior margin of eye, maxillary almost to posterior margin of eye. Lips thin, lower lip with narrow lateral lobe. Lower jaw slightly projecting; symphyseal knob, if present, very small and hardly distinguished on specimen or on radiographs and not developed as in *P. micrurus*, *P. christinae*, and *Psednos* sp. 1 (Andriashev, 1992, fig. 3). Prominent tip of lower jaw (retroarticular process) on vertical with posterior end of eye (of pupil in paratype). Teeth sharp, closely set in numerous oblique rows of 6–7 (5–6) teeth in lower and upper jaws near symphysis. Upper jaw diastema narrow.

Gill slit almost vertical and not larger than eye diameter, completely above pectoral base and located low, dorsal end of gill slit about level with middle of subocular space, its ventral end level with end of oblique mouth. Opercular flap triangu-

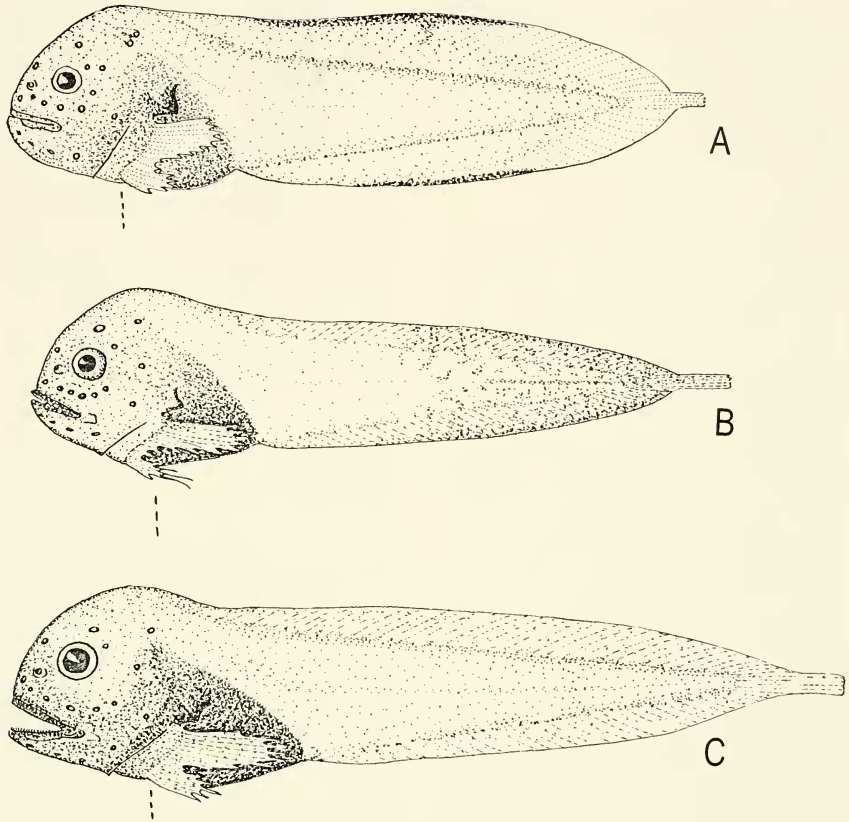

Figure 9. Three species of *Psednos*. (A) *P. gelatinosus* sp. nov. Juvenile, 30-mm standard length (SL). Holotype MCZ 64537. Southeast of Greenland, 0–650 m. (B) *P. groenlandicus* sp. nov. Male, 39.5-mm SL. Holotype ZMUC P 82660 (partially skinned; the black pigmentation along vertebrae is seen). Davis Strait, 930 m. (C) *P. harteli* sp. nov. Male, 48-mm SL. Holotype MCZ 63035. Western North Atlantic, 0–1008 m.

lar, sharply angled. The end of operculum directed posteriorly.

Pectoral fin 15(8+2+5) on left side and 15(8+1+6) on right side of holotype, 15(8+2+5) in two other specimens. Upper pectoral lobe 70(71)% HL, almost reaching anal-fin origin. Notch rays usually 2, short, about 30(25)% of upper lobe length. Lower lobe with thin elongate rays, about 70(88%) of upper lobe length. Pectoral fin located low, uppermost ray about level with posterior tip of oblique maxillary. Lowermost pectoral ray inserted a pupil diameter from prominent posterior tip of lower jaw (retroarticular process) and on a vertical with midpoint (⅓ in paratype) of postocular distance. Pectoral girdle of holotype (Fig. 8B) with 3 rounded radials.

Fenestrae in cartilaginous basal lamina absent. Scapula without a handlelike projection. Coracoid half-moon shaped.

Vertebrae 47(47), hemal spine of 11th vertebrae aligned with 1st anal-fin ray. Hemal spine present at least on 10th vertebrae. Interneural of 1st dorsal ray fits between neural spines of 4th and 5th vertebrae.

Sensory System. Coronal pore absent. Nasal pores 2, small and widely spaced, upper one opens behind vertical to nostril (level with nostril in holotype, but above it in paratype) and level with upper margin of eye. Infraorbital 6(5+1) on both sides of holotype and additional specimen and 4+1 pores on left side, 5+1 on right side in paratype. Temporal 1+1, t_1 pore large, longitudinally oval, twice size of io_6. Suprabranchial pore situated at a distance of 51(49)% HL from upper end of gill slit. Preoperculo-mandibular 6. Chin pores (pm_1–pm_1) spaced at a distance about equal to pm_1–pm_2.

Measurements and Counts. As percentage of SL: HL 24.8 (23.0), HW 14.7 (11.7), bd 28.6 (26.8), bdA 17.2 (14.7), preD 30.3 (26.4), preA 38.0 (33.8), mandanus — (18.9), anusA — (20.8), UPL 17.7 (16.0), notch 5.6 (4.0), LPL 13.4 (14.2), eye 5.1 (5.3), snout 8.1 (7.5), io 12.7 (10.9), postoc 14.6 (13.2), upj 12.6 (10.6), gsl 5.1 (5.5); as percentage of head length: HW 59.2 (50.8), bd 115 (116), bdA 69 (64), UPL 71.0 (70), eye 20.4 (23 0), snout 32.7 (32.8), io 51.0 (47.5), upj 51.0 (45.9), gsl 20.4 (23.8), postoc 59.2 (57 0). V 47(10+37), D 41, A 34–35, P 15(8+1–2+5–6), C 6. Radials 3. Gill rakers 7.

Color. Skin uniformly light but caudal part of body and especially margins of anal and dorsal fins with slight blackish pigmentation. In holotype, skin at end of caudal part of body damaged and a slight, but distinct, area of black pigmentation present along vertebrae, at least posteriorly, where skin is damaged. Pigment associated with bodies of vertebrae, very unusual for liparids. In paratype and additional specimen slight black pigmentation along vertebrae can also be seen in some places. Skin on snout and lower side of head unpigmented, only lips and edge of opercular flap are blackish. Surface of head below skin and gelatinous tissue dotted by black stellate melanophores, which are clearly seen through transparent skin. Dark color of head and belly is due to black mouth, gill cavity, and peritoneum. Midline of belly and lower lobe of pectoral fin with slight blackish pigmentation. Urogenital papilla pigmented. Stomach black. Pyloric ceca and anterior part of intestine a lighter dark dusky color. Reddish in life, body semitransparent; and a few milky-white spots present on lower jaw (P. R. Møller, personal communication).

Distribution. All 3 specimens caught southwest of Greenland (63°–65°N), in the Davis Strait at a depth of 930–1055 m.

Etymology. The name "groenlandicus" refers to Greenland waters, the type locality.

Comparative Notes. Psednos groenlandicus belongs to a group of *Psednos* with 47 vertebrae, no coronal pore, 6(5+1) io pores, and 6 preoperculo-mandibular pores. It is distinguished by its short mouth cleft reaching to below anterior margin of eye (upper jaw 10.6–12.6% SL), by an almost vertical and short gill slit about equal to eye. Pectoral notch usually has 2 rays, the caudal part of the body has slight blackish pigmentation near the end and along the vertebrae.

Most similar to *P. harteli,* which occurs more southward (ca. 40°N) but differs from it by elongate thin lower-lobe rays and 2 notch rays (vs thick handlike lower lobe and 1 notch ray), a short mouth (reaching to below anterior margin of eye vs pupil), a shorter upper jaw (10.6–12.6 vs 13.5% SL), a gill slit that is almost vertical (vs oblique), by peculiar pigmentation along vertebrae, and blackish pigment near end of caudal part of body (unpigmented in *P. harteli*). It also differs by a more compressed head (width 50–60 vs 70% HL), and by its black lips and mouth (vs brownish). *Psednos groenlandicus* dif-

fers from *P. christinae* by presence of only 6 (vs 7) pores in preoperculo-mandibular canal, unusual pigmentation along vertebrae, its short paddlelike (vs fingerlike) pyloric ceca, wider head (interorbital distance 47.5–51 vs 35–39% HL), dusky intestine (vs unpigmented); and scapula without handle (vs having a short, stout, anteriorly directed handle).

Psednos harteli new species

Hartel's Dwarf Snailfish (Figs. 5A, 6A, 9C)

Material. Holotype. MCZ 63035, adult male, 48 mm SL, 55 mm TL. R/V *Knorr*, Cr. 98. Western North Atlantic, 40°45′00″N, 65°03′00″W, 05 Oct. 1982. Multiple opening closing net, MOC 20-059,0. Depth 0–1008 m.

Diagnosis. A North Atlantic *Psednos* with V 47, D 42, no coronal pore, io 6(5+1), 6 preoperculo-mandibular and 1 suprabranchial pores, lower pectoral lobe wide and thick, handlike (Fig. 6A), 1 pectoral notch ray, gill slit distinctly oblique and short (about equal to eye), large mouth (cleft reaching to below pupil, upper jaw 13.5% SL), caudal part of body unpigmented.

Description. Body moderately humpbacked, depth at occiput 3.6 times in SL and 1.5 times depth at anal-fin origin. Trunk not long, preanal distance 38% SL. Dorsal and anal fins low and overlap half of caudal fin. Anus approximately on vertical at ½ postorbital distance, about midway between symphysis of lower jaw and anal-fin origin. Small thin urogenital papilla present. Skin transparent. Subcutaneous gelatinous layer weakly developed. Pyloric ceca not studied.

Head 4 in SL, wide, its width 70% HL and about 1.6 in head depth. Depth at occiput much greater than head length (112.5% HL). Anterodorsal profile of head rounded to tip of snout. Snout blunt, 1.4 eye diameter. Nostril level with eye center, small, about equal to diameter of nasal pore. Eye 4.8 in HL, pupil about ⅔ of eye diameter. Interorbital space wide, about 50% HL and 2.5 larger than eye. Subocular distance about equal to eye. Mouth terminal, moderately oblique forming about 30° angle to horizontal. Symphysis of upper jaw about level with midpoint of subocular distance. Mouth cleft reaching posteriorly to anterior half of pupil, maxillary reaching to below posterior margin of eye. Lower jaw included when mouth closed. Prominent tip of lower jaw (retroarticular process) on vertical at posterior edge of eye. Chin not deep, lower jaw not massive. Symphyseal knob absent. Teeth sharp, closely set in numerous oblique and curved rows, 6–7 teeth in row near symphysis in both jaws.

Gill slit about equal to eye diameter, completely above pectoral base and distinctly oblique. Dorsal end of gill slit below level of eye, ventral end almost level with posterior end of oblique mouth. Opercular flap small, triangular. End of operculum directed downward and level with lower third of subocular space.

Pectoral fin 14(8+1+5), with a wide, handlike lower lobe consisting of 5 thick rays united by membrane along more than half of their length (Fig. 6A) that is unique in *Psednos*. Width of lower lobe only slightly less than width of upper lobe. Upper lobe almost reaching anal-fin origin, its length 63% HL; 1 notch ray, about 26% of length of upper lobe. Pectoral fin situated low, uppermost ray level with posterior tip of oblique maxilla. Lowermost ray inserted about on a vertical with midpoint of postocular distance or ½ eye diameter behind prominent posterior tip of lower jaw.

Vertebrae V 47(11+36), hemal spine of 12th vertebrae aligns with 1st anal-fin ray. Hemal spines present also at least on 10th–11th vertebrae. Interneural of 1st dorsal ray fits between 5th and 6th vertebrae. Symphyseal knob clearly visible on radiographs of *P. micrurus*, *P. christinae*, and *Psednos* sp. 1 (Andriashev, 1992, fig. 3) not present in this species (Fig. 5A).

Sensory System. Coronal pore absent. Nasal 2, n_2 pore as large as nostril and open far above nostril and level with upper margin of eye. Infraorbital 6(5+1), io_{1-5}

pore in a line below eye; io_6 pore opens behind upper margin of eye. Pore t_1 large, longitudinally oval and 2 times diameter of io_6. Temporal 1+1; suprabranchial pore about ½ HL from dorsal end of gill slit. Preoperculo-mandibular 6, pm_6 pore about level with eye center. Chin pores spaced at a distance equal to pm_1–pm_2. The pm_2–pm_4 pores slightly enlarged, oval.

Measurement and Counts. HL 25.0, HW 17.7 (70.8), bd 28.1 (112.5), bdA 18.8 (75), preD 31.2, preA 41.7, mand-anus 20.8, anusA 20.4, UPL 15.6 (62.5), notch 4.2, LPL 11.0 (70% UPL), eye 5.2 (20.8), snout 7.3 (29.2), io 12.9 (51.7), postoc 14.2 (56.7), upj 13.5 (54.2), gsl 5.2 (20.8). V 47(11+36), D 42, A 35, P 14(8+1+5), C 6.

Color. Skin uniformly light, caudal part of body without any sign of dark pigmentation. Head and belly look dark because of the pigmentation of mouth, gill cavity, and peritoneum. Skin light on snout and lower side of head. Lips light brownish. Color of internal organs not studied.

Distribution. The only specimen was caught above the continental slope of eastern North America (about 40°N), at a depth of 0–1008 m.

Etymology. The new species is named for the American ichthyologist Karsten Edward Hartel of the Museum of Comparative Zoology, Harvard University.

Comparative Notes. Psednos harteli belongs to a group of *Psednos* with 47 vertebrae, no coronal pore, 6(5+1) io pores, and 6 preoperculo-mandibular pores. It is distinguished by its thick, handlike lower pectoral lobe, a distinctly oblique gill slit, a wide head (70% HL), and an unpigmented caudal part. It is the most similar to *P. groenlandicus* (see above). *Psednos harteli* differs from the sympatric, but deeper-living (1042–1368 m) *P. barnardi*, by a larger eye (21 vs 17.8% HL), an oblique (vs almost vertical) gill slit equal to eye diameter (vs 1.7) that is located low (its dorsal end is below level of eye vs level with pupil), a larger mouth cleft reaching almost to eye center (vs anterior margin of eye), dark brown peritoneum (vs bluish-black), and light skin on chin and lower jaw (vs black). *Psednos harteli* differs from *P. christinae* in number of preoperculo-mandibular pores (6 vs 7), a handlike lower pectoral lobe, wider head (70 vs 53% HL), wider interorbital (52 vs 35–39% HL), rounded (not straight) anterodorsal profile, a longer upper jaw (54 vs 42–46% HL), and larger preanal distance (42 vs 34–36% SL). In addition, the body is less humpbacked; the depth at occiput 1.5 (vs 2) times the depth above anal-fin origin and the lowermost pectoral ray is inserted on vertical at about the middle of postocular distance (just behind a vertical to eye in *P. christinae*).

Psednos microps new species

Smalleye Dwarf Snailfish (Figs. 3C, 10A)

Psednos microps (non Barnard, 1927): Stein, 1979: 6, fig. 1 (ex parte: 1 of 2 specimens, USNM 200520; Indian Ocean).

Material. Holotype. USNM 200520, juv. female, 18 mm SL. R/V *Anton Bruun*, Sta. 7105. SW Indian Ocean, Crozet Basin, 35°02′S, 60°01′E, 9 Sep. 1963. Isaacs-Kidd midwater trawl, depth 275–2275 m.

Diagnosis. An Indian Ocean *Psednos* with V 41, D 37, coronal pore present, 1st temporal and 6th infraorbital pores absent, very small eye (13% HL), low gill slit, superior mouth, and pale skin.

Description. Depth at occiput 3.4 times in SL and 1.8 times greater than depth at anal-fin origin. Trunk rather long, preanal distance 44.4% SL. Anus located just behind base of lower pectoral lobe, about at vertical to midpostocular distance. Caudal rays missing.

Head large, 3.3 in SL and compressed, width 57% HL or 1.8 times in depth. Depth at occiput equal to head length. Anterodorsal profile slopes abruptly anteriorly but is concave above eye. Snout 2 times eye diameter. Nostril small, located high, slightly above level of upper eye margin. Eye very small, 7.6 times in HL. Mouth superior, forming angle 50–60° to horizontal. Symphysis of upper jaw level with upper margin of eye. Lower jaw pro-

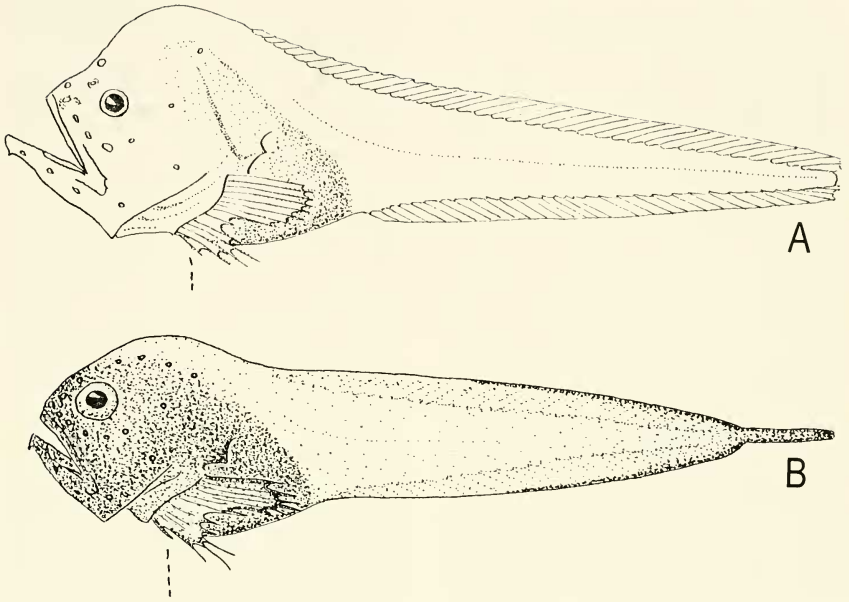

Figure 10. Two species of *Psednos*. (A) *P. microps* sp. nov. Juvenile, 18-mm standard length (SL). Holotype USNM 200520. Caudal rays missing. Pectoral fin length unknown. Indian Ocean, Crozet Basin, 275–2275 m. (B) *P. micruroides* sp. nov. Male, 31-mm SL. Holotype MCZ 64538. Southeast Greenland, 0–900 m.

jecting. Mouth cleft not reaching vertical with nostril, maxilla reaching vertical to anterior margin of pupil. Symphyseal knob present. Teeth sharp, about 5 in each row near symphysis of lower and upper jaws. Chin low, lower jaw not massive. Prominent tip of lower jaw (retroarticular process) angled at about 90° and on vertical with anterior margin of pupil.

Gill slit 1.4 eye diameters, completely above pectoral base and slightly oblique. Dorsal end of gill slit level with upper ⅕ of subocular distance, ventral end level with posterior end of oblique mouth. Opercular flap very small, triangular. End of operculum directed posterodorsally, its tip reaching midsubocular level.

Pectoral fin 14(8+1+5) with 1 notch ray that is clearly separated from neighboring rays. Uppermost pectoral ray level with posterior end of oblique mouth cleft, base of lowermost ray on vertical at ⅓ postocular distance.

Sensory System. Nasal pores 2, located high; n_1 pore level with nostril and above level of upper margin of eye; n_2 pore about 3 times larger than nostril and above eye by about a pupil diameter. Coronal pore present, equal in size to n_2 pore. Temporal pores 0+1 (the t_1 pore, usually above eye, absent); suprabranchial pore 40% HL from dorsal end of gill slit. Infraorbital 5+0 (the io_6 pore, usually behind upper margin of eye, absent). The io_1 pore on top of prominent projection of anterior suborbital bones and level with upper ½ of eye. Preoperculo-mandibular pores 6, pm_6 pore level with eye center. Chin pores (pm_1–pm_1) spaced at ⅔ of distance between pm_1–pm_2.

Measurements. HL 29.4, HW 16.7 (57), bd 29.4 (100), bdA 16.7 (57), preD 26.1, preA 44.4, mand-anus 25.0, anusA 25.0, pectoral rays broken, snout 7.8 (26.4), upj 16.1 (55), eye 3.9 (13.2), postoc 18.3 (62.3), io 12.8 (43.5), gsl 5.6 (18.9). V 41(10+31), D 37, A 30, P 14(8+1+5), C 6.

Color. Body pale, caudal part of body unpigmented. Peritoneum and gill cavity brown and clearly seen externally.

Etymology. The name "microps" in Greek refers to the small eyes of this species.

Distribution. Known only from the Crozet Basin in the southwestern Indian Ocean, at a depth 275–2275 m.

Comparative Notes. Psednos microps belongs to a species group with 41–43 vertebrae, a coronal pore, and 5(5+0) io pores. Unusual by absence of 1st temporal pore. Distinguished by very small eye (13% HL), superior mouth, low gill slit, and pale color. It differs from *P. steini* sp. nov., the only congener from the Indian Ocean, by absence of 1st temporal pore, the longer head (29 vs 24.5% SL), very small eye (7.6 vs 3.6 times in HL). Symphysis of upper jaw level with upper margin of eye (vs with lower ½ of eye), and accordingly higher nostril and n_1, n_2 io_2 pores (nostril and n_2 above eye vs level with eye center and its upper margin), and a gill slit and pectoral fin that are located lower. Occurs at greater depth (275–2275 vs 0–350 m).

If allometric growth of *P. microps* is similar to that of *P. barnardi*, one can assume that adult *P. microps* might have smaller heads (ca. 25% SL) and larger eyes (ca. 19% HL) and resemble *P. steini*; nevertheless, differences (absence of t_1 pore, high position of nostril and n_1, n_2, io_1 pores, and low location of gill slit and pectoral fin) clearly separate the species.

Psednos micruroides new species

Multipore Dwarf Snailfish (Figs. 2, 3A, 5C, 10B)

Material. Holotype. MCZ 64538. Subadult male, 31 mm SL, 36.5 mm TL. R/V *Endeavor*, Cr. 133. Off south-east Greenland, 63°50′18″N, 35°40′30″W, 13 Aug. 1985. 13.08.1985. EN 133-17. Depth 0–900 m. Coll. David Backus.

Diagnosis. A North Atlantic *Psednos* with V 43, D 38, coronal pore present, 6th infraorbital pore absent, 3–4 pores in temporal canal; eye 22.7% HL, mouth terminal, and gill slit equal to eye diameter.

Description. Depth at occiput 3.7 times in SL or about 2 times depth at anal-fin origin. Trunk rather large, preanal about 45% SL. Dorsal and anal fins low, overlaping ¼ of caudal fin. Anus on vertical with midpoint of postocular distance. Urogenital papilla present. Skin transparent. Gelatinous subcutaneous tissue weakly developed. Pylorye ceca not studied because belly not dissected.

Head large, 3.5 times in SL and quite compressed, width about 60% HL or 1.5 in head depth. Depth at occiput slightly less than head length (96% HL). Anterodorsal profile sloping to tip of snout. Snout blunt, about equal to eye diameter. Nostril about ½ pore diameter, level with eye center. Eye 4.4 times in HL, pupil about ⅔ of eye. Interorbital 46% HL and 2 times larger than eye. Mouth terminal, oblique, forming 55–60° angle. Symphysis of upper jaw about level with lower margin of eye. Lips thin, posterior ½ of lower lip with lateral lobe. Mouth cleft reaching posterior to vertical at anterior margin of eye, maxilla reaching posterior margin of pupil. Lower jaw included. Symphyseal knob well developed. Chin low, lower jaw not massive. Prominent tip of lower jaw (retroarticular process) on vertical with posterior margin of eye. Teeth small, in a few oblique rows, about 3–4 per row near symphysis of both upper and lower jaws.

Gill slit oblique, equal to eye diameter, completely above pectoral base; dorsal end slightly below the level of lower margin of eye. Opercular flap triangular. End of operculum directed posteroventrally and level with posterior end of oblique mouth.

Pectoral fin 13(7+1+5) with 1 notch ray, its length about 30% of upper lobe length. Upper pectoral lobe not reaching

anal-fin origin. Lower lobe with 5 thin rays, longest about 84% of upper lobe length. Pectoral fin located low, upper ray level with posterior end of oblique mouth. Lowermost pectoral ray inserted on vertical at midpoint of postocular distance or about ¾ of eye diameter from prominent posterior tip of lower jaw.

Vertebrae 43(11+32), hemal spine of 12th vertebrae aligned with 1st anal-fin ray. Hemal spines present at least on 10th–11th vertebrae. Interneural of 1st dorsal ray fits between 4th and 5th neural spines.

Sensory System. Coronal pore present. Nasal pores 2, upper level with upper margin of eye. Infraorbital 5(5+0) on left side, 4(4+0) on right side, small, about equal in size and situated on a curved line below eye; io_6 pore absent. Left temporal canal with 4 pores, right with 3 (Fig. 2). Pore t_1 situated above posterior margin of eye, small; t_2, t_3, and t_{sb} in 1 line and t_{sb} pore 36% HL from upper end of gill slit. Preoperculo-mandibular pores 6, pm_6 pore level with eye center. Chin pores small, interspace between pm_1 and pm_1 slightly less than distance between pm_1 and pm_2.

Measurements and Counts. HL 28.4, HW 17.7 (62. 5), bd 27.1 (95.4), bdA 13.9 (40), preD 32.3, preA 45.2, mand-anus 24.2, anusA 25.8, UPL 16.1 (56.0), notch 4.8, LPL 13.5, eye 6.5 (22.7), snout 6.5 (22. 7), io 12.9 (45.5), postoc 16.8 (59.2), upj 12.9 (45.5), gsl 6.5 (22.7). V 43(11+32), D 38, A 30, P 13(7+1+5), C 6.

Color. Head and belly dark, body pale, margins of vertical fins and margins of upper and lower pectoral lobes darkly pigmented. Skin on snout, lips and lower jaw, mouth and gill cavity, and margins of opercular flap brownish-black. Peritoneum brownish-black and clearly seen externally. Lower pectoral rays blackish. Color of internal organs not studied.

Distribution. The only known specimen caught in midwater southeast of Greenland at a depth of 0–900 m.

Etymology. The name *micruroides* is a derivative of Barnard's original specific name, *micrurus*, and is used because of the similarity between the two species.

Comparative Notes. Psednos micruroides belongs to a group of *Psednos* with few vertebrae (41–43), a coronal pore, but 6th infraorbital pore absent. It differs from all others species of this group by presence of 3–4 temporal pores in a row. It is also distinguished by its large head (28.4% SL), a gill slit equal to eye, and color pattern. Few vertebrae and the presence of a coronal pore make it similar to *P. micrurus* (see below). However, *P. micrurus* has 17 pectoral rays (vs 13), pectoral fin is not divided into 2 lobes (vs distinctly bilobed with an obvious notch), and the lower pectoral rays are longer than the upper ones (vs the lower lobe shorter than the upper). Also, the maximum body depth in *P. micrurus* clearly exceeds head length (138% HL) but in *P. micruroides* it is slightly less than head length (96%). *Psednos micrurus* has a short head (22.2% SL) and the upper pectoral lobe is greater than head length, whereas in *P. micruroides* the head is much larger (28% SL) and the upper pectoral lobe is less than head length (about 60% HL). The head of *P. micrurus* is very compressed and equal to about 0.5 HL (Andriashev, 1992: 8) and the teeth in lower jaw have two teeth per row near symphysis. In *P. micruroides* the head is wider (63% HL) and the teeth in the lower jaw are 3–4 per row.

Psednos micrurus Barnard, 1927

Barnard's Dwarf Snailfish (Fig. 11)

Psednos micrurus Barnard, 1927a: 76; 1927b: 927, pl. 33, fig. 5 (off Cape Point, South Africa, 660–700 fath.). Holotype: BMNH 1930.1.14.7. Ovigerous female SL 45 mm; bad condition in 1992. Paratype disintegrated (see Andriashev, 1992). Andriashev, 1986: 107 (ex parte; see Barnard, 1927); 1992: 4, figs. 2, 3a; 1993a: 7, fig. 2B (ex parte: redescription of the holotype).

Paraliparis micrurus (non Barnard, 1927): Stein, 1979: 6, fig. 1. 1986a: 494 (Indian Ocean).—Andriashev, 1986: 107, fig. 48; 1992: 4, fig. 1; 1993a: 7, fig. 1 (ex parte: see Stein, 1979).

Material. Radiograph (ZISP 17451) of the holotype and pectoral girdle preparation no. 544, *Psednos* cf.

micrurus ZISP 51704, SL 13 mm, TL 14.5 mm. Madagascar Ridge, 31°18′S, 46°05′E, RV *Vityaz*, Sta. 2773, 25 Dec. 1988, at a depth 1000–0 m over bottom at 2600-2100 m.

Diagnosis. A *Psednos* from off South Africa with V 43, coronal pore present; pectoral unnotched; head short (22% SL), preanal large (50% SL), teeth on lower jaw in double row, color grayish-brown.

Description. This description is a combination of Barnard's original description (1927), redescription of the holotype (Andriashev, 1992: 6, figs. 2, 3a), and my observations. Trunk long, preanal distance about equal to half of standard length. Pyloric ceca 5, equally short and thick. "Mouth very oblique, lower jaw projecting .... Caudal completely confluent with dorsal and anal. Vent between lower extremities of pectorals .... Resembling *Amitra* (=*Paraliparis liparinus*) in the pectoral" (Barnard, 1927a: 76). "Maxilla reaching to below anterior third of eye. Distance from snout to origin of dorsal nearly twice, to origin of anal fin 2 and ⅓ times, length of head. P 17, rays at least as long as head, the lower rays probably slightly longer .... Length up to 45 mm. Grayish brown (as preserved). The type has the body cavity filled with a number of large eggs, 1 mm in diameter. Another specimen of the same size is rather badly mutilated, but confirmed the above characters" (Barnard, 1927a: 77).

Andriashev (1992: 6, figs. 2, 3a) noted the following. Outer outline of head rises abruptly from short snout to highly rounded occiput and then tapers more gently to thin caudal part of body. Head very compressed, its width equal to about ½ of head length. Depth at occiput is 2 times as high as that at anal-fin origin. Snout not projecting, blunt, rostral fold not developed. Lips thin. Mouth distinctly superior, strongly oblique; upper jaw forms an angle about 50–60° to horizontal midline of body. Lower jaw projecting, with a symphyseal knob. Teeth in jaws very small, simple, sharpened; those in lower jaw form a narrow band consisting of an irregular double row. Posterior end of the lower jaw forms a distinct ventrally directed angle. Eye round, large, about 4 times in head length.

Sensory Pores. Few pores have been noted on the holotype. Andriashev (1992: 8) found: "Pores of infraorbital canal are in line under eye. Remains of small canal behind eye are discernible with the terminal pore io_6 that may evidence of an interruption of the infraorbital canal behind eye; trace of suprabranchial pore widely spaced from the upper margin of gill opening may be descerned .... Nasal pores and a coronal one are not discernible because of a damaged skin." Coronal pore always present in *Psednos* with few vertebrae (41–43) so it is probably present in *P. micrurus*. The reconstruction of pores by Andriashev (1992, p. 9, fig. 1), based on figure 1 in Stein (1979) belongs to another species (see below *P. steini* sp. nov.).

Pectoral girdle (based on Andriashev, 1992, fig. 2) has 3 rounded and almost equally spaced radials; lower radial largest and ½ again as large as upper radials. Cartilaginous basal lamina without fenestrae. Scapula probably without a handlelike projection, coracoid with the short, rather thick, anteriorly directed projection. Pectoral fins very damaged and only a few rays remain, at least 13–14 in one fin.

"Parapophyses of three posterior abdominal vertebrae are probably joined together forming a gradually elongated haemal spines; the longest spine is on the 12th vertebra but only the haemal spine of 13th vertebra fits to the 1st anal ray; thus number of vertebrae is probably 12 abdominal (9+3) and 31 (30+1, as urostyle vertebra lost) caudal vertebrae, totaling 43. Number of caudal rays is unknown. Interneural of the 1st dorsal ray fits between 5 to 6th neural spines" (Andriashev, 1992: 9).

Counts. V 43, D ca. 37, A ca. 30. P damaged but at least 13–14, Barnard (1927a, b) counted 17. C. unknown.

Color. "Body is uniformly pale, greyish; peritoneum dark brown dorsally; esophagus pigmented intensively, blackish-brown;

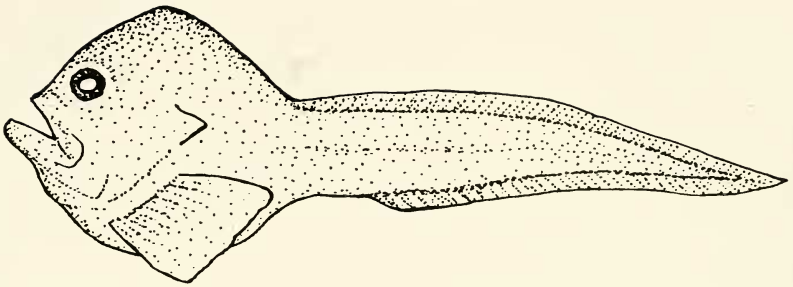

Figure 11. *Psednos micrurus* Barnard. Female, 45-mm standard length. Holotype BMNH 1930.1.14.7 (after Barnard, 1927b). South Africa, 1208–1280 m.

stomach and pyloric caeca light brown because of scarce melanophores, adjacent part of intestine blackish, the rest of intestine not pigmented except of short part near anus" (Andriashev, 1992: 9).

Distribution. Only known from off Cape Point, South Africa, at a depth of 1208–1280 m. Other Indian Ocean specimens cited by Stein (1979) belong to other species (see *P. steini* sp. nov. and *P. microps* sp. nov). However, the species may range north to the Madagascar Ridge based on a 13-mm-SL juvenile in poor condition (ZISP 51704) that is similar to *P. micrurus*. This specimen has V 42(10+32), D 37, A 30, C 6. Interneural of 1st dorsal ray fits between 4th and 5th vertebrae. In percentage of SL: preD 36.9, preA 50, bd 25.4 (studied in 1992 by A. Andriashev). It is similar to *P. micrurus* in meristic counts and large preanal but differs from it by absence of pyloric ceca (vs 5 in *P. micrurus*).

Comparative Notes. Psednos micrurus belongs to the group of *Psednos* with few vertebrae (41–43). It differs from other species of the group by a long preanal distance (ca. 50 vs 38.5–45% SL), a short head (22 vs 24.5–29.5% SL) that is very compressed (width 50% HL), teeth on lower jaw in double row, grayish-brown color, and unnotched pectoral fin. Unnotched pectoral fins (without a short notch ray but with the lower lobe rays longer than upper) as described for *P. micrurus* by Barnard (1927a,b) are unusual in liparids. However, it is a valid character and is found in *Paraliparis challengeri* and in the related *P. liparinus* (Andriashev, 1993b). It is impossible to check this character in *P. micrurus* because the holotype is in bad condition (Andriashev, 1992) but Barnard (1927a,b) stated that the pectoral fin of *P. micrurus* is similar to the unnotched fin of another liparid, *Amitra liparina* Goode, 1881 (synonym of *Paraliparis liparinus*). Stein (1979) doubted the character in citing Burke (1930: 170), who had redescribed Goode's species and found its pectoral fin deeply notched. At the time of Stein's comment it was not known that Burke based his redescription of *Amitra* (=*Paraliparis*) *liparina* on specimens belonging to another species. Andriashev (1993b) later stated that the unnotched pectoral fin is a unique and remarkable diagnostic character for *P. liparinus* (Goode, 1881). Thus an unnotched pectoral fin with elongated lower rays is a valid character in Liparidae and is probably the most distinguishing feature for *P. micrurus*.

Psednos mirabilis new species

Marvellous Dwarf Snailfish (Figs. 12A, 13A)

Material. Holotype. MCZ 155423, unripe male SL 28 mm. R/V *Delaware II*, Sta. 15. Slope off New England, 39°47′N, 70°39′W, 4 Feb. 1999, DE 99-02: 015, 0–700 m over bottom at 1370–1700 m.

Diagnosis. A *Psednos* from the North Atlantic with V 41, D 34, coronal pore present, temporal pores 1+1, large gill slit (47% HL or 2 eye diameters); P 13(8+0+5), no notch ray; large head (29.4% SL), eye 21.2% HL, head and belly black, caudal part of body light, margins of dorsal and anal fins with narrow blackish pigmentation.

Description. Body only slightly humpbacked, depth at occiput 1.6 times greater than depth at anal-fin origin. Maximum depth (at occiput) 3.6 times in SL. Preanal about 46% SL. Dorsal and anal overlap 36% of caudal fin. Anus close to base of lower lobe of pectoral fin. Gelatinous subcutaneous tissue weakly developed.

Head long (3.3 in SL), wide (1.3 in head depth or about 70% HL). Depth at occiput almost equal to head length (92% HL), anterodorsal profile of head only slanted slightly anteriorly. Snout blunt and wide, 1.4 eye diameters, its tip located high, almost level with upper margin of eye. Nostril located high, level with upper margin of eye, about half diameter of upper nasal pore. Eye 4.7 in HL, pupil ⅔ eye diameter. Interorbital 2.2 times eye. Mouth superior, almost vertical. Lower jaw included. Teeth 3–4 and 2–3 per row near symphysis of upper and lower jaws, respectively. Symphyseal knob present.

Gill slit large, about 2.2 eye diameters, very oblique, and entirely above pectoral base; its dorsal end below level of eye. Opercular flap triangular, operculum directed posteroventrally, tip level with posterior end of oblique mouth.

Pectoral fin 13(8+0+5), lacking notch ray (uncommon in *Psednos*). Lower lobe with 5 rays clearly separated from upper lobe. Upper lobe rays short (about 47% HL), not reaching to anal-fin origin. Lower pectoral lobe about 88% of upper lobe length. Pectoral fin low, uppermost ray about level with posterior end of oblique mouth. Pectoral girdle (Fig. 13A) with 3 rounded, equally spaced radials. Basal cartilaginous lamina without fenestrae. Scapula without a handlelike projection. Coracoid damaged.

Vertebrae 41(10+31), vertebral column not highly curved anteriorly. Interneural of 1st dorsal ray fits between neural spines of 5th and 6th vertebrae.

Sensory System. Coronal pore present, nasal pores 2, infraorbital 5(5+0), temporal 1+1, preoperculo-mandibular 6. Pores n_1, n_2, and io_1 high: io_1 level with upper margin of eye, with n_1 and n_2 pores clearly above it.

Measurements and Counts. HL 29.4 HW 21.4 (71), bd 27.9 (92), bdA 17.9 (59), preD ca. 32.1, preA ca. 46.4, UPL 14.3 (47), LPL 12.5, snout 8.9 (29.4), eye 6.4 (21.2), postoc 17.1 (56), io 14.3 (47), upj 12.1 (40), gsl 14.3 (47). V 41(10+31), D 34, A 29, P 13(8+0+5), C 6. Radials 3.

Color. Head and belly appear black, caudal part of body pale. Dorsal, anal, and caudal fins with narrow blackish margin. Pectoral fin pale with blackish pigmentation along rays. Peritoneum, mouth, and gill cavity black. Skin on head transparent, head muscles densely pigmented under the skin with black melanophores that are clearly seen externally. Anal area black. Stomach black.

Distribution. Known only from the slope off southern New England in the western North Atlantic (about 40°N), over bottom at a depth of 1370–1700 m.

Etymology. Named "mirabilis" (Lat.), which means amazing or marvelous.

Comparative Notes. Psednos mirabilis belongs to the group of *Psednos* with few vertebrae (41–43), a coronal pore, 5(5+0) io pores, and 1+1 temporal pores. Distinguished by large gill slit (47% HL or 2 eye diameters), pectoral notch lacking a notch ray, long head (29.4% SL), and color pattern. It is most similar to *P. micruroides* but differs in having 2 widely spaced temporal pores (vs 3 or 4 in a row), a large gill slit (47 vs 23% HL, or twice as large as eye vs equal to eye), comparatively short pectoral fin (47 vs 56% HL) that lacks a notch ray, by different pectoral ray counts P 8+0+5 (vs 7+1+5), a more vertical

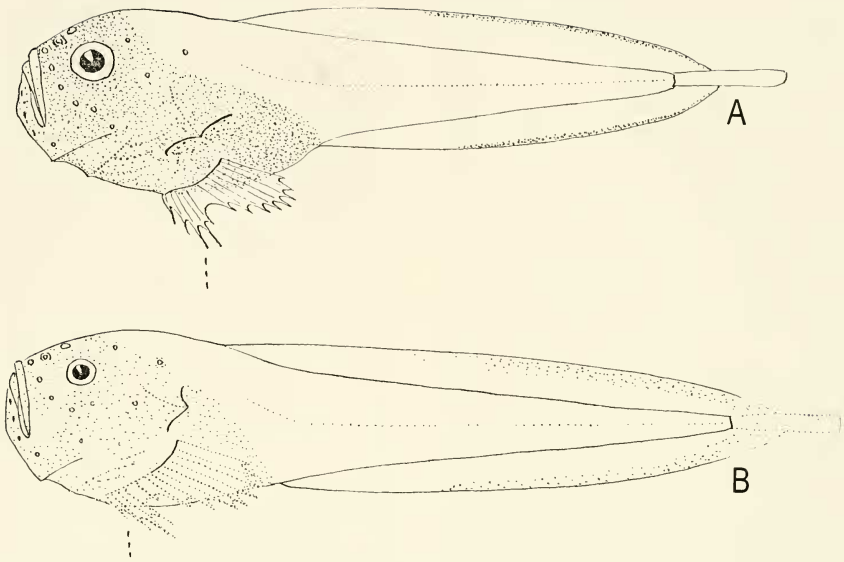

Figure 12. Two species of *Psednos*. (A) *P. mirabilis* sp. nov. Male, 28-mm standard length (SL). Holotype MCZ 155423. Slope off New England, 1370–1700 m. Position of gill slit and pectoral fin shown approximately. Anterior nasal pore not seen. (B) *P. sargassicus* sp. nov. Female, 52-mm SL. Holotype. MCZ 89997. Northern Sargasso Sea, depth 0–1050 m. Position of gill slit and pectoral fin, length of its rays and caudal fin shown approximately. Anterior nasal pore not seen.

mouth, and by the high location of the tip of snout, nostril, and snout pores. It is caught at a greater depth, 1300–1700 (vs 0–900) m.

Psednos sargassicus new species

Sargasso Dwarf Snailfish (Figs. 12B, 13B)

Material. Holotype. MCZ 89997. Adult female 52 mm SL. R/V *Atlantis II*, Cr. 71. Northern Sargasso Sea. 35°30′N, 67°14′30″W. 26 Sep. 1972. Depth 1050–0 m. Coll. A. E. Jahn.

Diagnosis. A *Psednos* from the North Atlantic with V 42, D 37, coronal pore present, io 5(5+0), temporal 1+1, head 25% SL, eye small (15.3% HL), gill slit located high (dorsal end about level with eye center), preanal short (38.5% SL), pectoral fin with 1 notch ray; caudal part of body pale; head, belly, and margins of vertical fins brown.

Description. Body slightly humpbacked, depth at occiput 4.3 in SL or 1.8 times depth at anal-fin origin. Trunk not long, preanal 38.5% SL. Anus located behind base of lower pectoral lobe.

Head 4 times in SL, compressed (width 1.7 in head depth or 54% HL). Depth at occiput 92% HL, anterodorsal profile only slightly slanted anteriorly. Snout blunt and wide, length 1.9 eye diameters; tip of snout high, almost level with upper margin of eye. Nostril small, about ½ diameter of upper nasal pore, level with upper margin of eye. Eye small, 6.5 times in HL. Interorbital 2.6 times greater than eye. Mouth very oblique, almost vertical. Teeth about 5–6 and 4–5 per row near symphysis upper and lower jaws, respectively. Wide upper jaw diastema.

Gill slit 1.5 eye diameters, completely above pectoral base, dorsal end about level

with eye center. Opercular flap triangular. Operculum posteriorly directed, end slightly below level of eye.

Pectoral girdle (Fig. 13B) with 3 large, equally spaced radials. Cartilaginous basal lamina without fenestrae. Scapula crescent-shaped, handlelike projection entirely fused with body as evident by remnant anterior fenestrae covered by thin bone. Coracoid half-moon shaped, handlelike projection entirely fused with body by means of thin riblike bone (lamellae); an unusual tiny hole present on body. Pectoral fin 15(9+1+4), with 1 notch ray. Length of lower lobe and notch rays unknown because of damage. Uppermost pectoral ray about level with posterior end of oblique mouth.

Vertebrae 42(10+32). Interneural of 1st dorsal ray fits between neural spines of 4th and 5th vertebrae.

Sensory System. Coronal pore present, nasal 2, infraorbital 5(5+0), temporal 1+1, preoperculo-mandibular 6. Snout pores located high: io_1 and n_1 level with upper margin of eye, n_2 above it.

Measurements and Counts. HL 25, HW 13.5 (54), bd 23 (92), bdA 19.2 (52.3), preD ca. 28.8, preA ca. 38.5, snout 7.3 (29.2), eye 3.8 (15.4), postoc 14.2 (57), io 10.2 (40.8), gsl 3.8 (15). V 42(10+32), D 37, A 31, P 15(9+1+4), C 6 (?). Radials 3, rounded.

Color. Head and belly dark brown, caudal part of body pale (partially lacking skin at end). Peritoneum, mouth, and gill cavity dark brown. Margins of dorsal and anal fins and anal area brown. Snout light brown, suprabranchial pore bordered with brown.

Distribution. Only known from the northern Sargasso Sea in the North Atlantic (about 35°30′N) at a depth of 0–1050 m.

Etymology. Named "sargassicus" in reference to type locality, the Sargasso Sea.

Comparative Notes. Psednos sargassicus belongs to the group of *Psednos* with few vertebrae (41–43), a coronal pore, 5(5+0) infraorbital pores, and 1+1 temporal pores. Distinguished by a small eye (15.3% HL), gill slit located high (dorsal end almost level with eye center), and short preanal (38.5% SL). Also, pectoral fin has 1 notch ray; and head 25% SL. Caudal part of body pale, but head, belly, and margins of vertical fins brown. Most similar to *P. mirabilis* but differs in having a smaller eye (15.4 vs 21.2% HL), short gill slit (15 vs 47% HL or 1.5 vs 2.2 eye diameter) located high (its dorsal end level with eye center vs below eye level), pectoral notch with 1 ray (vs without a ray), and color is brown not black.

It shares a small eye with *P. microps* of the Indian Ocean but differs from it in having an anterior temporal pore, t 1+1 (vs t 0+1), smaller head, higher gill slit, a less humpbacked body, and by brown margins on vertical fin (vs unpigmented).

Psednos steini new species

Stein's Dwarf Snailfish (Fig. 13)

Paraliparis micrurus (non Barnard, 1927): Stein, 1979: 6, fig. 1 (ex parte: one of two specimens, USNM 200488; Indian Ocean, 2600 miles east of the Cape of Good Hope).

Psednos micrurus (non Barnard, 1927): Andriashev, 1986: 107, fig. 48; 1992: 9, fig. 1; 1993a: 9, fig. 1 (ex parte: figure after Stein, 1979, and explanation of pores depicted).

Material. Holotype, USNM 200488. Adult male, 37 mm SL. R/V *Anton Bruun*, Sta. 351 C. South-west Indian Ocean, 31°35′S, 65°08′E, 28/29 Jun. 1964, depth 0–350 m over 1428 m. Now disintegrated.

Diagnosis. An Indian Ocean *Psednos* with about 43 vertebrae, D 36, coronal pore present, temporal pores 1+1; pectoral fin 14(8+1+5), with 1 notch ray; eye not less than 20% HL, gill slit equal to eye and vertical, its dorsal end level with pupil; color tan.

Description. This new species is based on 1 of 2 *Psednos* specimens described from the Indian Ocean by Stein (1979), which he treated under the name *Paraliparis micrurus*. The specimen is now disintegrated, but Stein's text and figure (Stein, 1979) are excellent and they form the basis of this description. Characters

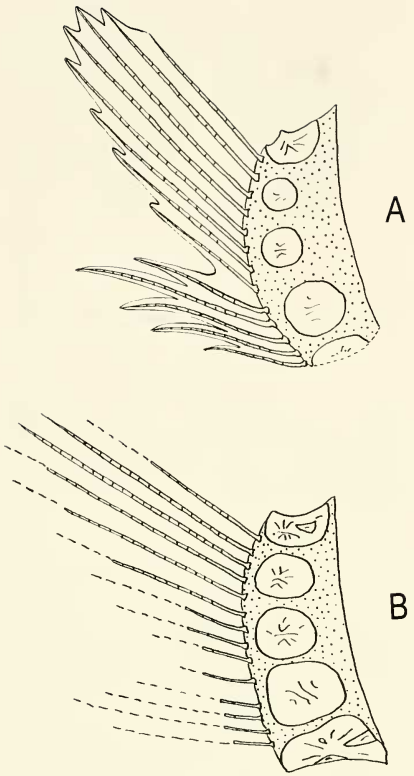

Figure 13. Right pectoral girdle and fin of two *Psednos*. (A) *P. mirabilis*. Holotype. Coracoid damaged. (B) *P. sargassicus*. Holotype. Length of lower lobe and notch rays unknown.

and measurements based on Stein's figure are placed in square brackets.

Body humpbacked, [depth above occiput 3.9 times in SL or 2.3 greater than depth at anal-fin origin]. Trunk rather long, preanal 43.6% SL. [Dorsal and anal fins overlap ½ of caudal]. Anal-fin origin below about 8th dorsal-fin ray. Anus between bases of lower pectoral-fin lobes. Small urogenital papilla present [in male]. Pyloric ceca short, flat, and blunt.

Head 4.1 in SL, width unknown. Depth at occiput slightly larger than head length (107% HL), anterodorsal profile evenly sloping, slightly concave. Snout about equal to eye diameter. Nostril with slightly raised rim [level with eye center]. Eye 3.6 times in HL. Mouth superior, distinctly oblique, forming an angle of about 50° to horizontal. [Symphysis of upper jaw level with eye center.] Maxillary reaching vertical at anterior ½ of eye [mouth cleft to vertical at nostril]. Symphyseal knob present. "Teeth in both jaws simple, moderately stout, slightly recurved. Upper jaw teeth in irregular oblique rows forming narrow band less than four teeth wide, uniserial posteriorly; mandibular teeth in about 13 oblique rows forming band similar to upper jaw. Suborbital bones extend anteriorly forming distinct projections above snout on either side of upper jaw" (Stein 1979: 7). [Chin low, lower jaw not massive. Prominent tip of lower jaw (retroarticular process) angled at ca. 90° and on vertical to posterior margin of eye.]

Gill slit [vertical, about equal to eye diameter], completely above pectoral fin base [dorsal end level with lower margin of eye; ventral end level with lower ⅓ of subocular space]. Opercular flap small triangular [operculum posteroventrally directed, tip level with upper ⅓ of subocular space].

"Pectoral fin moderately deep notch; uppermost ray on horizontal line between posterior corner of maxillary and lower margin of orbit. Upper lobe of eight closely spaced rays, separated from five closely spaced lower lobe rays by a single short ray in notch, distinctly separated from rays above and below it. Origin of ventralmost pectoral rays about below posterior margin of interopercle" (Stein 1979: 7). Pectoral fin 14(8+1+5). [Pectoral fin short, length of upper lobe ca. 56% HL, tip not reaching anal fin origin. Lower pectoral lobe shorter than upper one. Base of lowermost ray on vertical at ¾ of postocular distance. Upper ray level with lower ⅓ of subocular space.]

Vertebral number unknown but in other

Psednos number of vertebrae usually is 6–8 more than the number of dorsal-fin rays; therefore, vertebral number probably is about 43.

Sensory System. Stein noted 2 nasal, 5 infraorbital, 6 preoperculo-mandibular pores ("Burke's pore formula 2–5–6–?") and a coronal pore. Some pores are clearly depicted (Fig. 14). Upper nasal pore above nostril and level with upper margin of eye. Four infraorbital pores in a line below eye [these seem to be io_{2-5}, the io_1 pore usually situated at beginning of suborbital bone projection is not shown on figure]. The io_6 pore behind posterodorsal margin of eye absent as in other *Psednos* with low vertebral counts and the coronal pore present. Two temporal pores are shown: t_1 pore above posterior edge of eye, another (suprabranchial) pore level with 1st but much higher and ahead from the upper end of gill slit. Last preoperculo-mandibular pore level with lower half of eye. Thus, there are 1 coronal, 2 nasal, 1+1 temporal, 5(5+0) infraorbital, and 6 preoperculo-mandibular pores.

Measurements and Counts. HL 24.5, bd 26.2 (107), preD 28.1, preA 43.6, snout to anus 23.4, UPL 13.6 (55.6), eye 6.8 (27.8% HL [but on picture about 20%]), snout 7.0 (28.9), maxillary 13.6 (55.6). V about 43, D 36, A 28, P 14(8+1+5), C 5 (?).

Color. "Skin tan or transparent. Body tan, inside of mouth, gill cavity, and peritoneum, dark brown. Stomach blackish." (Stein 1979: 7).

Distribution. Known only from the southwestern Indian Ocean, in the northern part of Crozet Basin near the Southwest Indian Ridge, midwater 0–350 m.

Etymology. Named after David L. Stein, American ichthyologist who originally described the specimen on which this species is based and who is well known for his research on liparid fishes.

Comparative Notes. Psednos steini belongs to a group of *Psednos* with low numbers of vertebrae (41–43, D 34–38), a coronal pore, 5(5+0) io pores, 1+1 temporal pores. Distinguished by a small, vertical gill slit (equal to eye) that is located high (dorsal end level with pupil), eye not less than 20% HL, pectoral fin with 14(8+1+5) rays and 1 notch ray; and a tan color. Most similar to *P. sargassicus* but differs in much larger eye (not less than 20% HL vs 15.4%), a gill slit equal to eye (vs 1.5 eye diameter), and a pale caudal part of body (vs tan). Stein (1979) described the holotype of *P. steini* using the name "*Paraliparis micrurus.*" He was the first to find specimens similar to *Psednos micrurus* since Barnard's 1927 description but a detailed comparison was difficult because the holotype was thought to be lost and only the poor original description was available (Barnard, 1927a,b). Stein thought that some differences between his specimens and *P. micrurus* were due to allometric growth, but now, the study of new comparative material shows that this is a distinct species.

SPECIES INCERTAE SEDIS

Psednos sp. 1

Psednos sp. 1 Andriashev, 1992: 15, figs. 3c, 8; 1993a: 12, fig. 2B. Based on BMNH 7709/76, 1 specimen 39 mm SL, south of Iceland, 55°59′N, 19°58′W, depth 1250–1500 m and BMNH 9801/60, 1 specimen SL 39 mm, off northern Spain, 41°57′N, 16°49′W, 985–1010 m.

Andriashev's *Psednos* sp. 1 was not described in detail because the specimens are in bad condition, but the diagnostic characters are clear, and it is included in the key. However, because these BMNH specimens were not seen during this study, and because no additional material was found, it is not being formally described here.

These specimens belong to a group of *Psednos* with few vertebrae (41–43) and no coronal pore. They differ from all other species of this group by the gill slit extending ventrally in front of 2–3 pectoral rays, and by a lower pectoral lobe that is longer than upper lobe. The other eastern North Atlantic congeners, *P. christinae* Andriashev and *P. andriashevi* sp. nov., belong to another group, with more verte-

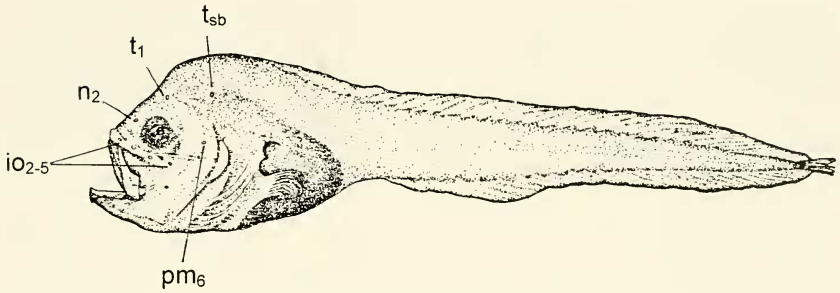

Figure 14. *Psednos steini* sp. nov. Male, 37 mm standard length. Holotype USNM 200488. Indian Ocean, Crozet Basin, 0–350 m (from Stein, 1979).

brae (47) and the coronal pore absent. Andriashev's species 1 has 43 vertebrae (9–10+33–34), D 38, A 31, P 14(9+5), C 6, lower pectoral lobe longer than upper lobe, and the coracoid has a strong handlelike projection.

DISCUSSION

The presence of 10 new species of *Psednos* in the Atlantic and Indian oceans and the expected existence of a few more undescribed species in other regions suggests that the genus *Psednos* is large and speciose, and has several species that are still undescribed. The species of *Psednos* are variable in meristic counts, in number and position of sensory pores, in the depth and width of head, in the extent of inclination of the mouth, in the size of eye, in the size and position of the gill slit, in the structure of pectoral fin and its girdle, and in pigmentation. Based on these characters, the known species of *Psednos* might be divided in two groups, as follows.

Group 1. Vertebrae 41–43, coronal pore present, infraorbital pores 5(5+0) (postorbital pore io_6 absent). Included are *P. micrurus*, *P. mirabilis*, *P. micruroides*, *P. microps*, *P. sagassicus*, *P. steini*, and *Psednos* sp. 1. However, the number of temporal pores varies in group 1; they are usually 1+1 (in *P. steini*, *P. mirabilis*, *P. sargassicus*), rarely 3–4 (in *P. micruroides*), or 0+1 (in *P. microps*). Species of this group occur in waters of South Africa (*P. micrurus*), the southwestern Indian Ocean (*P. steini*, *P. microps*), and also in the Atlantic: northern Sargasso Sea (*P. sargassicus*), off the slope of New England (*P. mirabilis*), waters southeast of Greenland (*P. micruroides*), and eastern North Atlantic (*Psednos* sp. 1). Undescribed *Psednos* sp. 2 (*sensu* Andriashev, 1992) from southern California and Baja California is also assigned to this group because it has a coronal pore.

Group 2. Vertebrae 47, coronal pore absent, infraorbital pores 6(5+1), temporal pores usually 1+1 (except *P. gelatinosus*, which has 1+2). Included in this group are *P. christinae*, *P. andriashevi*, *P. barnardi*, *P. groenlandicus*, *P. harteli*, and *P. gelatinosus*. The number of preoperculo-mandibular pores is variable in this group; the two known eastern North Atlantic species have 7 pores (*P. christinae* and *P. andriashevi*), whereas all western North Atlantic species have 6 pores (*P. barnardi*, *P. groenlandicus*, *P. gelatinosus*, *P. harteli*). All group 2 species occur in the North Atlantic.

The pectoral girdle has been studied only in *P. micrurus* (Andriashev, 1992, fig. 2), *P. andriashevi* (Andriashev, 1992, fig. 7), *Psednos* sp. 1 (Andriashev, 1992, fig. 8), and *P. christinae*, *P. groenlandicus*, *P. mirabilis*, and *P. sargassicus* in the present study. In all species studied, the cartilagi-

nous basal lamina is without fenestrae and 3 rounded, equally spaced radials are present. Differences between species are in a shape of scapula: with a handlelike projection in *P. christinae, P. andriashevi,* and *Psednos* sp. 1, or without a projection (which is fused within its body) in *P. groenlandicus, P. mirabilis, P. sargassicus,* and, obviously, in *P. micrurus.* The shape of the coracoid also varies: *Psednos* sp. 1 has a long handlelike projection, in *P. micrurus* it is short and wide, and the coracoid is half-moon shape and lacks a projection (which is fused with its body—see *P. sargassicus*) in *P. christinae, P. andriashevi, P. groenlandicus, P. mirabilis,* and *P. sargassicus.* The lower lobe of pectoral fin is usually shorter than the upper lobe but in *Psednos* sp. 1 and *P. andriashevi* the lower lobe is longer than the upper lobe. In addition, the pectoral notch usually has 1 or 2 rays, but they are lacking in *P. mirabilis.*

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