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THE EELPOUT GENUS *PACHYCARA* (TELEOSTEI: ZOARCIDAE)
IN THE NORTHEASTERN PACIFIC OCEAN, WITH
DESCRIPTIONS OF TWO NEW SPECIES

By

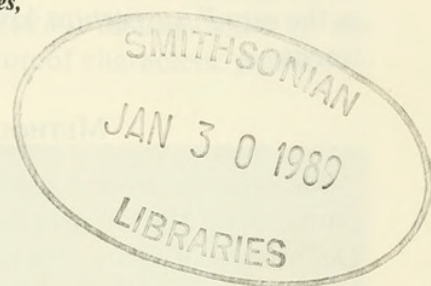
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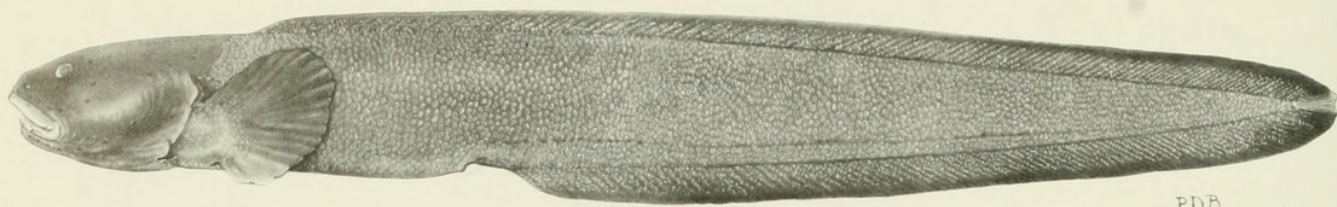
ABSTRACT: The eelpout genus *Pachycara* Zugmayer, 1911, is recognized from the North Pacific Ocean for the first time. Four species are included, two of which—*P. gymninium* and *P. lepinium*—are new. *Pachycara gymninium* differs from *P. lepinium* mainly in having a scaleless nape, the mediolateral lateral line originating in the pectoral axil versus posterior to the pectoral margin, more numerous precaudal vertebrae, and shorter pectoral and pelvic fins. The type species of *Pachycara*—*P. obesum*—from the abyssal Atlantic, is shown to be synonymous with the earlier described *Maynea bulbiceps* Garman, 1899, from the eastern tropical Pacific. Another species described by Garman (1899)—*Phucocoetes suspectus*—is placed in *Pachycara* and redescribed from three specimens.

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INTRODUCTION

The eelpout genus *Pachycara* was erected for a single specimen taken in the Bay of Biscay at a depth of 4,780 m by the expeditions of Prince Albert I of Monaco (Zugmayer 1911a, b). A second (juvenile) specimen of the type species, *P. obesum*, was described from off Virginia by Markle and Sedberry (1978). Earlier, Garman (1899) described *Maynea bulbiceps* from the eastern tropical Pacific (Gulf of Panama). This species was placed in *Pachycara* as a putative Pacific sister species of *P. obesum* by Anderson (1984).

Anderson (1988) included an Antarctic species, first described as *Lycodes brachycephalus* by Pappenheim (1912), in *Pachycara* because it lacked the three apomorphic characters previously established for *Lycodes* (Anderson 1984): 1) possession of cartilaginous laminae along the ventral surface of the dentary bones ("mental crests" of Andriashev 1954); 2) loss of the palatine membrane (oral valve); and 3) loss of head pores in adults (except for some pedomorphic species). Anderson (1984) included 11 species in *Pachycara*, only three of which had been de-



PDB

FIGURE 1. *Pachycara bulbiceps* (Garman), BCPM 980-99, 525 mm SL, off the Queen Charlotte Islands, British Columbia.

scribed previously, and a revision of the genus is in progress.

The purpose of this paper is to describe in advance of the senior author's revision two new species of *Pachycara* from the northeastern Pacific Ocean that have been known in collections for many years. In addition, we redescribe the type species, *P. obesum*, herein synonymized with *P. bulbiceps*, now known from six North Atlantic and 32 northeastern Pacific specimens, as well as the rare *P. suspectum*, known from three specimens.

METHODS

Measurements were made with an ocular micrometer or dial calipers to the nearest 0.1 mm. Definitions of characters and methodology follows Gosztanyi (1977), or, in cases of contradiction, Peden and Anderson (1978) and Anderson (1982, 1984). All specimens were measured and radiographed to create Table 1, except 16 of 38 *P. gymninium* in SIO 67-121. Character state modifiers are based on those numerically scored characters of Anderson (1984). Museum abbreviations follow Leviton et al. (1985). Measurements are in standard length (SL). Certain proportions expressed in percent head length (HL) or SL.

KEY TO NORTHEASTERN PACIFIC *PACHYCARA* SPECIES

- 1A. Pelvic fins present 2
- 1B. Pelvic fins absent
..... *Pachycara bulbiceps* (Garman, 1899)
- 2A. Number of precaudal vertebrae 21-23; lateral line with complete, ventral branch only; head length 15.6-17.7% SL; anal fin origin associated with vertebrae 20-22
..... *Pachycara suspectum* (Garman, 1899)
- 2B. Number of precaudal vertebrae 23-31 (usually 25 or more); lateral line with complete mediolateral and ventral branches; head length 12.0-15.9% SL;

anal fin origin associated with vertebrae 23-31 3

- 3A. Scales present on nape; mediolateral branch of lateral line originating posterior to pectoral fin margin; pectoral fin length 72.5-89.9% HL; pelvic fin length 11.5-17.3% HL; number of precaudal vertebrae 23-26 *Pachycara lepinium* n. sp.
- 3B. Scales absent on nape (rarely present in small patches immediately anterior to dorsal fin origin); mediolateral branch of lateral line originating in pectoral axil; pectoral fin length 63.0-70.8% HL; pelvic fin length 4.8-11.3% HL; number of precaudal vertebrae 28-31
..... *Pachycara gymninium* n. sp.

Pachycara bulbiceps (Garman, 1899)

(Figures 1-3)

Maynea bulbiceps Garman, 1899:140, 141, pl. E, fig. 1.
McAllister and Rees 1964:106, 107. Percy et al. 1982:387, 399, 400.

Pachycara obesa Zugmayer, 1911a:12; 1911b:134-136, pl. VI, fig. 6. Markle and Sedberry 1978:22-25, fig. 1. Merrett and Marshall 1981:240. Andriashev 1973:547.

Pachychara obesa Zugmayer (lapsus calami). Fowler 1936: 1056, fig. 47. Andriashev 1986:1149, text fig.

MATERIAL EXAMINED.—Northeastern Atlantic: MOM, uncat. (holotype of *Pachycara obesa*); Bay of Biscay; 45°27'N, 06°05'W; 4,780 m; PRINCESSE ALICE sta. 1554; 7-9 Sept. 1903. BMNH 1981.6.16:15 (1); off Cap Blanc, West Africa; 20°17.2'N, 21°42.3'W; 4,002-4,007 m; DISCOVERY sta. 9131; 17 Nov. 1976. IOS, uncat. (1); off Senegal; 18°08.6'N, 20°11.7'W; 3,120 m; DISCOVERY sta. 10884; 12 Aug. 1983. IOS, uncat. (1); Porcupine Sea Bight; 49°37.1'N, 13°48.5'W; 3,990-3,920 m; DISCOVERY sta. 51803; 26 Sept. 1983. Northwestern Atlantic: USNM 215611 (1); off Virginia; 36°42.0'N, 74°04.5'W; 2,400-2,450 m; EASTWARD cr. 7506, sta. 20; 24-25 July 1975. MCZ 57612 (1); Middle Atlantic Bight; 38°44.0'N, 70°10.0'W; 3,028 m; OCEANUS cr. 93, sta. 911; 31 Mar. 1981. Gulf of Panama: MCZ 28681 (holotype of *Maynea bulbiceps*); 06°10'N, 83°06'W; 2,690 m; ALBATROSS sta. 3361; 25 Feb. 1890. UMML 22860 (2); 06°53-49'N, 79°27-28'W; 3,193-3,201 m; JOHN E. PILLSBURY sta. P-526; 5 May 1967. UMML 33484 (1); 06°47-48'N, 79°13'-80°00'W; 3,045-3,218 m; JAMES M. GILLISS sta. GS-3; 14 Jan. 1972. UMML 33485 (2); 06°52'N, 79°28'W; 3,200-3,229 m; JAMES M. GILLISS sta. GS-1; 13-14 Jan. 1972. SIO 81-148 (4); 05°09.8'N,

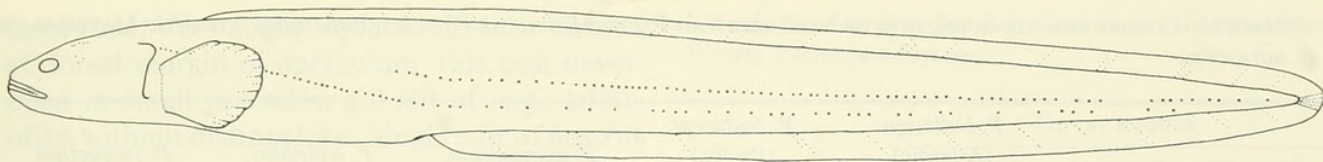


FIGURE 2. *Pachycara bulbiceps* (Garman), diagrammatic of CAS 55588, 338 mm SL, from the Gulf of Panama, showing extent of lateral lines.

81°41.2'W; 3,900–4,000 m; MELVILLE; 3 Oct. 1981. SIO 85-33 (4); 05°20.6'N, 81°55.5'W; 3,866 m; DSRV ALVIN dives 1361, 1363; 9–12 Apr. 1984. CAS 55588 (1); recat. from SIO 81-148. Middle American Trench: SIO 73-286 (3); off Costa Rica; 09°43.8'N, 86°02.0'W; 2,601 m; ALEXANDER AGASSIZ; 19–20 Apr. 1973. SIO 73-268 (1); off Guatemala; 13°27.0'N, 91°59.2'W; 3,332 m; ALEXANDER AGASSIZ; 13–14 Apr. 1973. Mexico: SIO 66-35 (1); off Guadalupe Isl.; 29°01.0'N, 118°01.2'W; 3,310 m; ALEXANDER AGASSIZ; 5–6 Apr. 1966. Cascadia Abyssal Plain (off Oregon): OSUO 2559 (2); 45°27.8–27.0'N, 126°17.4–21.0'W; 2,606 m; YAQUINA sta. CP-2C, BMT 157; 17 Jan. 1970. OSUO 2560 (2); 46°02.2'N, 126°33.5–28.5'W; 2,706 m; YAQUINA sta. CP-2A, BMT 257; 15 Feb. 1971. OSUO 2561 (2); 45°18.0–17.0'N, 126°26.4–30.5'W; 2,710 m; YAQUINA sta. CP-2C, BMT 266; 18 Feb.

1971. OSUO 2562 (1); 44°43.1–46.0'N, 127°29.3–28.6'W; 2,818 m; YAQUINA sta. CP-3E, BMT 317; 3 Feb. 1973. CAS 61220 (2); 44°39.7–39.0'N, 126°39.6–44.8'W; 2,816 m; CAYUSE sta. CP-2E, BMT 253; 30 Sept. 1970. LACM 44316-1 (1); 45°20.6–20.9'N, 126°35.7–39.7'W; 2,750 m; YAQUINA sta. CP-2C, BMT 264; 17 Feb. 1971. LACM 44317-1 (1); 46°01.4–05.0'N, 127°31.0–32.5'W; 2,835 m; YAQUINA sta. CP-3A, BMT 322; 12 Mar. 1973. British Columbia: BCPM 980-99 (1); off Queen Charlotte Isl., W of Tasu Sound; 2,780 m; EASTWARD HO set 17; 26 Aug. 1979.

DIAGNOSIS.—A species of *Pachycara* as defined by Anderson (1984) distinguished by the following combination of characters: pelvic fins

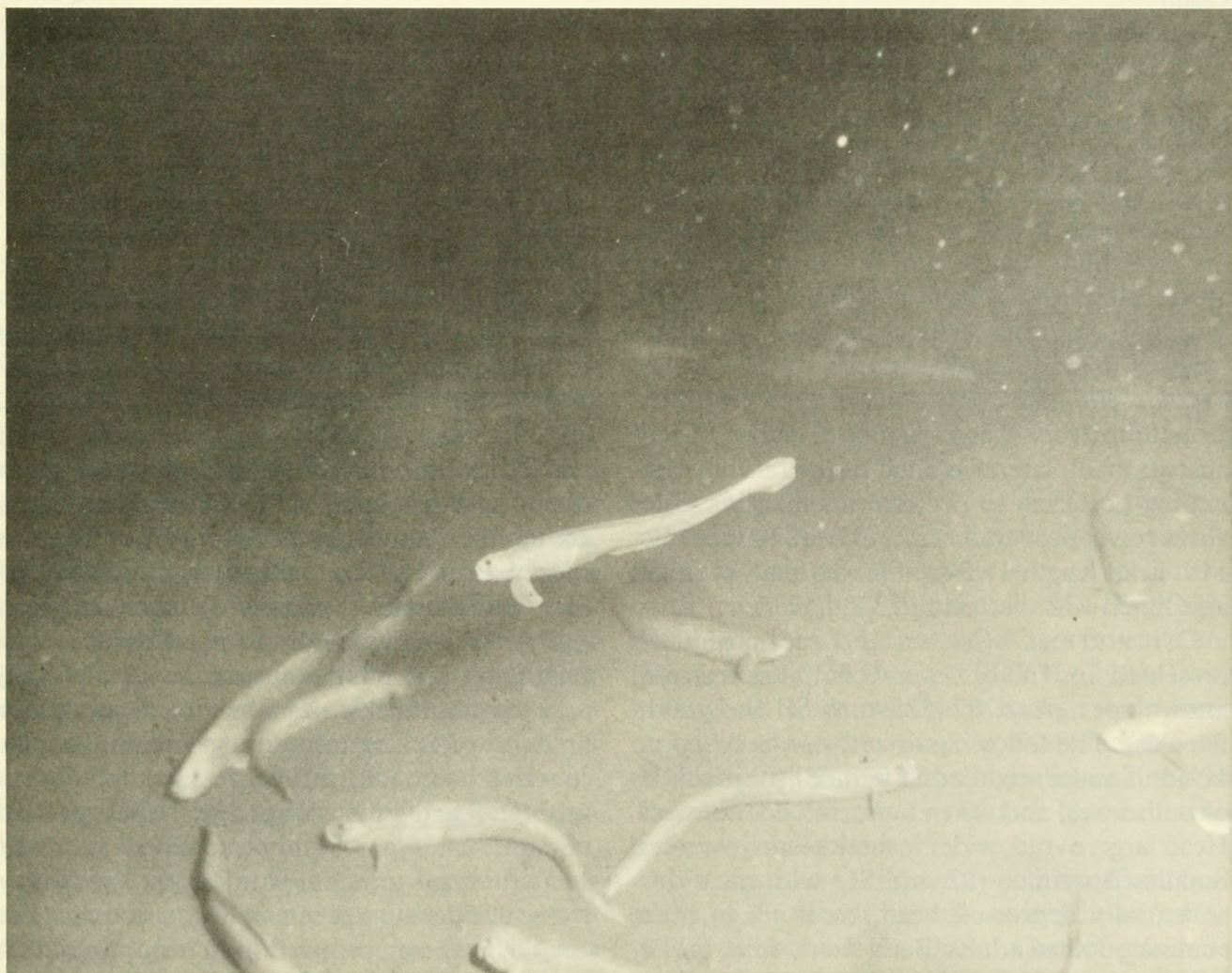


FIGURE 3. Group of *Pachycara* sp. (presumably *P. bulbiceps*) near a baitfall in the Gulf of Panama (05°20'N, 81°55'W; depth, 3,850 m). Photographed by Craig R. Smith, University of Washington, DSRV ALVIN dive 1140, 28 Sept. 1981.

TABLE 1. COUNTS AND MEASUREMENTS OF NORTHEASTERN PACIFIC *PACHYCARA* SPECIES, INCLUDING ATLANTIC MATERIAL OF *P. BULBICEPS*.

	<i>P. bulbiceps</i> (Atlantic)	<i>P. bulbiceps</i> (Pacific)	<i>P. gymninium</i>	<i>P. lepinium</i>	<i>P. suspectum</i>
Measurements, in percent SL					
Head length	12.3–15.0	11.8–14.8	12.0–15.6	13.8–15.9	15.6–17.7
Head width	5.7–8.5	5.5–10.1	5.7–8.2	6.5–11.8	8.0–8.9
Pectoral length	9.9–12.2	8.7–12.9	8.3–10.3	10.2–13.5	9.1–10.1
Predorsal length	17.8–18.7	16.0–19.8	15.9–21.5	15.8–23.2	15.9–18.2
Preanal length	34.9–40.1	35.1–40.0	38.5–44.1	34.3–41.9	35.8–36.0
Body height	6.4–12.7	5.7–11.6	7.4–13.6	8.3–16.9	8.4–9.9
Gill slit length	4.9–5.9	4.1–6.9	3.3–5.2	4.9–9.4	7.0 (in 1)
Caudal fin length	2.4–4.2	1.5–3.6	1.9–5.2	1.5–2.7	3.2 (in 1)
Measurements, in percent HL					
Head width	38.8–73.1	43.5–80.5	37.3–64.1	44.5–75.3	49.7–52.7
Upper jaw length	33.9–43.2	37.1–52.7	33.3–52.8	35.9–52.0	38.4–41.4
Pectoral length	67.8–99.5	64.1–99.9	63.0–70.8	72.5–89.9	57.4–58.6
Snout length	19.4–22.7	16.8–26.2	15.8–25.5	17.6–25.9	18.5–22.3
Eye diameter	16.2–26.4	11.5–22.4	13.6–23.3	12.4–18.7	16.8–19.5
Gill slit length	32.9–50.9	31.4–49.8	21.0–43.1	33.9–59.8	39.7 (in 1)
Interorbital width	10.6–17.4	7.0–11.5	9.1–11.3	7.1–13.8	6.4–7.3
Interpupillary width	26.4–38.0	18.2–32.8	26.9–35.7	22.3–44.4	24.2 (in 1)
Pelvic fin length	absent	absent	4.8–11.3	11.5–17.3	9.7–11.7
Counts					
Vertebrae	25–31 + 82–90 = 113–118	27–31 + 83–91 = 112–119	28–31 + 73–80 = 102–109	23–26 + 80–94 = 105–120	21–23 + 84–87 = 105–110
Dorsal fin rays	104–109	105–114	96–103	99–113	100–106
Anal fin rays	86–94	88–97	77–84	85–98	85–89
Caudal fin rays	8–12	10–12	10–12	9–12	9
Pectoral fin rays	16–19	16–18	14–18	15–18	16
Pelvic fin rays	absent	absent	3	3	3
Gill rakers	2–3 + 11–13 = 13–16	0–4 + 11–15 = 11–19	3–5 + 10–14 = 13–19	2–5 + 11–15 = 12–19	1–2 + 14–15 = 16
Vomerine teeth	3–6	2–9	3–8	5–18	3–6
Palatine teeth	2–7	4–10	3–14	7–40	9–12

absent; mediolateral branch of lateral line originating posterior to pectoral fin margin; scales absent on nape; vertebrae 25–31 + 82–91 = 112–119; head length 11.8–15.0% SL; anal fin origin associated with vertebrae 23–30.

DESCRIPTION.—Counts and measurements presented in Table 1 were compiled from all known specimens, 82–525 mm SL (no gravid females). The following description is based on 10 adult males, eight adult females, 10 juveniles of both sexes, and seven eviscerated specimens. Head large, ovoid, wider in adults than juveniles. Smallest specimen (82 mm SL) with most dorsoventrally depressed head, resulting in more acute snout than adults. Body short, deep, broader in cross section in adults than juveniles. Body more slender than similarly sized *P. gymninium*

and *P. lepinium*; body height at anal fin origin of smallest specimen (5.7% SL; Table 1) measuring like slender genus *Lycenchelys*, however specimens >160 mm with body height $\geq 7.8\%$ SL. Tail laterally compressed, more so posteriorly, tapering gradually to tip. Skin firm, not gelatinous, but pliable around head, especially near mouth, cheeks, and nape due to subdermal lipid layer. Scales minute, cycloid, imbedded, covering body, tail, and vertical fins to one-half to three-fourths their height; no scales on head or nape; scales present on pectoral axil and base, and on breast to isthmus in largest specimens. No scales developed in smallest specimen. Eye circular, larger in proportion to head in smallest specimens than largest adults. Gill slit short, usually extending ventrally to lower margin of pec-

toral base. Very slight, squared-off lobe formed at dorsal margin of operculum, this best developed in small juveniles; gill slit of large adults often without distinct lobe. Single pair of nostrils at snout tip, nasal tube not reaching upper lip. Pectoral fin large, its origin at or just below body midline; posterior margin somewhat wedge-shaped to almost evenly rounded; lowermost 6–9 rays shorter and thicker than others, their tips not at all or slightly exserted; pectoral rays usually 17–18 (Table 2).

Mouth terminal, upper jaw slightly longer in relation to head in adult males than comparably sized females; upper jaw 45.0–52.7% HL (\bar{x} = 48.8%, n = 10) in males over 330 mm SL, 41.8–44.6% HL (\bar{x} = 43.1%, n = 5) in females over 330 mm SL. Minute epidermal prickles on lips and occasionally in patches on snout. Palatine membrane (oral valve) moderately developed in adults, not reaching vomer, larger in juveniles, reaching anterior edge of vomer. Teeth in jaws and palate small, conical, dentition not sexually dimorphic. Jaw teeth in single row in smallest specimen; premaxillae of adults with 2–3 rows anteriorly, blending into single, posterior row; dentary with 3–5 rows anteriorly, blending into single or double posterior row. Vomerine teeth in irregular patch; palatine teeth in single row.

Cephalic lateralis system reduced, numerical variation in pores of postorbital and suborbital canals only. Postorbital pores one, three and four present on one side, pore one only on the other in one specimen; pores one and four present in 21 specimens. Two pairs of anterior supraorbital (nasal) pores, one set mesial to nasal tube, the other posteromesially. Usually six suborbital pores, all emanating from ventral ramus of suborbital bone chain, but a seventh pore emanating from ascending ramus behind eye, just below first postorbital pore on one side in one specimen. Eight (not seven as reported by Markle and Sedberry 1978) preoperculomandibular pores, four emanating from dentary, one from anguloarticular, and three from preopercle. Interorbital and occipital (supratemporal) pores absent. Body lateral line of two branches: mediolateral, originating at or just posterior to pectoral fin margin, complete to tail tip (not evident in some material), and ventral, originating just posterior to fourth postorbital pore, coursing gradually across body to just above anus, then running just above anal fin to tail tip (Fig. 2).

TABLE 2. PECTORAL FIN RAY COUNTS OF NORTHEASTERN PACIFIC *PACHYCARA* SPECIES.

Species	Fin ray number					
	14	15	16	17	18	19
<i>P. gymninium</i> , n = 30	3	12	11	3	1	0
<i>P. lepinium</i> , n = 30	0	1	3	20	6	0
<i>P. bulbiceps</i> , n = 34	0	0	4	20	9	1*
<i>P. suspectus</i> , n = 3	0	0	3	0	0	0

* USNM 215611, recounted after Markle and Sedberry (1978) who reported it as 17.

Vertebrae symmetrical, no geographical variation exhibited numerically. Caudal fin rays variable, with two epural, 4–6 upper hypural, and 3–5 lower hypural rays. Last anal ray associated with second preural vertebra, last dorsal ray associated with third or fourth preural. Dorsal fin origin associated with vertebrae 4–7, with no free pterygiophores. All dorsal elements soft rays, first one not segmented, but bilaterally divided at least near base. Anal fin origin associated with antepenultimate to ultimate precaudal vertebrae, with 3–9 anal fin pterygiophores inserted anterior to haemal spine of first caudal vertebra.

Gill rakers short, roughly triangular in adults, more slender and longer in juveniles; adults with 3–4 epibranchial rakers and usually 12–14 on ceratobranchial; raker denticles absent. Branchiostegal rays six: four articulating with ceratohyal and two with epihyal. Two nublike pyloric caeca, not longer in smallest specimens than largest, as in some zoarcids. Pseudobranch filaments relatively long, about one eye diameter in length in adults (less in smallest specimens), numbering 3–7.

Fresh specimens uniformly dark brown, head and most of pectoral fins darker, but not black. Pectoral base pale in some preserved specimens, with irregular gray mottling in IOS DISCOVERY sta. 51803. Dorsal fin of this juvenile and a large adult (IOS DISCOVERY sta. 10884) with thin white bands over black background mostly at mid-body and near tail tip; anal fin with fewer white bands. Orobranchial chamber pale to dark brown. Abdomen and eyes dark blue in freshly preserved specimens.

DISTRIBUTION.—Presently known from both sides of the North Atlantic at depths of 2,400–4,780 m, and off the Queen Charlotte Islands, British Columbia, to the Gulf of Panama, North Pacific, at depths of 2,601–4,000 m over brown

and green mud bottoms, where the species may swarm near food falls or baited traps (Fig. 3).

***Pachycara suspectum* (Garman, 1899)**

(Figure 4)

Phucocoetes suspectus Garman, 1899:137, pl. XXX, fig. 3, 3a.

MATERIAL EXAMINED.—MCZ 28683 (holotype); off Acapulco, Mexico; 16°33.0'N, 99°52.5'W; 1,207 m; ALBATROSS sta. 3418; 11 Apr. 1890. SIO 68-106 (1); Gulf of California; 25°56.6'N, 110°37.5'W; 1,280 m; 22 Jan. 1968. ZMUC P-761085 (1); Gulf of Panama; 07°22'N, 79°32'W; 915–975 m; GALATHEA sta. 739; 15 May 1952.

DIAGNOSIS.—A species of *Pachycara* as defined by Anderson (1984) distinguished by the following combination of characters: pelvic fins present; lateral line with ventral branch only; scales absent on nape; vertebrae 21–23 + 84–87 = 105–110; head length 15.6–17.7% SL; anal fin origin associated with vertebrae 20–22.

DESCRIPTION.—Counts and measurements presented in Table 1 were compiled from all three specimens (females), 218–280 mm SL; holotype badly damaged. Head large, ovoid, deepest at occiput, dorsoventrally depressed. Snout acute, steeply sloping anteriorly. Body short, deep, ovoid in cross section. Skin firm, not gelatinous, but pliable around mouth and cheeks due to subdermal lipid layer. Scales minute, cycloid, imbedded, sparse anteriorly, covering body and tail, absent on unpaired fins, head, nape, and pectoral base. Eye ovoid, entering dorsal profile of head when viewed laterally. Gill slit long, extending ventrally to near pelvic base. Slight, squared-off lobe formed at dorsal margin of operculum. Single pair of nostrils at snout tip, nasal tube not reaching upper lip. Pectoral fin large, its origin well below body midline; posterior margin wedge-shaped; lowermost 6–7 rays shorter and thicker than others, their tips very slightly exerted.

Mouth terminal, upper jaw extending posteriorly to vertical through middle of eye. No epidermal prickles on lips or snout. Palatine membrane (oral valve) moderately developed, reaching anterior margin of vomer. Teeth in jaws and palate small, conical. Jaw teeth in two rows anteriorly, blending into single posterior row in all three specimens. Vomerine teeth in irregular patch; palatine teeth in single or double (ZMUC P-761085) row.

Cephalic lateralis system reduced, numerical variation not detected (two specimens damaged).

Postorbital pores one, three, and four present in SIO 68-106. Two pairs of anterior supraorbital (nasal) pores, one set mesial to nasal tube, the other dorsally. Seven suborbital bones present from which emanate six pores from ventral ramus of chain and one from ascending ramus behind eye, just below first postorbital pore. Eight preoperculomandibular pores, four emanating from dentary, one from anguloarticular, and three from preopercle. Interorbital and occipital pores absent. Body lateral line of single, complete, ventral branch only; lateral line originating just posterior to fourth postorbital pore, coursing steeply downward on anterior portion of abdomen, then running just above anal fin to tail tip (Garman 1899, pl. XXX).

Vertebrae symmetrical. Caudal fin with one epural and four upper and lower hypural rays (in two). Last anal ray associated with second preural vertebra, last dorsal ray associated with fourth preural vertebrae. Dorsal fin origin associated with vertebrae 2–3, with no free pterygiophores. All dorsal elements soft rays, first one not segmented, but bilaterally divided. Anal fin origin associated with penultimate precaudal vertebra, with 2–4 anal fin pterygiophores inserted anterior to haemal spine of first caudal vertebra.

Gill rakers short, roughly triangular, ventral-most blunt, but dorsalmost 5–6 with sharp tips; raker denticles absent. Branchiostegal rays six: four articulating with ceratohyal and two with epihyal. Two nublike pyloric caeca. Pseudo-branch filaments short, numbering 3–4.

Coloration of fresh specimens not confirmed, although Garman (1899) reported holotype as “blackish.” Recent material greatly faded. One gravid female, 218 mm SL (SIO 68-106), with ova averaging 4.4 mm in diameter.

DISTRIBUTION.—Currently known from the Gulf of California south to the Gulf of Panama at depths of 915–1,280 m over green and brown mud bottoms.

***Pachycara gymninium* n. sp.**

(Figure 5)

Lycodes sp. Hubbs et al., 1979:14.

Lycenchelys “E.” Pearcy et al., 1982:387.

HOLOTYPE.—USNM 280121 (female, 422 mm SL); British Columbia, W of Tasu Sound, Queen Charlotte Islands; 52°38.0'N, 132°05.8'W; trap, 2,744 m; TALAPUS set 18; 4 Feb. 1980.

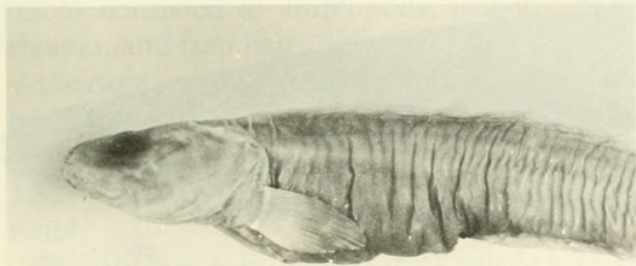


FIGURE 4. *Pachycara suspectum* (Garman), SIO 68-106, 218 mm SL, from the Gulf of California.

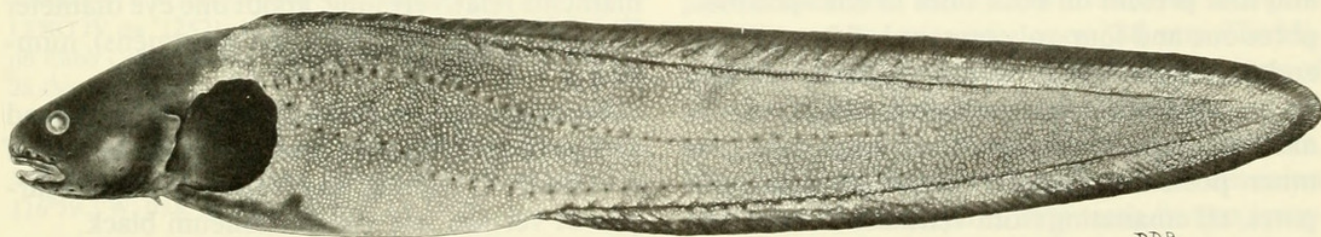
PARATYPES.—British Columbia: BCPM 980-121 (1); same as holotype. BCPM 979-11365 (2); W of Tasu Sound; trap, 2,744 m; EASTWARD HO set 5; 16 Aug. 1979. BCPM 979-11369 (6); W of Tasu Sound; trap, 2,889 m; EASTWARD HO set 12; 22 Aug. 1979. BCPM 980-100 (1); W of Tasu Sound; trap, 2,926 m; EASTWARD HO set 18; Aug. 1979. USNM 221113 (1); recat. from BCPM 979-11369. NMC 86-0444 (1); W of Tasu Sound; trap, 2,743–2,926 m; EASTWARD HO set 11; 21 Aug. 1979. Cascadia Abyssal Plain: CAS 60524 (1); 45°18.7'–18.5'N, 126°34.4'–28.6'W; trawl, 2,750 m; YAQUINA sta. CP-2C, BMT 265; 18 Feb. 1971. CAS 60525 (1); 45°21.5'–21.7'N, 127°33.0'–38.5'W; trawl, 2,800 m; YAQUINA sta. CP-3C, BMT 280; 18 May 1971. California: OSUO 2558 (1); Mendocino Ridge; 40°45.8'N, 127°31.6'W; trap, 3,225 m; USGS S. P. LEE sta. L2-86-5T; 20–21 July 1986. SIO 67-121 (36); SW of Cordell Bank; 37°57.4'N, 123°40.5'W; trap, 2,707–3,219 m; THOMAS WASHINGTON; 16–17 June 1967. Mexico: SIO 65-69 (3); off Guadalupe Isl., 4 mi E of southern tip; trap, 1,829 m; 4–5 Mar. 1965. SIO 68-120 (6); Gulf of California; 25°35.4'N, 109°46.0'W; trap, over 1,728 m; THOMAS WASHINGTON; 24–25 Jan. 1968. SIO 70-12 (3); off Baja California Norte; 31°10.0'–06.9'N, 118°52.6'–53.4'W; trap, 2,524 m; MELVILLE; 16–17 Dec. 1969.

ADDITIONAL MATERIAL.—SIO 66-19 (2); off Guadalupe Isl., Mexico; 29°07.8'N, 118°12.5'W; trap, 2,378 m; ALEXANDER AGASSIZ; 1–2 Apr. 1966.

DIAGNOSIS.—A species of *Pachycara* as defined by Anderson (1984) distinguished by the following combination of characters: pelvic fins present, their lengths 4.8–11.3% HL; mediolateral branch of lateral line originating in pectoral axil just posterior to vertical through pectoral

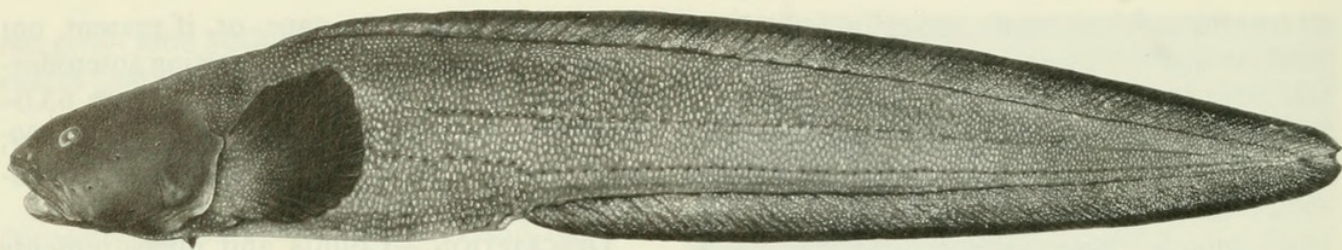
base; scales absent on nape, or, if present, not extending anterior to line connecting anterodorsal edges of gill slits; pectoral fin length 63.0–70.8% HL; vertebrae 28–31 + 73–80 = 102–109; head length 12.0–15.6% SL; anal fin origin associated with vertebrae 27–31.

DESCRIPTION.—Counts and measurements presented in Table 1 were compiled from all known specimens, 76–422 mm SL (including one gravid female). The following description is based on 10 adult males, nine adult females, 42 juveniles of both sexes, and two eviscerated adults. Head large, ovoid, wider in adults than juveniles. Body short, deep, broader in cross section in adults than juveniles. Tail laterally compressed, more so posteriorly, tapering gradually to tip. Skin firm, not gelatinous, but pliable around head, especially near mouth, cheeks and nape, owing to subdermal lipid layer. Scales minute, cycloid, imbedded, covering body, tail and vertical fins to about half their height; usually no scales on nape, but when present, restricted to small patches immediately anterior to dorsal fin origin, or, rarely, extending anteriorly to line connecting anterodorsal edges of gill slits. Scales usually absent on pectoral base, when present, usually in irregular, ovoid patch not extending from dorsal to ventral margin of fin and not extending onto fin more than 15% of its length. Scales on right cheek in small patch between preoperculum and mandibular pores seven and eight in one specimen (SIO 67-121, 235 mm SL female), scales otherwise absent on head. No scales developed in smallest specimen, 76 mm SL. Eye circular, larger in proportion to head in small specimens than largest adults. Gill slit somewhat shortened, usually extending ventrally to just above ventral margin of pectoral base, but restricted to mid-height of pectoral base in a few specimens, and extending to below ventral margin of pectoral base in a few others. Slight, rounded or squared-



P.D.B.

FIGURE 5. *Pachycara gymninium* n. sp., USNM 280121 (holotype, 422 mm SL), off the Queen Charlotte Islands, British Columbia.



rdb

FIGURE 6. *Pachycara lepinium* n. sp., USNM 280120 (holotype, 465 mm SL), off the Queen Charlotte Islands, British Columbia.

off, posteriorly-directed lobe formed at dorsal margin of operculum, its dorsalmost margin usually straight, but deeply concave in one specimen. Single pair of nostrils at snout tip, nasal tube very short, usually not reaching upper lip (reaching upper lip only in few juveniles less than 220 mm SL). Pectoral fin large, its origin just below body midline; posterior margin nearly evenly rounded (except in few injured specimens); ventralmost 3–5 rays shorter and thicker than others, their tips not at all, or just slightly exerted; pectoral rays usually 15–16 (Table 2).

Mouth terminal, upper jaw slightly longer in relation to head in adult males than comparably sized adult females; upper jaw 40.5–52.8% HL (\bar{x} = 43.9%, n = 12) in males over 280 mm SL, 37.7–41.8% HL (\bar{x} = 39.5%, n = 11) in females over 295 mm SL. Minute, epidermal prickles on anterior portions of lips and chin, these often nearly rubbed off in large specimens. Palatine membrane (oral valve) moderately developed, almost reaching anterior margin of vomer in most specimens. Teeth in jaws and palate small, conical, dentition not sexually dimorphic. Jaw teeth in single row anteriorly in smallest specimens, in 4–5 anterior rows in adults, blending into single posterior row in all. Vomerine teeth in irregular patch or arched row; palatine teeth in single row.

Cephalic lateralis pore system reduced, numerical variation in pores of postorbital and suborbital canals only. Postorbital pores one, three, and four present on both sides in one specimen; pores one and four only present in 18; pores one and four on one side, pores one, three, and four on the other in nine specimens. Two pairs of nasal pores, one set mesial to nasal tube, the other posteromesially. Usually six suborbital pores, all emanating from ventral ramus of suborbital bone chain, but a seventh pore emanating from ascending ramus behind eye just below first postorbital pore in seven specimens, and, in one,

from just above sixth pore on cheek. Eight preoperculo-mandibular pores, four emanating from dentary, one from anguloarticular, and three from preopercle. Interorbital and occipital (supratemporal) pores absent. Body lateral line of two branches: mediolateral, originating in pectoral axil on vertical through pectoral base, complete to tail tip, and ventral, originating just posterior to fourth postorbital pore, coursing gradually across body to just above anus, then running to tail tip above anal fin base.

Vertebrae symmetrical, no geographical variation exhibited numerically. Caudal fin rays variable, with one or two epural, 4–6 upper hypural, and 4–5 lower hypural rays. Last anal ray associated with second preural vertebra, last dorsal ray associated with fourth preural vertebra. Dorsal fin origin associated with vertebrae 3–5, with no free pterygiophores. All dorsal elements soft rays, first one not segmented, but bilaterally divided at least near base. Anal fin origin associated with antepenultimate to ultimate precaudal vertebrae, with 3–5 pterygiophores inserted anterior to haemal spine of first caudal vertebra.

Gill rakers short, roughly triangular in adults, more slender, but not pointed, in smallest specimens; adults with 3–5 epibranchial rakers and usually 11–13 on ceratobranchial; raker denticles absent. Branchiostegal rays six: four articulating with ceratohyal and two with epihyal. Two nub-like pyloric caeca, not appreciably longer in smallest specimens than largest. Pseudobranch filaments relatively long, about one eye diameter in length (or more in smallest specimens), numbering 3–5.

Fresh specimens uniformly dark brown, head and pectoral fin darker, almost black. Lining of orobranchial chamber dark brown or black. Margins of vertical fins and peritoneum black.

One gravid female known (CAS 60524, 350 mm SL), with 80 ova 5.2–7.2 mm in diameter (\bar{x} = 5.8 mm). Stomach contents of several spec-

imens consisted of amphipods, isopods, polychaetes, and trap bait.

DISTRIBUTION.—Off the Queen Charlotte Islands, British Columbia, south to off Guadalupe Island, Mexico, and in the Gulf of California in 1,829–3,219 m over brown and green mud bottoms.

ETYMOLOGY.—From the Greek *γυμνός* (naked) and *ινίον* (nape) in reference to the species' scaleless head.

***Pachycara lepinium* n. sp.**

(Figure 6)

Lycodes sp. Hubbs et al., 1979:14.

Lycenchelys "D." Pearcy et al., 1982:387.

HOLOTYPE.—USNM 280120 (male, 465 mm SL); British Columbia, W of Tasu Sound, Queen Charlotte Islands; 52°38.0'N, 132°05.8'W; trap, 2,744 m; TALAPUS set 8; 4 Feb. 1980.

PARATYPES.—British Columbia: BCPM 980-121 (1); same as holotype. BCPM 980-98 (1); W of Tasu Sound; trap, 2,889 m; EASTWARD HO set 6; Aug. 1979. NMC 86-0445 (1); W of Tasu Sound; trap, 2,744 m; EASTWARD HO set 5; 16 Aug. 1979. USNM 221114 (1); W of Tasu Sound; trap, 2,889 m; EASTWARD HO set 12; 22 Aug. 1979. Cascadia Abyssal Plain: CAS 60526 (1); 44°23.0–25.4'N, 125°34.0–35.0'W; trawl, 2,878 m; YAQUINA sta. CP-1F, BMT 410; 4 Aug. 1974. CAS 60527 (1); 45°46.9–45.7'N, 126°35.5'W; trawl, 2,665 m; YAQUINA sta. CP-2A, BMT 259; 15 Feb. 1971. CAS 60528 (1); 44°41.7–43.6'N, 125°33.5–32.5'W; trawl, 2,825 m; YAQUINA sta. CP-1E, BMT 120; 6 Oct. 1969. CAS 60529 (1); 45°53.1–51.8'N, 126°39.0–42.5'W; trawl, 2,713 m; YAQUINA sta. CP-2A, BMT 154; 16 Jan. 1970. CAS 60530 (1); 44°29.6–45.2'N, 126°29.0–35.9'W; trawl, 2,818 m; YAQUINA sta. CP-2D, OTB 90; 23 Oct. 1965. OSUO 2563 (1); 45°09.3–10.5'N, 125°38.3–38.0'W; trawl, 2,669 m; YAQUINA sta. CP-1C, BMT 93; 15–16 July 1969. LACM 44315-1 (1); 44°39.7–39.0'N, 126°39.6–44.8'W; trawl, 2,816 m; CA-YUSE sta. CP-2E, BMT 253; 30 Sept. 1970. California: SIO 66-50 (1); off Cape Mendocino; 40°34.6–34.7'N, 125°51.4–51.5'W; trap, 2,970 m; ALEXANDER AGASSIZ; 21–22 May 1966. SIO 60-475 (1); off Farallon Isl.; trawl, ca. 1,800 m; 10 Nov. 1960. SIO 59-288 (1); San Clemente Basin; 32°39.0'N, 118°09.3'W; trap, 2,027 m; 23–24 July 1959. SIO 59-289 (3); San Clemente Basin; 32°39.0'N, 118°09.3'W; trap, 2,023 m; 23–24 July 1959. SIO 65-452 (4); San Clemente Basin; 32°38.7'N, 118°08.4'W; trap, 2,008 m; ALEXANDER AGASSIZ; 25 Sept. 1965. LACM 32114-2 (1); San Clemente Basin; 32°38.0–37.5'N, 118°09.0–06.4'W; trap, 1,829–1,939 m; VELLERO IV sta. 12521; 10 Dec. 1968. Mexico: SIO 59-365 (5); off Cabo Colnet; 31°02.7'N, 116°59.0'W; trap, 2,140 m; 27–28 Oct. 1959.

ADDITIONAL MATERIAL.—SIO 59-364 (1); off Cabo Colnet, Mexico; 31°00.5'N, 118°06.0'W; trap, 1,728 m; 27 Oct. 1959. SIO 59-366 (1); off Cabo Colnet, Mexico; 31°02.7'N, 116°59.3'W; trap, 2,140 m; 27–28 Oct. 1959.

DIAGNOSIS.—A species of *Pachycara* as defined by Anderson (1984) distinguished by the following combination of characters: pelvic fins

present, their length 11.5–17.3% HL; mediolateral branch of lateral line originating posterior to pectoral fin margin; scales present on nape, extending to interorbital region; pectoral fin length 72.5–89.9% HL; vertebrae 23–26 + 80–94 = 105–120; head length 13.8–15.9% SL; anal fin origin associated with vertebrae 23–26.

DESCRIPTION.—Counts and measurements presented in Table 1 were compiled from all known specimens, 221–597 mm SL (including one gravid female). The following description is based on six adult males, eight adult females, and 16 juveniles of both sexes. Head large, ovoid, wider in adults than juveniles. Body relatively short, deep, broader in cross section in adults than juveniles. Tail laterally compressed, more so posteriorly, tapering gradually to tip. Skin firm, not gelatinous, but somewhat pliable around head, especially near mouth and cheeks, due to subdermal lipid layer. Scales minute, cycloid, imbedded, covering body, tail, and vertical fins almost to their margins; scales on nape extend anteriorly to vertical one eye diameter anterior to dorsalmost edge of gill opening in smallest specimen, to interorbital region in adults. Scales present in pectoral axil and on base, extending on outer surface of fin to half or more its length; scales present on cheeks. Eye circular, relatively larger in proportion to head in smallest specimens than largest. Gill slit long, extending ventrally almost to pelvic fin origin; slight, rounded, posteriorly-directed lobe formed at dorsal margin of operculum. Single pair of nostrils at snout tip, nasal tube very short, not reaching upper lip. Pectoral fin large, its origin just below body midline; posterior margin almost evenly rounded; lowermost 5–6 rays shorter and thicker than others, their tips somewhat excised; pectoral rays usually 17–18 (Table 2).

Mouth subterminal in largest adults, terminal in young; upper jaw longer in relation to head in adult males than comparably sized adult females; upper jaw 48.8–52.0% HL (\bar{x} = 50.3, n = 5) in males over 380 mm SL, 41.7–46.4% HL (\bar{x} = 44.8%, n = 7) in females over 380 mm SL. Minute, epidermal prickles on anterior portions of lips and chin. Palatine membrane (oral valve) well developed, reaching anterior edge of vomer. Teeth in jaws and palate small, conical; dentition not sexually dimorphic. Jaw teeth in two irregular rows anteriorly in smallest specimens, in 4–5 anterior rows in adults, blending into single posterior row in all. Vomerine teeth in irregular

patch; palatine teeth in one or two (largest specimens) irregular rows.

Cephalic lateralis pore system reduced, numerical variation present only in pores of postorbital canal. Postorbital pores one, three, and four present, emanating from frontal, pterotic and lateral extrascapular, respectively; pores one and four only in two specimens; pores one and four on one side, one, three, and four on the other in two other specimens. Two pairs of nasal pores, one set mesial to nasal tube, the other set posteromesially. Six suborbital pores, all emanating from ventral ramus of suborbital bone chain. Eight preoperculomandibular pores, four emanating from dentary, one from anguloarticular, and three from preopercle. Interorbital and occipital (supratemporal) pores absent. Body lateral line of two branches: mediolateral, originating at or just posterior to pectoral fin margin, complete to tail tip, and ventral, originating just posterior to fourth postorbital pore, coursing gradually across body to just above anus, then running just above anal fin to tail tip.

Vertebrae symmetrical. Individuals from basins of southern California and northern Baja California with significantly more vertebrae than those from the north (specimens from British Columbia to Cape Mendocino with 105–110 vertebrae [$n = 13$, $\bar{x} = 107.2$, $SD = 1.58$], specimens from the Farallon Islands to Baja California with 116–120 vertebrae [$n = 16$, $\bar{x} = 117.2$, $SD = 0.49$]). Caudal fin rays variable, with two epural, 3–5 upper hypural and 3–5 lower hypural rays. Last anal ray associated with second preural vertebra, last dorsal ray associated with third or fourth preural vertebrae. Dorsal fin origin associated with vertebrae 4–5, with no free pterygiophores. All dorsal fin elements soft rays, first 1–2 not segmented, but bilaterally divided at least near base. Anal fin origin associated with antepenultimate to ultimate precaudal vertebra, with 2–5 pterygiophores inserted anterior to haemal spine of first caudal vertebra.

Gill rakers short, roughly triangular, relatively longer on dorsal portion of ceratobranchial; largest adults with four epibranchial rakers and 13–15 on ceratobranchial; raker denticles absent. Branchiostegal rays six: four articulating with ceratohyal and two with epihyal. Two nublke pyloric caeca, not appreciably longer in smallest specimens. Pseudobranch filaments relatively long, about one eye diameter in length in both adults and juveniles, numbering 2–5.

Fresh specimens uniformly dark brown, head and pectoral fin darker, almost black. Lining of orobranchial chamber dark brown or black. Margins of vertical fins and peritoneum black.

One gravid female, 412 mm SL (SIO 59-364, ovary somewhat damaged), had ova averaging 4.3 mm in diameter. Stomach contents of several specimens included polychaetes, bivalves, and amphipods.

DISTRIBUTION.—Off the Queen Charlotte Islands, British Columbia, south to off Guadalupe Island, Mexico, at depths of 1,728–2,970 m over brown and green mud bottoms. Often taken in traps and trawls with *P. gymninium*, but this species not yet known from the Gulf of California.

ETYMOLOGY.—From the Greek *λεπίς* (scale) and *ινίον* (nape) in reference to the species' scaly head.

DISCUSSION

The distribution of *P. bulbiceps* may at first glance appear anomalous, in that the species is widely distributed in the North Atlantic, but otherwise restricted to the northeastern Pacific continental rise and adjacent abyss. Anderson (1988) provided evidence that the pan-American, tropical, abyssal fish fauna was sundered by tectonic uplifting in the region of the Panamanian isthmus at least by the mid-Miocene. The present Caribbean deep-water ichthyofauna is very different from that of the eastern tropical Pacific (Garman 1899; Anderson et al. 1986). Thus, the Pacific and Atlantic stocks of *P. bulbiceps* would have had ample time to speciate if there were no South Atlantic–South Pacific populations linking the northern groups. Because abyssal trawl samples from the southwestern Atlantic and southeastern Pacific are generally lacking for most regions, isolation of the northern populations cannot be evaluated. Based on the paleogeography of the American tropics cited by Anderson (1988), the Atlantic and Pacific populations probably are not isolated from each other, and future abyssal collections off Chile, Argentina, Brazil, and probably southern Africa should produce specimens of *P. bulbiceps*. Among the characters presented in Table 1, as well as traditional data analysis used by us before (Peden and Anderson 1978; Peden 1981; Anderson 1982), including features of the axial skeleton, gill arches, dentition, squamation, and lateral lines, no numerical or morphological differences were de-

tected between the Atlantic and Pacific populations, thus isolation seems improbable. This is in contrast to North Atlantic and North Pacific populations of the grenadier *Coryphaenoides armatus*, which exhibited minor electrophoretic but significant biometric differences, resulting in Wilson and Waples' (1984) placement of these forms as separate subspecies. Similarly, Small (1981) found specific differences in the cosmopolitan bathyal genus *Antimora* and recognized an endemic North Pacific species (*A. microlepis*), while a second species (*A. rostrata*) was shown to be circumglobal but excluded from the North Pacific.

The geographic variation noted for *P. lepinium*, but not found in *P. gymninium*, is difficult to explain, but may relate to differing environmental conditions that affect vertebral number in the basins of the Southern California Bight. Still, no variation was noted in the eight individuals of *P. gymninium* from this area, or in *P. bulbiceps* along its entire range. If the distributions of these species are broader than present samples reflect (and they probably are), significant geographic variation may be found when adequate material is analyzed along the ranges of all species, as was found for the eelpouts *Lycodapus mandibularis* (Peden 1979) and *Lycodes diapterus* (Peden 1981). The lack of variation noted for *P. gymninium* may be due to either the present poor sample size or is a valid specific character, as found in another eelpout genus, *Gymnelus* (Anderson 1982).

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