

A NEW GENUS AND SPECIES OF CERATIOID ANGLERFISH FROM THE
NORTH PACIFIC OCEAN WITH A REVIEW OF THE ALLIED GENERA
CTENOCHIRICHTHYS, *CHIROPHRYNE* AND *LEPTACANTHICHTHYS*¹

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ABSTRACT: A new genus and species of deep-sea anglerfish is described on the basis of two specimens collected from the north Pacific Ocean. The new form is most strikingly characterized by having an unusually elongate pectoral-fin lobe that bears the fin rays along its dorsal margin, a unique and derived condition shared with three other oneirodid genera: *Ctenochirichthys*, *Chirophryne*, and *Leptacanthichthys*. The new form is described and compared osteologically with its nearest allies. It differs in having an extremely short snout, strongly convex frontal bones, and an oblique jaw suspension, appearing to be intermediate in many ways between more generalized oneirodids and the other three "long-pectoralized" forms. It is probably most closely related phylogenetically to *Ctenochirichthys*. *Chirophryne* is perhaps intermediate between the new genus and *Ctenochirichthys* on one hand, and *Leptacanthichthys* on the other. A key to the "long-pectoralized" genera is provided.

INTRODUCTION

Among the previously described genera of the deep-sea anglerfish family Oneirodidae are three forms unique among the Ceratioidei in having an unusually elongate pectoral-fin lobe that bears the fin rays along its dorsal margin. These genera are *Leptacanthichthys*, *Chirophryne*, and *Ctenochirichthys*. *Leptacanthichthys* was originally described by Regan and Trewavas (1932) as one of five subgenera of the genus *Dolopichthys* Garman (1899) to include a single species, *D. gracilispinis* Regan (1925), based on two metamorphosed female specimens. Since that time the name *Leptacanthichthys* has been given generic status (Bertelsen 1951:94). Pietsch (1974) described the osteology of the genus and discussed its phylogenetic relationships with other oneirodid genera. More recently, Pietsch (1976) reported a case of sexual parasitism in *Leptacanthichthys*, the first known occurrence of this peculiar mode of reproduction in the family Oneirodidae and the first record of a male for the genus.

Chirophryne and *Ctenochirichthys* were introduced by Regan and Trewavas (1932) as monotypic genera: *Chirophryne xenolophus*, described from a single metamorphosed female, and *Ctenochirichthys longimanus*, based on two metamorphosed

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females. Since the original publication a second female of *C. xenolophus* was reported by Pietsch (1974:31, fig. 58). Two additional larval males and an adolescent male of *C. longimanus* were reported by Bertelsen (1951:95) and Beebe and Crane (1947:166), respectively.

Recently, a fourth 'long-pectored' oneirodid, representing an undescribed genus and species, was discovered among the ceratioids in the collections of the Institute of Oceanography of the Academy of Sciences of the USSR, Moscow, and the Scripps Institution of Oceanography in La Jolla. This new form is described and compared with its nearest allies below.

METHODS AND MATERIALS

Standard lengths (SL) are used throughout. Measurements were taken on the left side whenever possible and rounded to the nearest 0.5 mm. To insure accurate fin-ray counts skin was removed from the pectoral fins and incisions were made in the skin to reveal the rays of the dorsal and anal fins. Sockets, indicating missing teeth in the jaws and on the vomer, were included in total tooth counts. Jaw tooth counts are the sum of left and right sides. Head length is the distance from the tip of the upper jaw to the posteriormost margin of the preoperculum; head depth is the distance from the tip of the sphenotic spine to the base of the quadrate spine; lower jaw length is the distance from the symphyseal spine to the posteriormost margin of the articular; illicium length is the distance from the articulation of the pterygiophore of the illicium and the illicial bone to the dorsal surface of the esca bulb, excluding esca appendages. Terminology used in describing the various parts of the angling apparatus follows Bradbury (1967). Definitions of terms used for the different stages of development follow Bertelsen (1951:10-11). Study material is deposited in the following institutions: BMNH—British Museum (Natural History), London; IOS—Institute of Oceanographic Sciences, Surrey, England (formerly the National Institute of Oceanography); LACM—Natural History Museum of Los Angeles County; MCZ—Museum of Comparative Zoology, Harvard University; ROM—Royal Ontario Museum, Toronto; SIO—Scripps Institution of Oceanography, La Jolla; CAS-SU—Stanford University (collections now housed at the California Academy of Sciences, San Francisco [CAS]); ZMUC—Zoological Museum, University of Copenhagen.

OSTEOLOGY

The osteology of *Leptacanthichthys* previously has been described in detail and compared with that of other oneirodid genera (Pietsch 1974). Material sufficient for a thorough osteological study of *Ctenochirichthys* and *Chirophryne* is unavailable; a few comparative aspects however, are discussed based on superficial dissection. An osteological preparation of one of the two known specimens of *Puck* (SIO H52-363), made using the trypsin digestion technique of Taylor (1967), forms the basis for the following description.

Cranium.—The T-shaped supraethmoid of *Puck* has a long ventromedial process that forms, together with the lateral ethmoids and relatively thin, dorsally concave ethmoid cartilage, large, roughly circular, nasal foramina (Fig. 1). This is similar to the condition found in *Oneiroides* and *Danaphryne* (Pietsch 1974:16, fig. 22). Like *Danaphryne*, but again in contrast to *Leptacanthichthys*, the illicial trough of *Puck* is deep and narrow resulting from a lateral compression of the anterior portion of the skull, rather than a medial, dorsoventral depression of the ethmoid region. The width of the ethmoid cartilage and underlying vomer of *Puck* is greater than the distance between the anterolateral tips of the lateral ethmoids (Fig. 1).

The frontal bones of *Puck* (Fig. 2) are similar to those of *Oneiroides* and *Danaphryne*, having a strongly convex dorsal margin and occupying a relatively posterior position on the skull. The frontals of *Leptacanthichthys* are considerably longer, have a nearly linear dorsal margin, and occupy a more anterior position, overhanging and extending past the anterior limits of the ethmoid cartilage and vomer (Pietsch 1974:18-19, figs. 2, 28-31, 34). *Ctenochirichthys* and *Chirophryne* have moderately convex frontals (Figs. 11, 14).

The sphenotics of *Puck*, *Chirophryne*, and *Leptacanthichthys* are large, forming

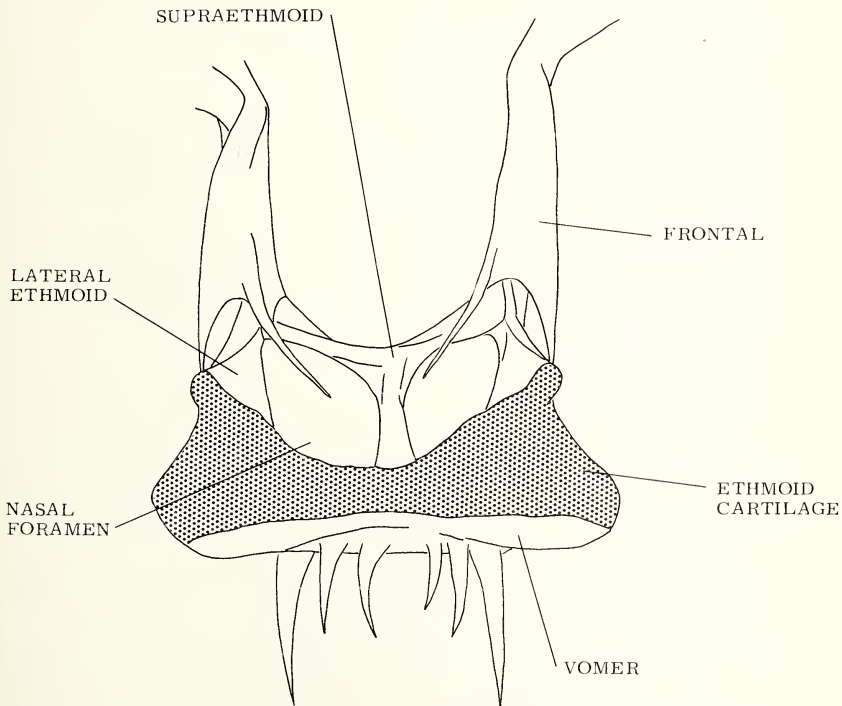


FIGURE 1. Anterior view of anterior half of cranium of *Puck pinnata*, SIO H52-363, 66.0 mm.

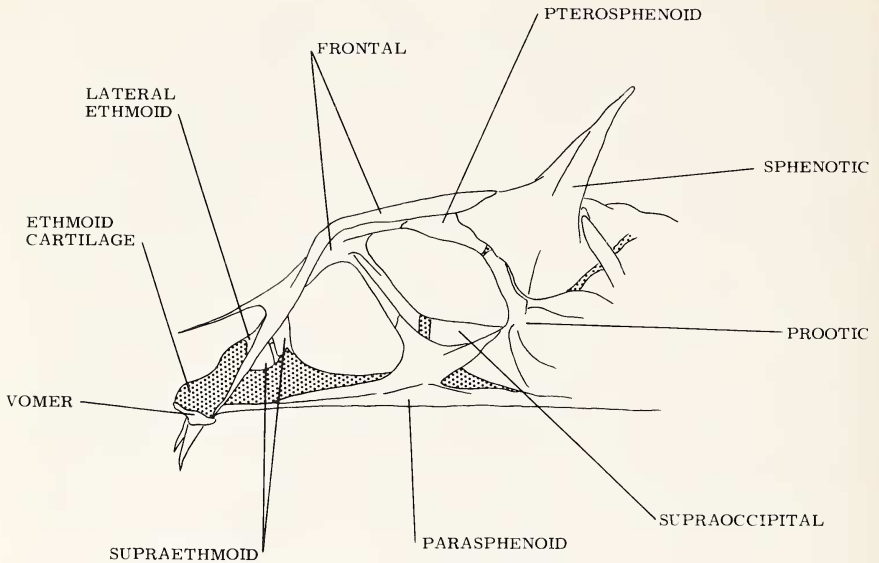


FIGURE 2. Lateral view of cranium of *Puck pinnata*, SIO H52-363, 66.0 mm.

an elongate spine (Figs. 2, 9, 14, 16; Pietsch 1974:19, fig. 34). The sphenotic spines of *Ctenochirichthys* are short, in some specimens not piercing the skin (Fig. 11).

Mandibular, palatine, and hyoid arches.- *Puck* differs from other "long-pectoral-aid" oneirodids in the angle of the jaw suspension. The suspensorium of *Puck* is strongly oblique in a posterior direction, resulting in a more posterior position for the lower jaw. In contrast, the angle of the jaw suspension in *Ctenochirichthys*, *Chirophryne*, and *Leptacanthichthys* is nearly vertical; the lower jaw extends forward slightly beyond the premaxillaries.

Puck and *Ctenochirichthys* are similar in that the distal ends of the upper jaw bones are held in a forward position on the dentary by a relatively short anterior maxillomandibular ligament, resulting in a short gape that terminates anterior to the eye (Fig. 3A, B, 9, 11). Although, the anterior maxillomandibular ligament of *Ctenochirichthys* is slightly longer than that of *Puck*, it originates much further forward on the dentary. For this reason, the length of the gape of *Ctenochirichthys* is slightly shorter than that of *Puck*. The anterior maxillomandibular ligament of *Chirophryne* and *Leptacanthichthys* is considerably longer than that of *Puck* and *Ctenochirichthys*, the upper jaw bones are more horizontal in position, and the gape of the mouth extends past the level of the eye (Figs. 3C, D, 14, 16).

In apparent correlation with this difference in jaw mechanism, the suspensoria (as well as the opercular apparatus and pectoral girdles) of *Puck* and *Ctenochirichthys* flare out laterally so that viewed head-on, the crania of these genera are considerably more narrow than the distance between the posterior ends of the lower jaw (Fig. 13A, B). Thus, the mouths of these two genera are short, yet wide, relative to other onei-

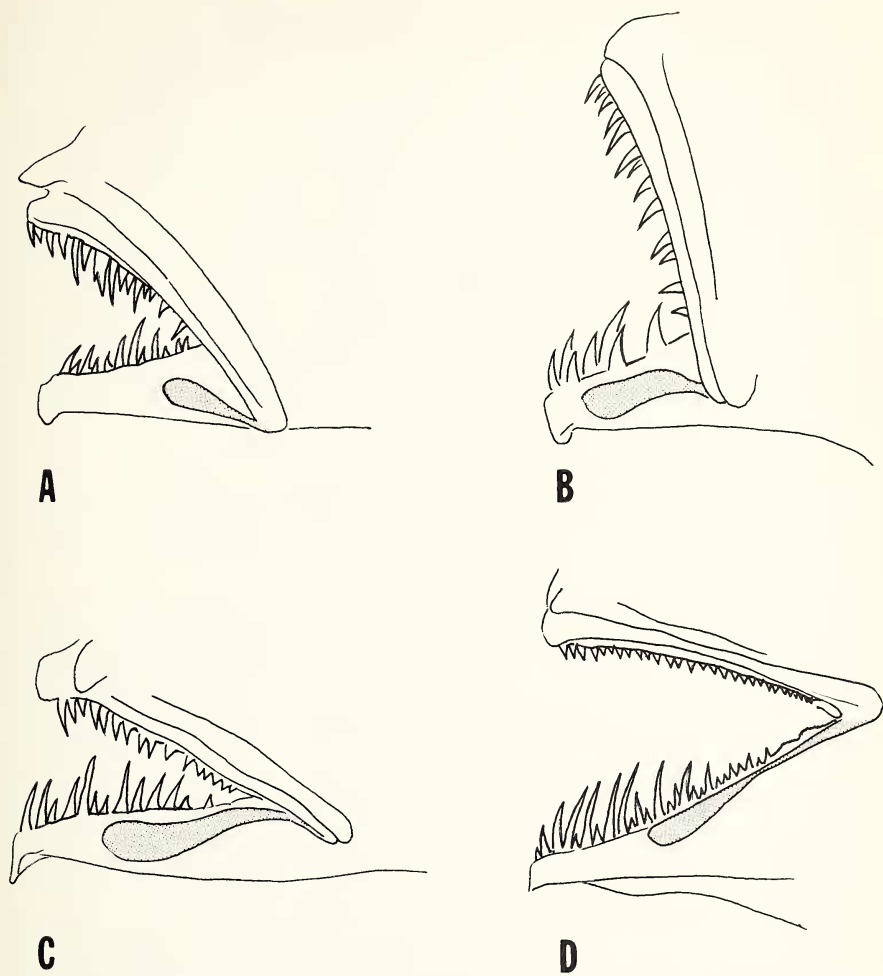


FIGURE 3. Lateral views of jaws with anterior maxillomandibular ligaments indicated by stippling: A. *Puck pinnata*, holotype, LACM 34276-1, 46.0 mm; B. *Ctenochirichthys longimanus*, lectotype, ZMUC P9297, 12.5 mm; C. *Chirophryne xenolphus*, SIO 70-306, 22.0 mm; D. *Leptacanthichthys gracilispinis*, LACM 33625-2, 56.0 mm.

roids. In contrast, the crania of *Chirophryne* and *Leptacanthichthys* are equal in width, or slightly wider than the distance between the posterior ends of the lower jaw (Fig. 13C, D); their mouths are consequently longer, yet more narrow.

Among oneirodids, differences in the size and shape of the bones of the lower jaw are correlated with differences in the length and depth of the cranium (Pietsch 1974:20). *Puck* has a relatively short, deep cranium, and consequently, like *Oneirodes* and *Danaphryne*, has short, deep dentaries and articular bones (Fig. 4; Pietsch 1974:

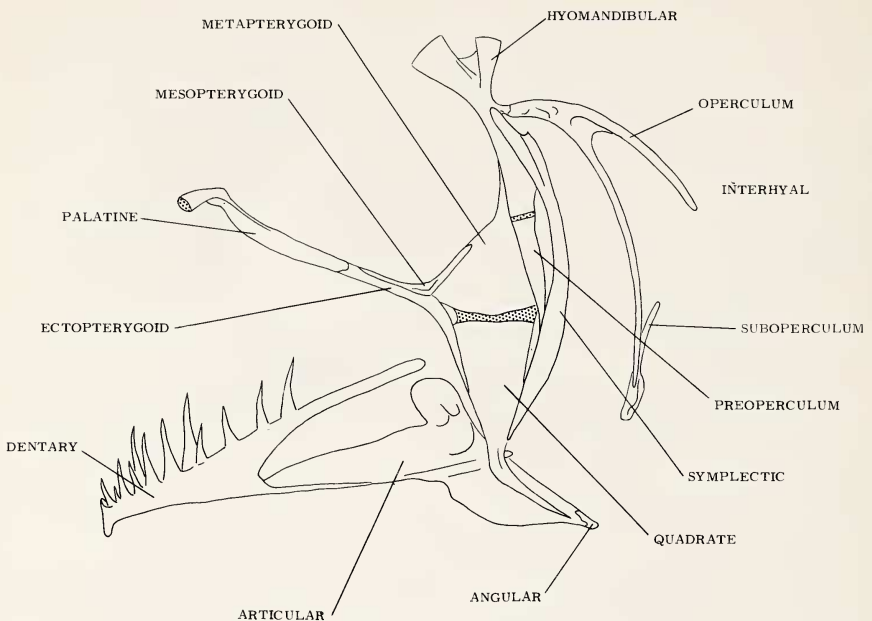


FIGURE 4. Lateral view of left side of lower jaw, suspensorium and opercular apparatus of *Puck pinnata*, SIO H52-363, 66.0 mm.

9, 20-21, figs. 8, 40). *Leptacanthichthys*, on the other hand, is a long-jawed genus with a more elongate, narrow cranium (Pietsch 1974: 20-21, fig. 42).

Variation in the length and width of the palatine arch is also associated with the length and depth of the cranium. *Puck*, *Oneiroides*, and *Danaphryne* have short, broad mesopterygoid, ectopterygoid and palatine bones as compared to *Leptacanthichthys* in which these bones are considerably more elongate and narrow (Fig. 4; Pietsch 1974: 9-10, 21, figs. 8, 40, 42).

At the articulation of the lower jaw and suspensorium, the articular and quadrate bones form spines (the mandibular and quadrate spines, respectively), which vary in relative length among oneirodids. The mandibular spine is considerably shorter than the quadrate spine in *Puck* and *Chirophryne* (Figs. 5A, 14), but, in contrast to all other oneirodids, the mandibular spine is considerably longer than the quadrate spine in *Leptacanthichthys* (Fig. 5B). Both spines are rudimentary in *Ctenochirichthys* (Fig. 11, Table 2).

In all oneirodids the jaw teeth are slender, recurved and depressible, large and small ones intermixed in both jaws. The considerably longer gape of *Leptacanthichthys* provides space for a greater number of upper and lower jaw teeth than are found in *Puck* and *Ctenochirichthys*. *Chirophryne*, known from only two small, adolescent females (11.0 and 22.0 mm), doubtless has a greater number of jaw teeth in larger specimens (Table 2).

Opercular apparatus.—The shape of the subopercular bone varies considerably

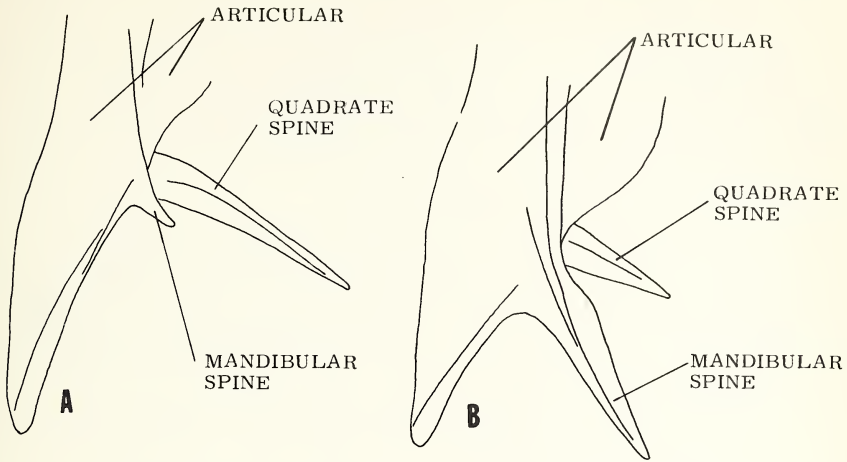


FIGURE 5. Ventrolateral views of posterior part of lower jaw, left side, showing arrangement of quadrate and mandibular spines: A. *Puck pinnata*, holotype, LACM 34276-1, 46.0 mm; B. *Leptacanthichthys gracilispinis*, LACM 33625-2, 56.0 mm.

between genera and is a diagnostic feature of many oneirodids. The subopercula of *Puck* and *Ctenochirichthys* are elongate and slender throughout their length, the upper end tapering to a point (Fig. 6A-C; Bertelsen 1951:94, fig. 51). Those of *Leptacanthichthys* and the two known specimens of *Chirophryne* (11.0 and 22.0 mm) are short and broad, the upper end rounded to bluntly pointed (Fig. 6D-G; Bertelsen 1951:94, figs. 49, 50; subopercula of other oneirodids are figured by Pietsch 1974).

Branchial arches.—The branchial arches of *Puck* are similar to those of *Danaphryne* and *Leptacanthichthys* (Pietsch 1974:25). Pharyngobranchials II and III are well developed and bear eight and ten long, slender teeth, respectively (Fig. 7; Pietsch 1974:25, fig. 51A, C).

Dorsal and anal fins.—*Puck*, *Chirophryne* and most specimens of *Leptacanthichthys* have five dorsal rays; *Ctenochirichthys* has six or seven. *Puck*, *Chirophryne* and most individuals of *Ctenochirichthys* have four anal rays; *Leptacanthichthys* has five or six (Table 1; fin-ray counts for other oneirodids are given by Pietsch 1974:27-28, table 23).

Pectoral lobe.—The pectoral lobe (pectoral fin, excluding fin rays) of *Puck*, *Ctenochirichthys*, *Leptacanthichthys* and, to a lesser degree, *Chirophryne* (but known only from small specimens), is unusually long and narrow (Fig. 8; Regan and Trewavas 1932:35-36, fig. 42C, D; Pietsch 1974:29, fig. 55). Unlike that of other oneirodids, the first radial (uppermost) is considerably shorter than the second; the cartilaginous distal end of the third radial is expanded in an antero-posterior direction to meet the distal end of the considerably shorter second radial. The fin rays, thus articulate along the upper margin of the pectoral lobe (Figs. 9, 11, 14, 16).

A curious division of the distal end of the lowermost radial and its cartilage is present in the pectoral lobe of both known specimens of *Puck* (Fig. 8A), possibly

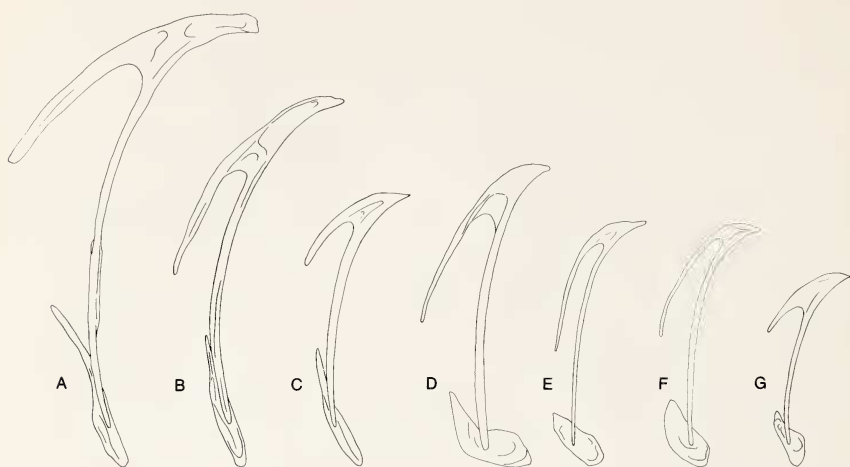


FIGURE 6. Lateral view of opercular bones, right side: A. *Puck pinnata*, SIO H52-363, 66.0 mm; B. *Puck pinnata*, holotype LACM 34276-1, 46.0 mm; C. *Ctenochirichthys longimanus*, paralectotype, BMNH 1932.5.3.20, 36.5 mm; D. *Leptacanthichthys gracilispinis*, ROM 27284, 54.0 mm; E. *Leptacanthichthys gracilispinis*, ROM 27293, 43.0 mm; F. *Leptacanthichthys gracilispinis*, ROM 27274, 41.0 mm; G. *Chirophryne xenolophus*, SIO 70-306, 22.0 mm.

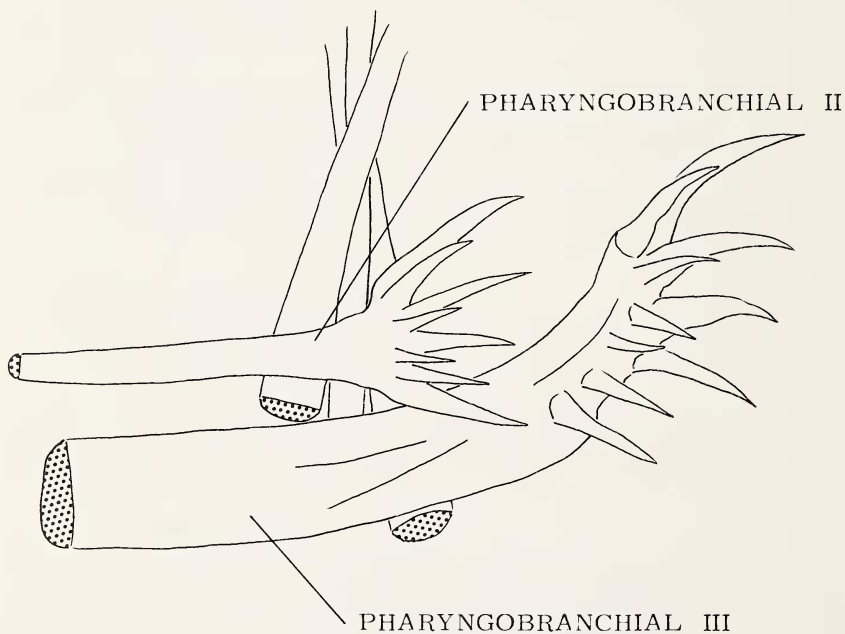


FIGURE 7. Pharyngobranchials of *Puck pinnata*, SIO H52-363, 66.0 mm.

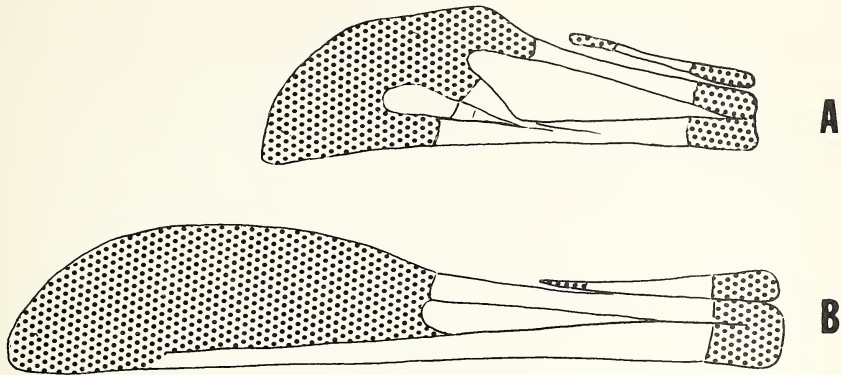


FIGURE 8. Lateral view of pectoral radials, left side: A. *Puck pinnata*, SIO H52-363, 66.0 mm; B. *Ctenochirichthys longimanus*, paralectotype, BMNH 1932.5.3.20, 36.5 mm.

indicating a fusion of two radials (see Pietsch 1972:41-42, fig. 23). All oneirodids are thought to have three pectoral radials, the possible presence of four radials in *Puck* further complicates the already cumbersome diagnosis of the family (Pietsch 1974:30).

Puck, *Chirophryne*, and *Leptacanthichthys* have pectoral-fin ray counts ranging from 18 to 21; *Ctenochirichthys* has considerably more pectoral-fin rays ranging from 28-30 (Table 1).

Skin Spines.—Skin spines could not be detected microscopically in the single osteological preparation of *Puck*.

SYSTEMATICS

KEY TO THE "LONG-PECTORALED" GENERA OF THE ONEIRODIDAE

- 1A. Sphenotic and articular spines short, in some cases not piercing skin (Fig. 11); length of pectoral lobe greater than 15 per cent of SL; pectoral fin rays 27-30*Ctenochirichthys* Regan and Trewavas 1932.
- 1B. Sphenotic and articular spines long, piercing skin (Figs. 9, 14, 16); length of pectoral fin lobe less than 15 per cent of SL; pectoral fin rays 17-212.

TABLE 1
Fin-ray frequencies for "long-pectoraled" genera of Oneirodidae

	Dorsal			Anal			Pectoral (both sides)								
	4	5	6	7	4	5	6	18	19	20	21	—	28	29	30
<i>Puck pinnatus</i>	2				2			4							
<i>Ctenochirichthys longimanus</i>		1	3		3	1							1	2	5
<i>Chirophryne xenolophus</i>	2				2			2	2						
<i>Leptacanthichthys gracilispinis</i>	1	7	2		9	1		1	2	4	7				

- 2A. Length of quadrate spine less than length of mandibular spine (Fig. 5B); dorsal profile of frontal bones nearly linear (Fig. 16); esca with a single appendage arising from dorsal surface (Fig. 17); anal fin rays 5-6
 *Leptacanthichthys* Regan and Trewavas 1932.
- 2B. Length of quadrate spine greater than length of mandibular spine (Fig. 5A); dorsal profile of frontal bones convex (Figs. 9, 14); esca with more than a single appendage, either five separate appendages arising from dorsal surface or three dorsal appendages and a lateral filament (Figs. 10, 15); anal fin rays 4 3.
- 3A. Length of anterior maxillo mandibular ligament greater than one-half length of premaxillary, gape of mouth extending beyond eye (Fig. 3C); suboperculum short and broad, upper end rounded (Fig. 6G); esca without a lateral filament (Fig. 15) *Chirophryne* Regan and Trewavas 1932.
- 3B. Length of anterior maxillo mandibular ligament less than one-half length of premaxillary, gape of mouth terminating before eye (Fig. 3A); suboperculum long and narrow, upper end tapering to a point (Fig. 6A, B); esca with a lateral filament (Fig. 10) *Puck* new genus.

Puck NEW GENUS

Type species.- *Puck pinnata* new species

Diagnosis for females.—A member of the Oneirodidae as diagnosed by Pietsch (1974:30) distinguished by the following combination of characters: snout extremely short, dorsal profile of frontal bones strongly convex, gape of mouth terminating anterior to eye; length of anterior maxillomandibular ligament less than one-half length of premaxillary (Fig. 3A); hyomandibular with a double head; anterior end of pterygiophore of illicium exposed, its posterior end concealed under skin; illicium length 10.7 - 18.5 per cent of SL; lower jaw with a small symphyseal spine; sphenotic spines well developed; articular spines present, quadrate spine nearly six times length of mandibular spine (Fig. 5A); angular spine absent; vomerine teeth present; pharyngobranchial I absent; pharyngobranchials II and III present and toothed (Fig. 7); epi-branchial teeth absent; hypobranchial II present; pectoral-fin lobe long and narrow, longer than the longest rays of pectoral fin (Figs. 8A, 9); suboperculum elongate, slender throughout length, upper end tapering to a point, lower end without anterior spine or projection (Fig. 6A, B); anal fin with 4 rays; skin naked (embedded dermal spines cannot be detected microscopically in bleached and stained skin), covering caudal fin to some distance from fin base.

Puck resembles the oneirodid genera *Ctenochirichthys*, *Chirophryne*, and *Leptacanthichthys* in having an unusually long and narrow pectoral-fin lobe in which the first radial is considerably shorter than the second, and the second ankylosed to the distal expansion of the third (Fig. 8A, B). *Puck* is clearly distinguished from these forms, however, by its extremely short snout, strongly convex frontal bones, and oblique jaw suspension. It is further distinguished from *Chirophryne* and *Leptacan-*

thichthys by having a short anterior maxillomandibular ligament, a short, yet wide mouth (Figs. 3, 13), and an elongate subopercular bone (Fig. 6); and from *Ctenochirichthys* by its well-developed sphenotic and articular spines (Figs. 9, 11, 13).

Males and larvae.—Unknown.

Etymology.—The name *Puck*, to be treated as a noun of feminine gender, is taken from Germanic folklore, a minor order of mischievous devils, sprites, goblins or demons; a devilish trickster.

Puck pinnata NEW SPECIES

Figures 1-3A, 4, 5A, 6A,B, 7, 8A, 9, 10, 13A, 18

Tables 1, 2

Holotype.—LACM 34276-1, 46.0 mm, female; *VITYAZ* Cruise 19, Station 3199, Sample 123b, western north Pacific, 38° 16' N, 152° 34' E; 6 m diameter conical ring net fished open with 5350 m of wire out; bottom depth 5420-5350 m; 0230-0545 hr; 16 October 1954.

Paratype.—SIO H52-363, 66.0 mm, female; *HORIZON*, between Stations SB 101 and 102; Berner, Juhl and Schaefer, collectors; eastern tropical Pacific, 6° 58' N, 88° 35' W; 3 m IKMT, fished open between surface and 1464 m; 1 July 1952.

Description of the holotype.—Escal bulb with a stout, rounded, anterodorsally directed and internally pigmented anterior papilla; a similar, posterodorsally directed medial papilla without internal pigment; distal ends of anterior and medial papillae darkly pigmented; an unpigmented, compressed posterior appendage bearing anterodorsally a lump of tissue of uncertain morphology; and a tapering, unpigmented lateral filament on each side, slightly less than length of escal bulb (Fig. 10).

Operculum bifurcate, the two forks forming an acute angle of 25°; length of lower fork 23.9 per cent of SL, upper fork 72.7 per cent of length of lower fork; length of suboperculum 40.9 per cent of length of lower fork (Fig. 6A, B).

Teeth as described for family; longest tooth in upper jaw 2.0 mm, in lower jaw 3.0 mm; pelvics absent; caudal fin 9 (2 unbranched - 4 branched - 3 unbranched); branchiostegal rays 6 (2 + 4).

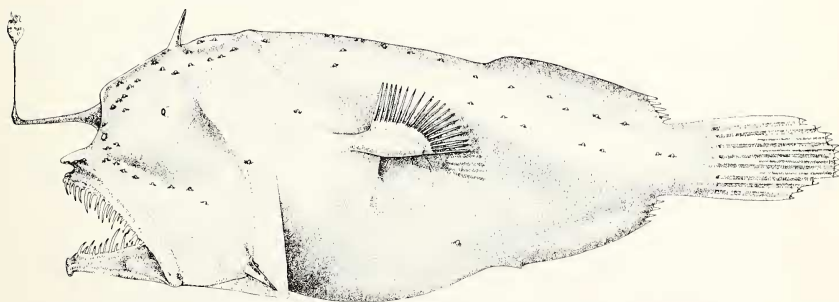


FIGURE 9. Holotype of *Puck pinnata*, LACM 34276-1, 46.0 mm.

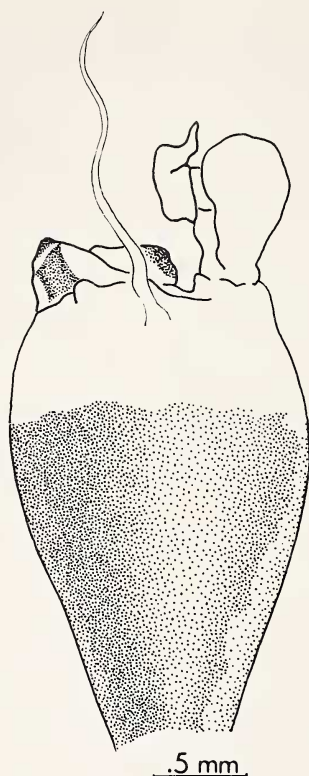


FIGURE 10. Esca of *Puck pinnata*, holotype, LACM 34276-1, 46.0 mm.

Fin ray counts are given in Table 1, tooth counts and body measurements in Table 2.

Etymology.—The specific name is derived from the Latin *pinnata*, meaning plumed or winged, in reference to the narrow, elongate pectoral fins.

Distribution.—*Puck pinnata* is known from two metamorphosed females: the holotype collected from the western north Pacific at 38° 16' N, 152° 34' E, and a second specimen from the eastern tropical Pacific at 6° 58' N, 88° 35' W (Fig. 18).

Ctenochirichthys Regan and Trewavas

Ctenochirichthys Regan and Trewavas 1932:82, pl. III, fig. 3 (type species *Ctenochirichthys longimanus* Regan and Trewavas 1932, by original designation).

Diagnosis for Females (based on two metamorphosed females, 12.5 and 36.5 mm).—The genus *Ctenochirichthys* differs from all other oneirodid genera in having greatly reduced sphenotic and articular spines that, in some cases do not pierce the skin, an extremely elongate pectoral-fin lobe greater than 15 per cent of SL, and a

TABLE 2
Tooth counts and body measurements in percent of SL for "long-pectoral" genera of Oneirodidae

	<i>Puck pimata</i>			<i>Chirophryne xenolophus</i>					<i>Leptacanthichthys gracilispinis</i>					<i>Ctenochirichthys longimanus</i>			
	Holotype			SIO		Holotype		LACM		ROM		Paralectotype		Lectotype		Lectotype	
	LACM 34276-1	SIO H52-363	SIO 70-306	SIO 70-306	ZMUC P9296	LACM 32776-1	LACM 34275-1	LACM 27274	ROM 27293	ROM 1925.8.11.14	BMNH 1925.8.11.14	ZMUC P9295	ZMUC P9297	LACM 33625-2	ROM 27284	ZMUC P9297	BMNH 1932.5.3.20
Standard length in mm	46.0	66.0	11.0	22.0	22.0	27.0	41.0	43.0	43.0	43.0	52.0	54.0	56.0	54.0	52.0	12.5	36.5
Length																	
Head	31.5	31.1	-	36.4	33.2	33.3	31.7	29.1	30.2	30.2	30.8	30.6	29.5	30.6	30.8	-	32.1
Lower jaw	38.0	35.6	-	40.9	34.1	33.3	34.1	26.7	32.7	32.7	32.7	33.3	31.2	33.3	32.7	-	35.6
Premaxillary	26.1	27.3	-	27.3	24.1	22.0	22.0	22.1	22.6	22.6	24.6	-	24.1	24.6	24.6	-	27.4
Illicium	18.5	10.6	22.7	18.2	22.7	24.1	23.2	22.1	23.3	23.3	19.2	24.1	20.5	24.1	19.2	31.2	24.8
Pectoral lobe	12.0	9.1	12.7	13.6	10.0	9.3	8.5	8.1	8.6	8.6	9.0	9.3	7.7	18.4	9.0	18.4	18.4
Sphenotic spine	6.5	7.6	-	10.4	4.1	4.1	4.9	4.6	4.4	4.4	3.6	3.7	4.5	4.4	3.6	-	1.6
Quadrate spine	7.6	6.8	-	11.8	4.5	3.3	3.2	3.0	-	-	-	2.8	3.4	3.4	-	rudimentary	rudimentary
Mandibular spine	1.3	1.4	-	2.0	6.8	5.9	4.9	4.6	4.9	4.9	4.8	4.6	5.7	4.6	4.8	rudimentary	rudimentary
Head depth	35.9	44.7	-	36.4	34.1	33.3	32.9	34.9	30.9	30.9	30.8	31.5	34.8	31.5	30.8	-	33.4
Teeth																	
Vomer	3-3	3-3	4-4	4-4	3-3	5-4	4-4	5-5	6-6	6-6	5-5	5-5	6-6	5-5	5-5	2-2	1-2
Upper jaw	35	47	22	30	52	61	85	70	102	102	81	120	154	17	81	17	37
Lower jaw	24	25	25	34	44	71	74	90	105	105	89	100	106	16	89	16	31

high number of pectoral fin rays, 27 to 30. In addition, *Ctenochirichthys* is unique in having the following combination of characters: snout short, dorsal profile of frontal bones convex; gape of mouth terminating anterior to or beneath eye; length of anterior maxillomandibular ligament less than one-half length of premaxillary (Fig. 3B); hyomandibular with a double head; anterior end of pterygiophore of illicium exposed, its posterior end concealed under skin; illicium length 24.8 - 31.2 per cent of SL; lower jaw with a small symphyseal spine; angular spine absent; vomerine teeth present; pharyngo-branchials II and III present and toothed; epibranchial teeth absent; suboperculum elongate, slender throughout length, upper end tapering to a point, lower end without anterior spine or projection (Fig. 6C); anal fin with 4 or 5 rays; skin presumably naked (bleached and stained skin not available for examination), covering caudal fin to some distance from fin base.

Diagnosis for males and larvae. — See Bertelsen (1951:95).

Ctenochirichthys longimanus Regan and Trewavas
 Figures 3B, 6C, 8B, 11-13B, 18
 Tables 1, 2

Dolopichthys heteracanthus Regan 1926:28 (in part).

Ctenochirichthys longimanus Regan and Trewavas 1932:82, pl.III, fig. 3 (original description; two specimens; lectotype, designated by Bertelsen 1951, ZMUC P9297). Bertelsen 1951:75, 94-96, figs. 51-52, table 16 (redescription of type material; males and larvae described; opercular bones, larval male, adolescent male, and lectotype figured; in key). Grey 1956:251 (synonymy; distribution). Bussing 1965: 222 (misidentification, specimen here referred to *Pentherichthys atratus*). Pietsch 1974:31, 32, 89, table 23 (relationships; in key).

Trematorhynchus multiradiatus Beebe and Crane 1947: 166, text fig. 11 (original description; single male specimen; CAS-SU 46491). Bertelsen 1951:95, fig. 52B (redescription; comparison with all known material; figured).

Material. — Two females, 12.5 - 36.5 mm, two larval males, 4.5 - 5.0 mm, and a single adolescent male, 11.5 mm.

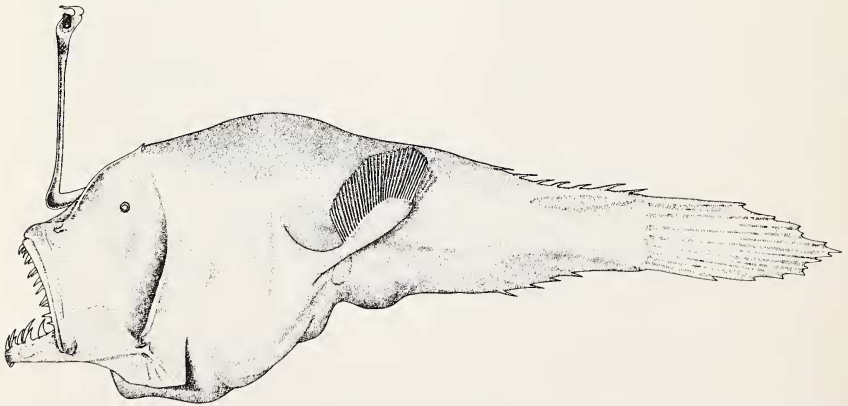


FIGURE 11. Paralectotype of *Ctenochirichthys longimanus*, BMNH 1932.5.3.20, 36.5 mm.

Lectotype of *Ctenochirichthys longimanus*.—ZMUC P9297, 12.5 mm; *DANA* Station 3548 (2); Gulf of Panama, 7° 06' N, 79° 55' W; 3000 m wire; 1030 hr; 3 September 1928.

Paralectotype of *Ctenochirichthys longimanus*—BMNH 1932.5.3.20, 36.5 mm; *DANA* Station 1206 (5); Gulf of Panama, 6° 40' N, 80° 47' W; 2500 m wire; 1845 hr; 14 January 1922.

Holotype of *Trematorhynchus multiradiatus*.—CAS-SU 46491, 11.5 mm; Eastern Pacific *ZACA* Expedition Station 225, Net No. T-1; 11 miles southwest of Jicaron Island, Panama, 7° 08' N, 81° 57' W; 1 m diameter conical ring net, 0-910 m; 20 March 1938.

Non-type material.—ZMUC P92795, 5.0 mm; *DANA* Station 3548(7); Gulf of Panama, 7° 06' N, 79° 55' W; 100 m wire; 2000 hr; 3 September 1928. ZMUC

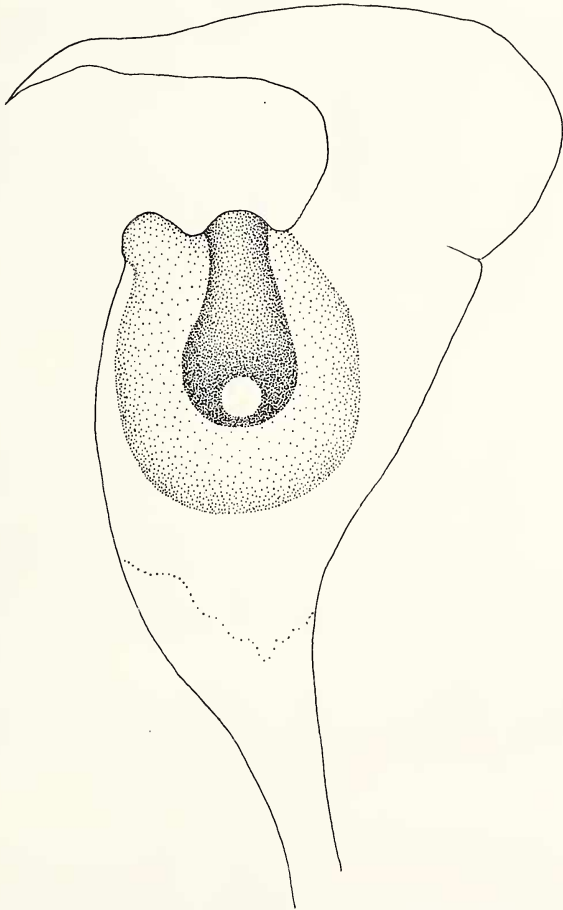


FIGURE 12. Esca of *Ctenochirichthys longimanus*, lectotype, ZMUC P9297, 12.5 mm.

P92794, 4.5 mm; DANA Station 1141(14); eastern north Atlantic, 34° 15' N, 16° 53' W; 300 m wire; 2355 hr; 14 October 1921.

Description of females.—Escal bulb with a short, rounded anterior appendage; a darkly pigmented, raised band of tissue extending over dorso-medial surface and down onto sides of bulb with a circular unpigmented area on each side; an unpigmented, compressed, tapering posterior appendage; lateral filaments absent (Fig. 12).

Operculum bifurcate, the two forks forming an acute angle of 38°; length of lower fork 21.9 per cent of SL, upper fork 52.5 per cent of length of lower fork; length of suboperculum 51.2 per cent of length of lower fork of operculum (Fig. 6C).

Teeth as described for family; pelvics absent; caudal fin 9 (2 unbranched-4 branched - 3 unbranched); branchiostegal rays 6 (2 + 4). Fin ray counts are given in Table 1, tooth counts and body measurement in Table 2.

Distribution.—*Ctenochirichthys longimanus* is known from five specimens, four of which were collected in the Gulf of Panama. The fifth specimen, a larval male, was taken in the eastern north Atlantic at 34° 15' N, 16° 53' W (Fig. 18).

Chirophyryne Regan and Trewavas

Chirophyryne Regan and Trewavas 1932:81-82, figs. 131-132 (type species *Chirophyryne xenolophus* Regan and Trewavas 1932, by original designation).

Diagnosis for females (based on two metamorphosed specimens, 11.0 and 22.0 mm).—*Chirophyryne* differs from other oneirodid genera in having the following combination of characters: snout moderate in length, dorsal profile of frontal bones convex; gape of mouth extending past eye; length of anterior maxillomandibular ligament greater than half length of premaxillary (Fig. 3C); hyomandibular with a double head; anterior end of pterygiophore of illicium exposed, its posterior end concealed under skin; illicium length 18.2 - 22.7 per cent of SL; lower jaw with a small symphyseal spine; sphenotic spines well developed; articular spines present, quadrate spine nearly six times length of mandibular spine; vomerine teeth present; pharyngobranchials II and III present and toothed; epibranchial teeth present; pectoral-fin lobe long and narrow, longer than the longest rays of pectoral fin; suboperculum short and broad, upper end rounded, lower end without anterior spine or projection (Fig. 6G); anal fin with 4 rays; skin presumably naked (bleached and stained skin not available for examination), covering caudal fin to some distance from fin base.

Males and larvae.—Unknown.

Chirophyryne xenolophus Regan and Trewavas

Figures 3C, 6D, 13C, 14, 15, 18

Tables 1, 2

Chirophyryne xenolophus Regan and Trewavas 1932:81-82, figs. 131-132 (original description; single specimen; holotype ZMUC P9296). Bertelsen 1951:75, 94, fig. 50 (redescription of holotype; opercular bone figured; in key). Grey 1956:250-251 (synonymy; distribution). Pietsch 1974:31, 32, 89, table 23 (relationships; in key).

Material.—Two adolescent females, 11.0 - 22.0 mm.

Holotype.—ZMUC P9296, 11.0 mm; *DANA* Station 3731(12); South China Sea, 14° 37' N, 119° 52' E; 2500 m wire; 0200 hr; 17 June 1929.

Non-type material.—SIO 70-306, 22.0 mm; ANTIPODES Expedition Station 4-51A, Trawl 1; 32° 10' N, 136° 05' E; 0-1400 m; 2355-0746 hr; 28-29 August 1970.

Description of 22.0 mm female.—Escal bulb with an unpigmented, tapering anterior appendage connected by a thin membrane to an internally-pigmented antero-

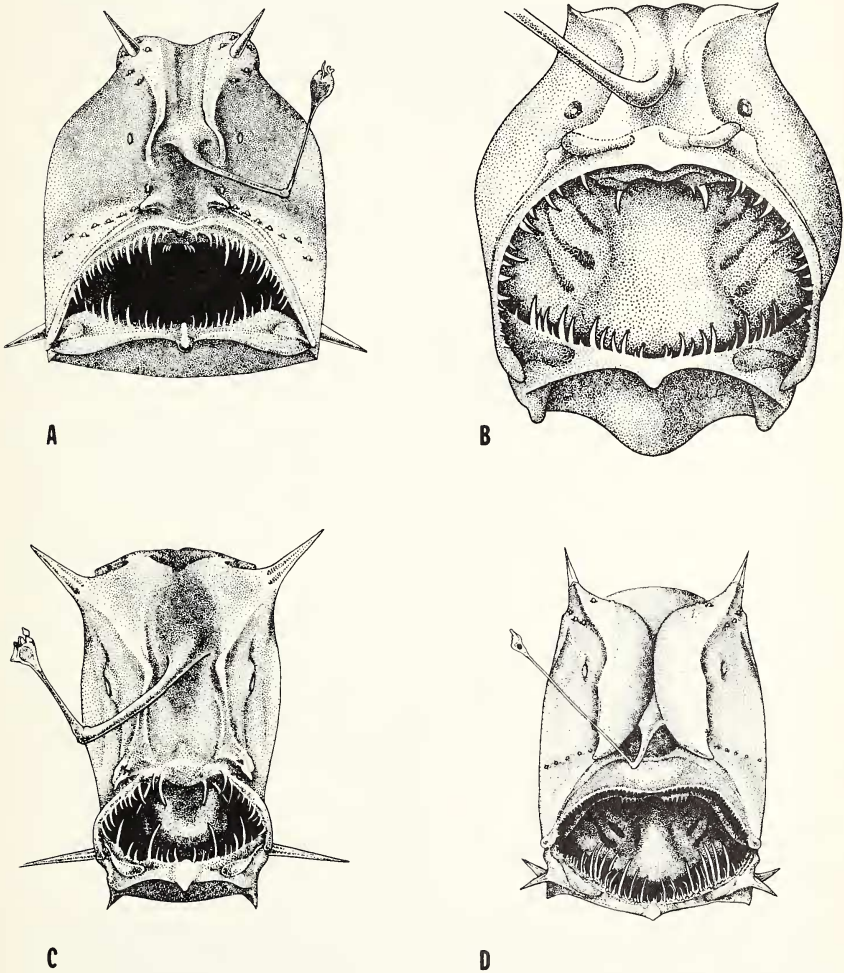


FIGURE 13. A. *Puck pinnata*, holotype, LACM 34276-1, 46.0 mm; B. *Ctenochirichthys longimanus*, paralectotype, BMNH 1932.5.3.20, 36.5 mm; C. *Chirophryne xenolophus*, SIO 70-306, 22.0 mm; D. *Leptacanthichthys gracilispinis*, LACM 33625-2, 56.0 mm.

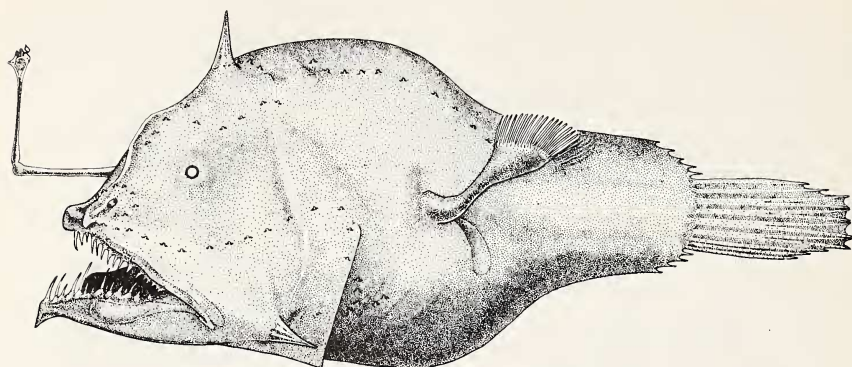


FIGURE 14. *Chirophryne xenolophus*, SIO 70-306, 22.0 mm.

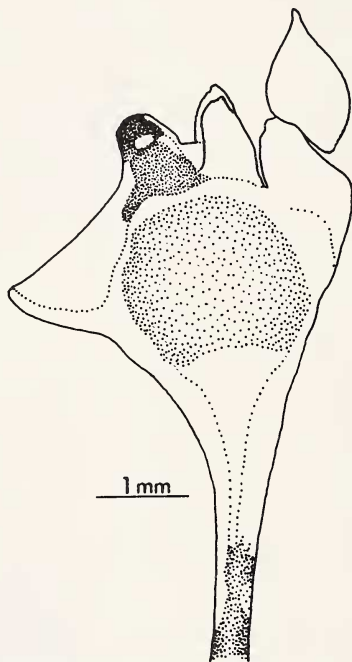


FIGURE 15. Esca of *Chirophryne xenolophus*, SIO 70-306, 22.0 mm.

dorsal appendage that is darkly pigmented on distal tip except for a small, circular, unpigmented area on each side; a pair of bilaterally placed, unpigmented medial appendages; an unpigmented, compressed, posterior appendage bearing distally a rounded lump of tissue that tapers to a point; lateral filaments absent (Fig. 15; Regan and Trewavas 1932:82 fig. 132).

Operculum bifurcate, the two forks forming an acute angle of 37°; length of lower fork 25.4 per cent of SL, upper fork 55.2 per cent of length of lower fork; length of suboperculum 32.5 per cent of length of lower fork of operculum (Fig. 6G).

Teeth as described for family; longest tooth in upper jaw 0.5 mm; in lower jaw 1.0 mm; pelvics absent; caudal fin 9 (2 unbranched - 4 branched - 3 unbranched); branchiostegal rays 6 (2 + 4).

Fin ray counts are given in Table 1, tooth counts and body measurements in Table 2.

Distribution.—*Chirophryne xenolophus* is known from two adolescent females: the holotype collected from the South China Sea and a second specimen from off Japan at 32° 10' N, 136° 05' E (Fig. 18).

Leptacanthichthys Regan and Trewavas

Dolopichthys (subgenus *Leptacanthichthys*) Regan and Trewavas 1932:66, 80, fig. 128 (genus *Dolopichthys* broadened to incorporate five subgenera, amended by Bertelsen 1951; type species *Dolopichthys gracilispinis* Regan 1925, by monotypy).

Leptacanthichthys Bertelsen 1951:74, 94, fig. 49 (subgenus *Leptacanthichthys* given generic status; type species *Dolopichthys gracilispinis* Regan 1925, by monotypy).

Diagnosis for females (based largely on osteological evidence presented by Pietsch 1974).—The genus *Leptacanthichthys* differs from other oneirodids by having a well-developed mandibular spine that is considerably longer than the quadrate spine (Fig. 5B). In addition, *Leptacanthichthys* is unique in having the following combination of characters: snout long, dorsal profile of frontal bones nearly linear; gape of mouth extending past eye; length of maxillomandibular ligament greater than half length of premaxillary (Fig. 3D) hyomandibular with a double head; anterior end of ptergiophore of illicium exposed, its posterior end concealed under skin; illicium length 19.2 - 24.1 per cent of SL; lower jaw with a small symphyisial spine; sphenotic spines well developed; angular spines absent; vomerine teeth present; pharyngobranchial I absent; pharyngobranchials II and III present and toothed; epibranchial teeth absent; hypobranchial II present; pectoral-fin lobe long and narrow, longer than the longest rays of pectoral fin; suboperculum short and broad, upper end rounded to bluntly pointed, lower end without anterior spine or projection (Fig. 6D-F) anal fin with 5 rays, rarely 6; skin naked (embedded dermal spines cannot be detected microscopically in bleached and stained skin), covering caudal fin to some distance from fin base.

Diagnosis for males (based on a single known male in late metamorphosis, parasitically attached to a sexually mature female, LACM 33625-2; Pietsch 1976 figs. 2-5).—Posterior nostril well separated from eye; upper end of suboperculum rounded; 6 lower denticles; gill cover pigmented with slightly darker pigmentation along posterior margin of suboperculum; dorsal pigment restricted to upper part of body extending beneath base of dorsal fin and just past anterior base of anal fin with a more heavily pigmented dorsal and ventral group of melanophores near hypural plate; peritoneum pigmented.

Larvae.—Unknown.

Leptacanthichthys gracilispinis (Regan)

Figures 3D, 5B, 6E-H, 13D, 16-18

Tables 1, 2

Dolopichthys gracilispinis Regan 1925:563 (original description; two specimens; lectotype designated by Bertelsen 1951, ZMUC P9295). Regan 1926:27, 30, pl. V, fig. 2 (brief description after Regan 1925; in key).

Dolopichthys (*Leptacanthichthys*) *gracilispinis* Regan and Trewavas 1932:66, 80 fig. 128 (genus *Dolopichthys* broadened to incorporate five subgenera, amended by Bertelsen 1951; description after Regan 1925, 1926; in key).

Leptacanthichthys gracilispinis Bertelsen 1951:74, 94, fig. 49 (subgenus *Leptacanthichthys* given generic status; description; in key). Grey 1956:250 (synonymy; distribution). Pietsch 1974:16-32, 82, 86-89, Figs. 22, 34, 39c, 42, 51c, 55, 59, 103, 104, tables 23, 24 (osteology; relationships, esca figured; in key).

Material.—Thirteen females, 10.5-56.0 mm, and a parasitic male in late metamorphosis, 7.5 mm.

Lectotype.—ZMUC P9295, 52.0 mm; *DANA* Station 1206(3); Gulf of Panama, 6° 40' N, 80° 47' W; 3500 m wire; 1845 hr; 14 January 1922.

Paralectotype.—BMNH 1925.8.11.14, 43.0 mm; *DANA* Station 1358(5); north Atlantic, 28° 15' N, 56° 00' W; 3000 m wire; 1530 hr; 2 June 1922.

Non-type material.—ROM 27284, 54.0 mm; *BRANDAL* Tow 20; 43° 23' N, 52° 30' W; Engel trawl, 0-1050 m; 25 July 1968. ROM 27293, 43.0 mm; *BRANDAL* Tow 22; 44° 00' N, 57° 52' W; Engel trawl, 0-1000 m; 26 July 1968. ROM 27274, 41.0 mm; *BRANDAL* Tow 14; 46° 00' N, 44° 30' W; Engel trawl, 0-1000 m; 18 July 1968.

LACM 33625-2, female, 56.0 mm, with parasitic male, 7.5 mm; *VELERO IV* Station 19009; 8° 10' N, 86° 00' W; 3 m IKMT, 0-750 m; 0625 hr; 24 May 1973. LACM 34275-1, 27.0 mm; *VITYAZ* Cruise 24, Station 3573, Sample 50; 38° 04' N, 144° 13' E; 1.6 m conical ring net, 0-3000 m; bottom depth 5660-5760 m; 0950-1530 hr; 4 May 1957. LACM 32776-1, 22.0 mm; *TERITU* Cruise Blood, Sweat, and Tears, Sample 70-7-6; 21° 20'-30' N, 158° 20-30' W; 2 m IKMT, 0-1250 m; 0746-1200 hr; 6 July 1970.

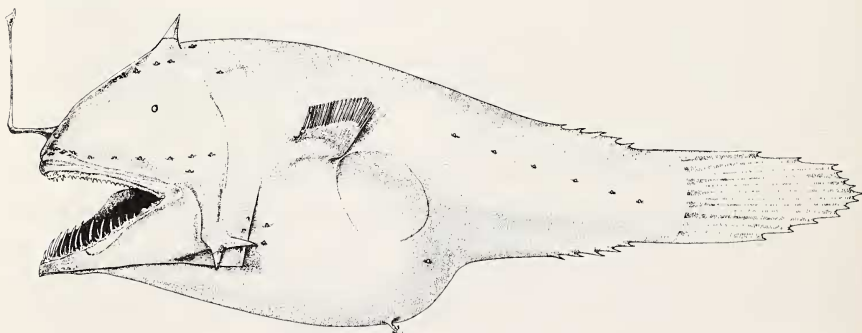


FIGURE 16. *Leptacanthichthys gracilispinis*, LACM 33625-2, 56.0 mm. Stalk of tissue protruding from belly bears embedded bones of upper jaw of a parasitic male (see Pietsch 1976).

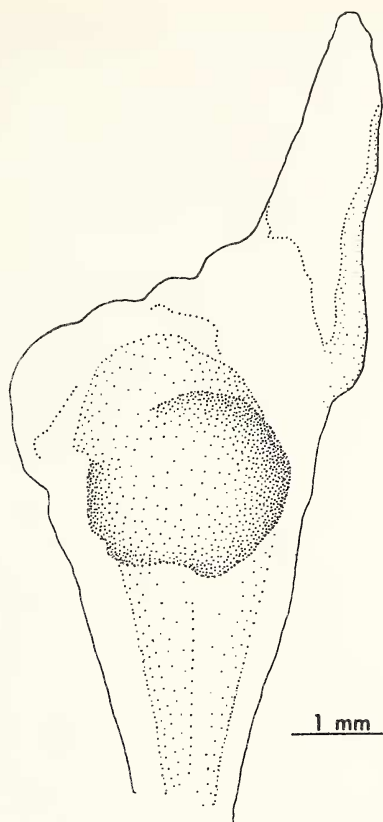


FIGURE 17. Esca of *Leptacanthichthys gracilispinis*, LACM 32776-1, 22.0 mm.

SIO 60-235, 13.0 mm; TETHYS Expedition; 0° 08.5' S, 138° 50.9' W; 0-2100 m; 3 - 4 July 1960. SIO 68-476, 10.5 mm; STYX Expedition VII-40; 22° 00' N, 171° 40' E; 3 m IKMT, 0-1250 m; bottom depth 3660 m; 0640-1300 hr; 15 September 1968.

CAS-SU 43423, 14.0 mm; GLADISFEN Net 874; 32° 12' N, 64° 36' W; 11 September 1930.

IOS uncatalogued, 12.5 mm; DISCOVERY II 8281-37; 31° 48' N, 63° 37' W; Rectangular Midwater Trawl with closing device, 1240-1265 m; 0200-0500 hr; 19 March 1973.

MCZ 50705, 12.5 mm; ATLANTIS II Cruise 49, RHB 1939; 40° 22' N, 58° 51' W; 3 m IKMT, 0-1040 m; 1235-1440 hr; 8 July 1969.

Description of females.—Escal bulb with a darkly pigmented streak on dorsal surface, and an unpigmented, compressed posterior appendage; anterior and lateral appendages absent (Fig. 17; Regan and Trewavas 1932:80 fig. 128).

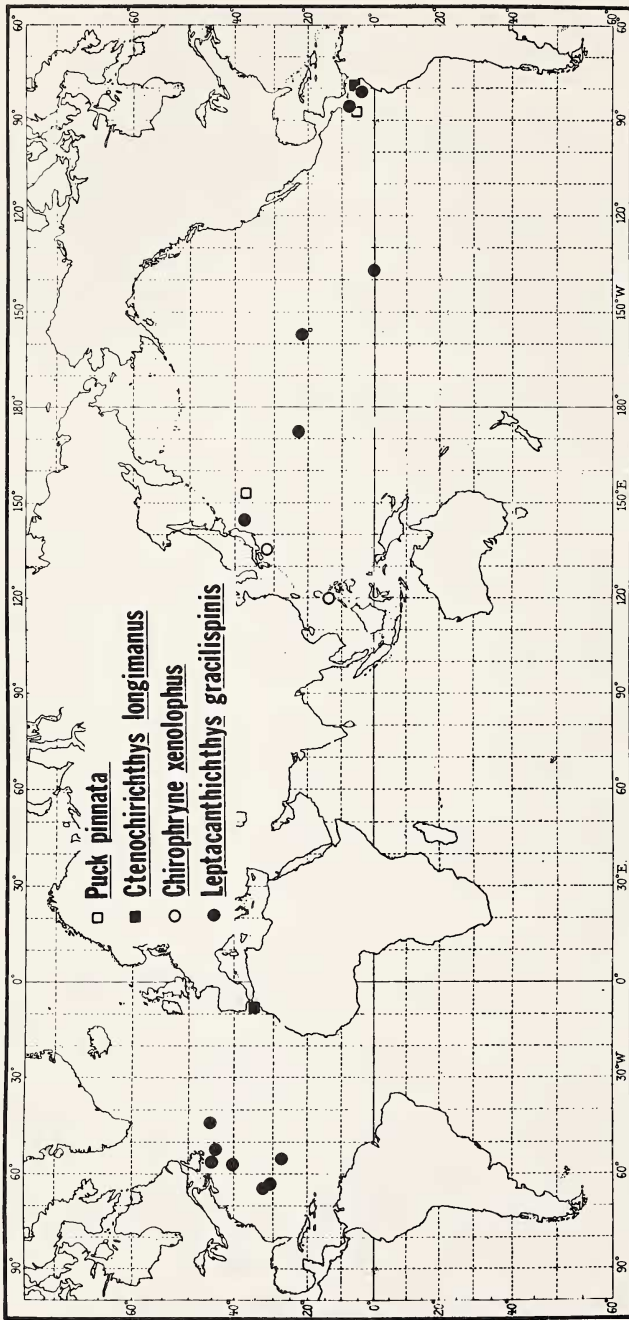


FIGURE 18. Distributions of "long-pectored" oneirodid genera. A single symbol may indicate more than one capture.

Operculum bifurcate, the two forks forming an acute angle of 18° to 27°; length of lower fork 18.1-19.5 per cent of SL; length of lower fork 64.4-70.5 per cent of length of lower fork; length of suboperculum 29.5-37.5 per cent of length of lower fork of operculum (Fig. 6D-F).

Teeth as described for family; D. 4-6, of 10 specimens counted one had D.4; A.5-6, P. 18-21, of 8 specimens counted, one had P.18; pelvics absent; caudal fin 9 (2 unbranched - 4 branched - 3 unbranched); branchiostegal rays 6 (2 + 4).

Fin ray counts are given in Table 1, tooth counts and body measurements in Table 2.

Distribution.—In the Atlantic Ocean, *L. gracilispinis* seems to be restricted to waters off the continental slope of North America where about one-half of the known material has been collected between 28° and 46° N, as far east as 44° W. The remaining material is from the north Pacific where it ranges from off Japan to the Gulf of Panama (Fig. 18). Ninety-two per cent of the known material was captured by gear fished below 1000 m; 62 per cent by gear fished below 1200 m.

DISCUSSION

The ceratioid family Oneirodidae is by far the largest and most diverse of the 11 deepsea anglerfish families, but probably remains the least well known. With the addition of *Puck*, 15 oneirodid genera are now recognized. Eleven of these genera consist of a single species and of these, nine are based on only one or two adolescent or adult females. The addition of yet another monotypic genus based on two female specimens is justified, however, as this new form clearly cannot reasonably be placed within any previously described genus. *Puck*, *Ctenochirichthys*, *Chirophryne*, and *Leptacanthichthys* share an unusually elongate pectoral-fin lobe that bears the fin rays along its dorsal margin. A similar arrangement is not found in any other ceratioid; it is mainly because of the common occurrence of this derived character complex that these four genera are thought to form a natural assemblage. Within this group of four genera, *Puck* appears to be most closely related phylogenetically to *Ctenochirichthys*. These two genera share a modification of the jaw mechanism in which the gape of the mouth is considerably shorter, but at the same time, wider, relative to other oneirodids. In addition, *Puck* and *Ctenochirichthys* share an elongate suboperculum, unlike the short and broad suboperculum of *Chirophryne* and *Leptacanthichthys*.

Puck appears to be intermediate in many ways between more generalized oneirodid genera, especially *Danaphryne*, and the other three, more specialized "long-pectoralized" genera. *Puck* is similar to *Danaphryne* and unlike *Leptacanthichthys* in the shape and relative size of the bones of the ethmoid region, in the shape and position of the frontals, and in the length and depth of the cranium and elements of the mandibular, palatine, and hyoid arches. *Puck*, on the other hand, shares the specialized pectoral lobe with *Ctenochirichthys*, *Chirophryne*, and *Leptacanthichthys* as well as the modification of the jaw mechanism of *Ctenochirichthys*.

Although apparently most closely related to *Puck*, probably the least derived of the four "long-pectoralized" genera, *Ctenochirichthys* is considered the most derived

member of the group in having reduced sphenotic and articular spines, a reduced number of vomerine teeth, a considerably more elongate pectoral lobe, a secondarily derived increase in the number of pectoral-fin rays, and a more elongate illicium.

Little can be said concerning relationships of *Chirophryne*, known from only two small, adolescent females. It is perhaps intermediate between *Puck* and *Ctenochirichthys* on one hand, with which it shares convex frontal bones, and *Leptacanthichthys* on the other, with which it shares a similar jaw mechanism and similarly-shaped subopercular bones.

Leptacanthichthys is derived and unique among "long-pectoraled" oneirodid genera in having a nearly linear profile of the frontal bones; it is unique among oneirodids in having a well-developed mandibular spine that is considerably longer than the quadrate spine.

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