THE CERATIOID FISHES IN THE COLLECTION OF THE MUSEU MUNICIPAL DO FUNCHAL (MELANOCETIDAE, HIMANTOLOPHIDAE, ONEIRODIDAE, LINOPHRYNIDAE)

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With 32 figures and 4 tables in the text

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Abbreviations used

an	angular	*op*	operculum
ang	angular	*p*	parietal
b	basal bone of illicium	*pal*	palatine
b. b. il	basal bone of illicium	*pcl*	post-cleithrum
ch	ceratohyal	*pmx*	praemaxillary
cl	cleithrum	*po*	praeoperculum
cor	hypocoracoid	*pop*	praeoperculum
den	dentary	*ps*	parasphenoid
ecp	ectopterygoid	*pto*	pterotic
enp	entopterygoid	*ptte*	posttemporal
eoc	exoccipital	*pv*	pelvic bone
ep	epi-hyal	*q*	quadrate
epo	epiotic	*r*	radials
f	frontal	*sc*	scapula
hm	hyomandibular	*scl*	supracleithrum
i_1	first illicium	S.L.	standard length
i_2	second illicium	*soc*	supra-occipital
ih	inter-hyal	*sop*	suboperculum
iop	interoperculum	*spo*	sphenotic
meth	mesethmoid	*sy*	symplectic
mp	metapterygoid	T.L.	total length
mx	maxillary	*v*	vomer
		vom	vomer

I. INTRODUCTION

It is not surprising that Angler-fish do not easily take a bait. Their plump bodies, their softness, the flabbiness of their muscles indicate a sluggish and passive way of life. These fishes obviously do not swim about actively pursuing other animals for food. On the contrary, they keep motionless for long periods—except perhaps for a gentle movement of their lure—waiting for animals attracted by the light of their esca waving in the water. Thus, of the 28 adult or adolescent specimens of Ceratioids in the Museum's collection only 4 have possibly been taken on the long lines of Madeira's fishermen. The latter were acquired at the local fish market and judging by their state of preservation or size cannot have been part of the stomach content of other fish. Their having been taken on hooks is, however, questionable as they show no sign of the usual tear or perforation in the mouth, and it is possible that they were picked up at the surface, for it is not very unusual that deep-sea fish are accidentally forced up or, possibly, come up of their own accord. All the remaining specimens (43 including the larvae) were taken from the stomachs of *Aphanopus carbo* and *Alepisaurus ferox*.

Though only very few are new to science, the collection is nevertheless interesting as some of the species are only known from one or two specimens and, in the case of the genus *Himantolophus*, findings of certain diagnostic characters of the formation of the esca, to distinguish the specimens at hand from one another, may help to throw some light on the synonymy within this genus.

One of the specimens included here belongs to a collection of the Museu do Seminário and I would like here to express my thanks to Canon Barreto, the Director, for the loan of it. Others who have been most helpful with advice and information of all sorts are Dr. E. Trewavas of the British Museum (Natural History) and Dr. E. Bertelsen of the Marinbiologisk Laboratorium of Charlottenlund Slot. To both of them my most grateful thanks. I would further like to thank Dr. Tokiharu Abe (Zoological Institute, University of Tokyo), Mr. Alfred Ebeling (Bingham Oceanographic Laboratory) and Mr. Luiz Saldanha of Lisbon for information regarding specimens in foreign collections or sending me photocopies of rare papers.

In the following account references to authors are only followed by the date of publication of their respective papers where more than one paper is noted in the list of literature (p. 157).

II. SYSTEMATIC ACCOUNT WITH REMARKS ON THE BIOLOGY AND SPECIAL MORPHOLOGY OF THE LUMINOUS BULB IN THE GENUS *HIMANTOLOPHUS*.

Family 1. ***Melanocetidae***

This family, at one time consisting of 5 genera, has been reduced to one single genus, *Melanocetus*, by Bertelsen. The latter was able to show that the male specimens referred to *Centrocetus* and *Xenoceratias* of Regan & Trewavas and *Rhynchoceratias* of Parr (1927) formed a natural development series belonging to the genus *Melanocetus*. Günther's (1887) sub-genus *Liocetus* [later raised to genus by Goode & Bean] erected for the single species *murrayi* was based on the alleged absence of vomerine teeth. Later, Regan (1926), however, on re-examining the type, found one well developed and two smaller teeth, so that the sub-genus (or genus) *Liocetus* became invalid.

Genus A. ***Melanocetus***

There are 6 specimens (all taken from the stomachs of *Aphanopus carbo*) belonging to *Melanocetus* in the collection:—Reg. No. 16398, good condition, S. L. 24.3mm., 1. X. 59; Reg. No. 4351, fair condition, S. L. abt. 60mm., 19.IV.54; Reg. No. 6205, very poor condition, S. L. abt. 80mm., 25.VII.55; Reg. No. 8645, very poor condition, S. L. abt. 80mm., 19.VI.56; Reg. No. 3602, fair condition, S. L. 91mm., 2.II.53; Reg. No. 15460, poor condition, S. L. 101mm., 19.II.59.

Bertelsen lists 9 species of *Melanocetus*. Three of these, *M. murrayi* Günther 1887, *johnsoni* 1864 and *polyactis* Regan 1925, are known from fully developed females as well as from larvae; 4 species, *M. megalodontis* Beebe & Crane 1947, *niger* Regan 1925, *ferox* Regan 1926, and *cirrifer* R. & T. 1932, are known from females only, lastly, *M. longirostris* (R. & T. 1932) and *nudus* (Beebe & Crane 1947), are only known from males. The only species he recognizes without any reserve are those represented by males, females and larvae, and a female species represented by 11 specimens from the «Dana» and 4 females recorded by Beebe & Crane. The two known from males he believes may probably belong to one of the species described only from females.

Only *M. johnsoni* and *murrayi* are known from larger numbers of specimens, and they are also the only ones so far found in the Atlantic

Ocean. The former commonly from both the North East and North West Atlantic (Madeira being the type locality), the latter being common in the North West Atlantic and Caribbean Sea and quite rare in the North East Atlantic. The 6 specimens belonging to the genus *Melanocetus* in our collection are, therefore, likely to belong, *a priori*, to *M. johnsoni*, but only 3, Nos. 16398, 4351 & 3602, can be identified as such with certainty, whereas the remaining 3 are too badly damaged for identification.

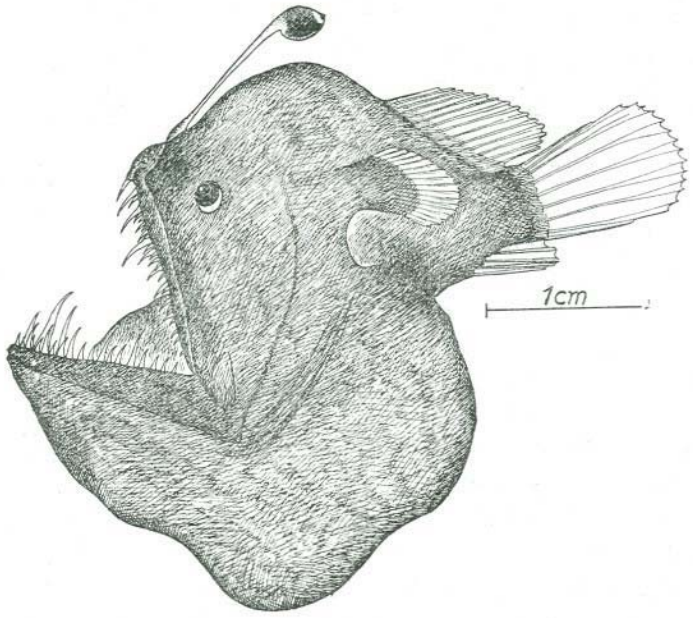

Fig. 1. — *Melanocetus johnsoni;* Reg. No. 16398.

1. ***Melanocetus johnsoni*** Günther

Fig. 1.

Melanocetus johnsoni Günther, 1864, Proc. Zool. Soc., p. 301, pl. XXV [not seen]; 1887, Rep. Sci. Res. Voy. Challenger Zool. vol. XXII, p. 56.*

The smallest specimen, No. 16398 (fig. 1), is almost completely undamaged. Its counts and percentages are the following: — D 14; P 17. In-

* For further synonymy see Bertelsen (p. 48)

terorbital width 60 °/₀ of post-orbital width.* As °/₀ of S. L.:—lower jaw 66; longest tooth 17.5; length of illicium 39; diameter of esca 8.2. The shape and pigmentation of the esca is in complete agreement with the description of it for *M. johnsoni* by Bertelsen.

Of the other two identifiable specimens the next in size is No. 4351. Its esca is squashed and unsuitable for measurements. The skin on the body is also badly torn in some places, but the fins are intact and measurements could be taken. The counts and percentages are the following:— D 14; P 18. Interorbital width 54 °/₀ of post-orbital width.* As °/₀ of S. L.:—lower jaw 54; longest tooth 16; length of illicium 44.

In No. 3602 nearly all the skin has disappeared through the action of the gastric juices, but otherwise all characters necessary for identification are intact. Its counts and percentages are as follows:—D 15; P 18. Interorbital width 54.7 as °/₀ of post-orbital width.* As °/₀ of S. L.:—lower jaw 50; longest tooth 11. 5; length of illicium 49. 4.

Comparing the above results with the characters of females given in Bertelsen's table 4 they clearly show that they are well within the ranges of variation given for their respective size groups.

Family 2. ***Himantolophidae***

Adult or adolescent female Himantolophids still belong to the great rarities of ichthyological collections. Up to 1951, the date when Bertelsen's work on the Ceratioid fishes was published, only just over 30 in all had been recorded.

The genus *Diceratias*, grouped in this family by Regan in 1925, has since then been assigned to another family, the Diceratiidae. Girard (1893) and Regan (1926) conclude that Reinhardt must have erroneously counted bifid rays as 2 when describing the type of *Himantolophus groenlandicus*. In fact, in all the existing material of Himantolophids, consisting of over 300 larval and grown specimens, none have been found with more than 6 dorsel rays. Bertelsen considers that with this weighty evidence Girard's and Regan's conclusions are essentially confirmed. The erection of the species *reinhardti* for one with a markedly lower fin-ray count by

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* After Bertelsen's method (see Bertelsen, p. 41. Footnote to table 4): Interorbital width between edges of frontals, postorbital width between edges of sphenotics.

Lütken (1878) is therefore not justified, so that his genus *Corynophorus*, erected for this species, has fallen into the synonymy of *Himantolophus*, together with Osório's *Corynolophus* 1909 which shows no characters to justify a seperation. Since Bertelsen showed that the males divided by Regan & Trewavas into two genera, *Lipactis* and *Rhynchoceratias*, also belong to *Himantolophus*, this family is left with one single genus.

Genus A. ***Himantolophus***

The *Himantolophus* males from the Atlantic described as *Lipactis tumidus* and *Rhynchoceratias brevirostris* by Regan (1925) and *R. altirostris* by Regan & Trewavas were all considered to be ontogenetic development stages of *Himantolophus groenlandicus* and thus the Atlantic Himantolophids were reduced to one single species. Our material, however, shows that there are at least 4 species, separated by characters that leave no doubt as to their validity. It is hoped to demonstrate this in the following.

The formation of the esca and appendages has been used extensively by Regan and Trewavas as a taxonomic character and though it has proved to be most valuable as such, Bertelsen considers that the significance of smaller details was somewhat exaggerated. Thus, naturally, the number of tentacles or their branchings or lengths are bound to vary in ontogeny and individually, even after all the essential parts of the esca have been fully formed.

It remains to explain now what are to be considered essential characters. Regan (1926) describes the esca of a small specimen, measuring 47 (33+14) mm. in total length, as «ending in a disc with 4 divergent lobes». Posteriorly it bears one single filament which obviously is the first representative of the tentacles of older stages. Regan & Trewavas mention a further, slightly larger specimen measuring 53 (36+17) mm. Though they do not mention the «divergent lobes», their presence can be taken for granted as the specimen is said to be somewhat more advanced than the former, having a pair of bifid tentacles below the base of the bulb and rudiments of another pair, and a pair of distal appendages. The absence of the «divergent lobes», under these circumstances, would certainly have been mentioned. From this one may conclude that fully developed swellings («divergent lobes») on the bulb represent the first stage; morphologically, and probably functionally a more essential character of the illicium, as the number and shape of these swellings is laid down in

early development and does not increase with age or growth of the animal. The pore through which the «Vorraum»* opens on the surface of the esca is obviously part of a mechanism linked with an essential function and is almost certain to be among the first characters to develop.

It is difficult to tell what the function of the swellings may be. The action of bellows to squirt out luminous clouds through the pore suggests itself. But Brauer (1908) found no sign of muscle fibres when making a histological examination of the luminous bulb of metamorphosed specimens of *Gigantactis vanhoeffeni* and *Dolopichthys niger*. The bulb of our large specimen had a small shallow cut across one of the swellings. On making this cut deeper and longer, so as to go through one swelling and the pore and deep enough to get down to the gland, revealed that the gland is surrounded by a mantle of black pigment only as far up as the bases of the swellings. The swellings themselves are not hollow, as would be necessary for them to act as bellows, but are filled with a vitreous mass of the consistancy of soft cartilage, rather similar to what was found in the gland below the pigment mantle and also inside the tentacles, only in the latter it was harder. Nor is there any sign of muscle fibres. The great transparency of this vitreous mass can be observed without dissection in the adolescent specimen because the epithelium covering the swellings is completely transparent, whereas in the adult specimen it is milky opaque. The only function it seems possible to attribute to the swellings is, therefore, that of prisms to scatter the light produced by luminous matter that has passed through the opening of the gland into the «Vorraum», or vestibule.

On fresh specimens a milky liquid can be made to come out of the pore of the esca by the excertion of slight pressure on the bulb. It is most likely that the passing of liquid matter produced in the gland also takes place in life, and it is also highly probable that this matter is luminous thus forming a luminous cloud. However, in the absence of muscles a quick formation of a cloud can only be brought about by an accelerated production of this liquid in the gland and not by contraction.

To come back to the significance of the swellings as a taxonomic character, considering the specimens that have been referred to *H. groenlandicus*, not only by virtue of the similarity in structure of their light or-

*Designation used by Brauer (1908) for a wide, but flat chamber between the gland and the outer wall of the bulb, into which the opening of the gland leads.

gans but also by the similarity of all other morphological characters, one is struck by the likeness of the formation of what we have called the essential parts of the esca. Obviously, this is not to say that the tentacles, when developed, are devoid of taxonomic significance. On the contrary, also here important analogies among different individuals of the same species are found. In *H. groenlandicus*, for instance, there always is the single anterior and posterior one, whatever length or shape they may be. Furthermore, there always are the posterior paired tentacles, somewhat varying in length and complexity of ramification, and the two distal appendages placed between the 4 swellings are very characteristic. Even though it has been observed that all these tentacles and appendages do not start to grow simultaneously it is, on the other hand, not likely that any single one would take on the shape and size of a fully developed growth before the second one shows signs of an appearance.

Generally speaking, the pore on the surface of the esca is a character probably common to all Ceratioid females, and thread-like filaments of greater or lesser length, thickness, ramification or simplicity are common to most of them. The case is different with the characteristic, paired swellings at the distal end of the bulb of the illicium, somewhere near a pore. In the 10 species of Ceratioid fishes it was possible to examine, it is only in those belonging to the genus *Himantolophus* that this character exists — in *Himantolophus appeli* (Clarke) and *H. azurlucens* Beebe, both from the Pacific Ocean, no mention is made of swellings near the extreme end of the bulb, but it is possible that they are only very slightly convex and exist nevertheless. Without being given a special significance they could then easily be overlooked.

In the 3 species into which I feel obliged to divide our material «divergent lobes» are definitely present. One of the species is, without any doubt, to be attributed to *Himantolophus groenlandicus*, another is likely to be *H. compressus* (Osório 1912), whereas the third cannot be attributed to any of the known species and will be described as new under the name of *Himantolophus albinares* in allusion to the white colour of the bases in which the anterior and posterior nostrils are placed.

There is a further species present among the *Himantolophus* material which will be considered individually under the designation *Himantolophus* sp. This criterion has been followed as, unfortunately, the luminous bulb was missing due to injury. The study of the skeleton quite definite-

ly revealed that it is a true *Himantolophu*, but cannot be attributed to any of the 3 species mentioned above.

Synopsis of Species (Females), mainly based on Formation of Illicium

I. Illicium long, thin and rather stiff; more than 70 % of S.L. Its greatest thickness in middle of length about 4 % of its length. Two pairs of elongated swellings of equal length. Pore on level with lower end of swellings. Only one pair of minute tentacles below pore . . . . . *H. compressus* (Osório)

II. Illicium short and stout, rather flexible; less than 50 % of S.L. Its greatest thickness in middle of length 7-10 % of its length.

A. Two pairs of swellings of equal size and shape. Lower end of pore level with lower end of posterior pair of swellings. In completely metamorphosed females greatly developed anterior and posterior unpaired tentacles present. In centre between swellings one pair of short, more or less complex distal appendages. Several large paired tentacles along posterior side of illicium below posterior unpaired tentacle. No white markings on body . . . . . *H. groenlandicus* Reinhardt

B. Two pairs of elongate swellings, the anterior pair only half as long as the posterior one. Pore between upper half of posterior pair of swellings. No anterior unpaired tentacle. One greatly developed distal tentacle in centre between swellings. Lateral single row of a few short weakly developed tentacles along illicium. Well defined white marks on caudal peduncle, anterior parts of bases of dorsal and anal, and a pair of large ones on forehead . . . . . *H. albinares* sp. n.

I. ***Himantolophus compressus*** (Osório)

Figs. 2-4.

Gorynophorus compressus Osório, 1912, Contrib. Conhec. Fauna bathyp. vis. Cost. Portugal, p. 90, figs. 1 & 2. Nobre, 1935, Faun. mar. Portugal I, Vertebr., pl. 33, fig. 106 [from Osório].

Material

One female specimen in good state of preservation. Kindly lent for examination by the Head of the Museu do Seminário, Canon Jaime G. Barreto. The attached label reads, «*Corynolophus*?, Câmara de Lobos, 8-1925».

Description

General aspect: There is no voluminous stomach content to inflate the stomach and the outline of the side view of the whole fish is elongate pear-shaped. Head very large, snout and particularly chin very thick and fleshy, with numerous close-set papillae. The length of each papilla being

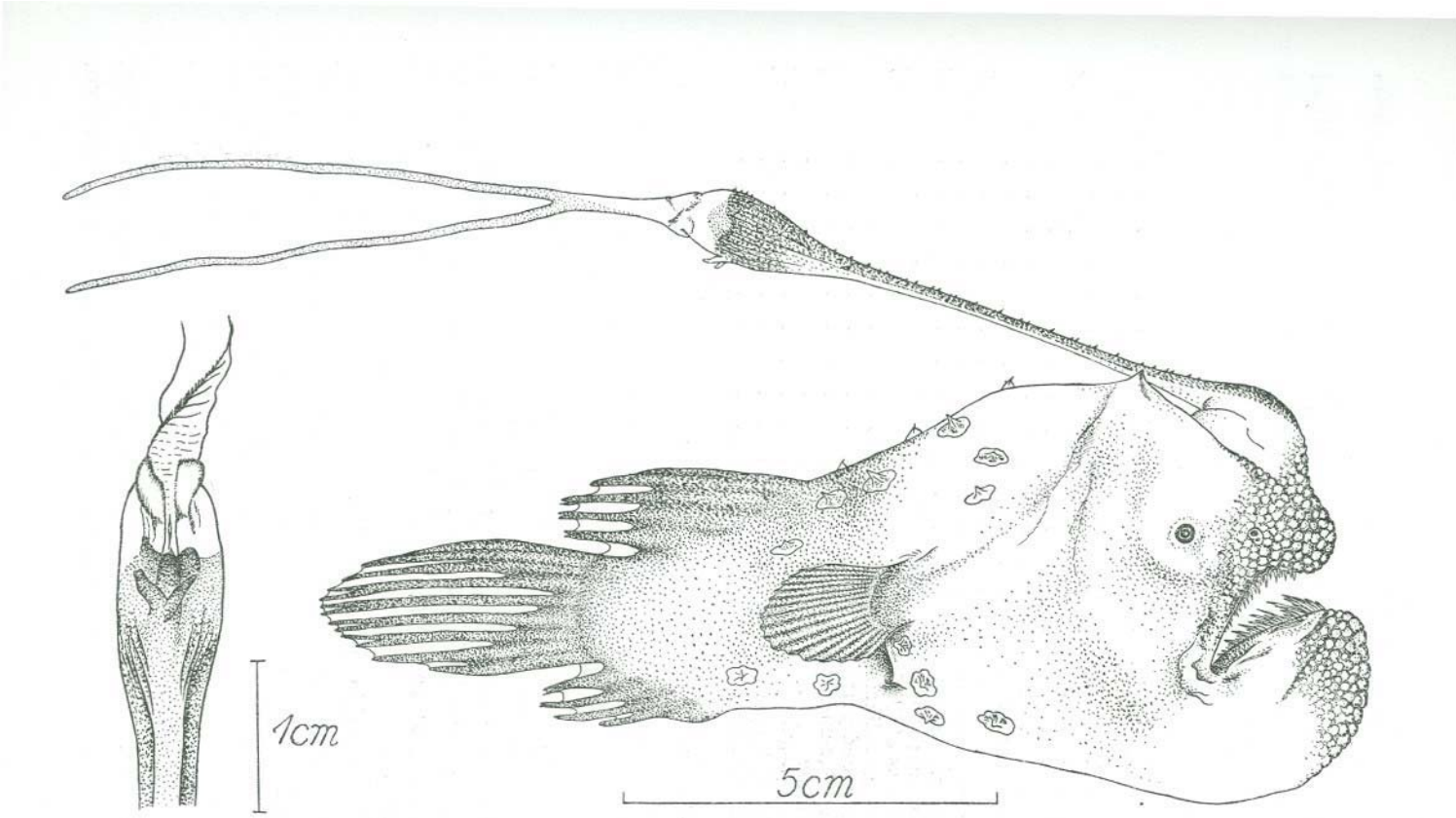

Fig. 2. — *Himantolophus compressus;* specimen of Museu do Seminário collection. Detail on left, luminous bulb seen from behind.

about equal to its transverse diameter. Caudal rather long. Dorsal and anal rays reaching well beyond the caudal peduncle. Illicium very long and thin, reaching beyond dorsal origin.

Measurements in mm.

Total length	141
Standard length	100
Snout	20
Head	63.5
Snout to dorsal	78
Snout to anal	86
Origin of anal to end of hypural	28
Distance between sphenotic spines	19.5
Length of lower jaw (bone)	29
Least depth of caudal peduncle	15.5
Length of illicium (from articulation to end of bulb)	86
Greatest thickness of illicium in middle of its length	3.5
Greatest transverse diameter of bulb	9
Length of undivided part of distal tentacle	14
Length of caudal (central rays)	44.5
Length of opercle	25
Length of subopercle	17.5
Greatest width of longer branch of opercle	2.5
Greatest width of subopercle	8

Counts: Dorsal 5; anal 4; pectorals 17.

The illicium is very long and somewhat stiff, not fleshy. On its upper side it bears numerous short but pointed, broad-based spines. The bulb is very large, compressed and regularly pear-shaped. On its extreme end there are two pairs of elongate lobes. From the centre, between the lobes, springs one thick tentacle, which branches into two simple long ends at some distance from its base. Except for two minute appendages on the posterior side of the bulb there are no other tentacles. The pore of the esca is situated just below the level of the lower ends of the posterior pair of swellings.

Teeth in jaws thin, pointed, slightly curved; in the upper 1-2 rows in the lower 2-3, those of the outer rows the smallest. Longest teeth of the lower jaw about 3 times as long as the longest teeth of the upper jaw.

A partial dissection of the right side, to show some of the bone structure, revealed that the opercle is very narrow, its greatest width being about 1/10 of its length, whereas the subopercle is broadly triangular. For further detail see Fig. 3.

The colour of the specimen is on the whole rather light on the body, with irregular large patches of brown. The rays of the fins are dark brown,

getting darker, almost black towards the ends. The membranes are transparent white to about half their distal lengths on dorsal and anal. On the caudal the colourless part reaches fairly near to the root of the rays between the median ones, getting gradually shorter towards the outer rays. The pattern resulting from this is very distinctly difined. On the illicium

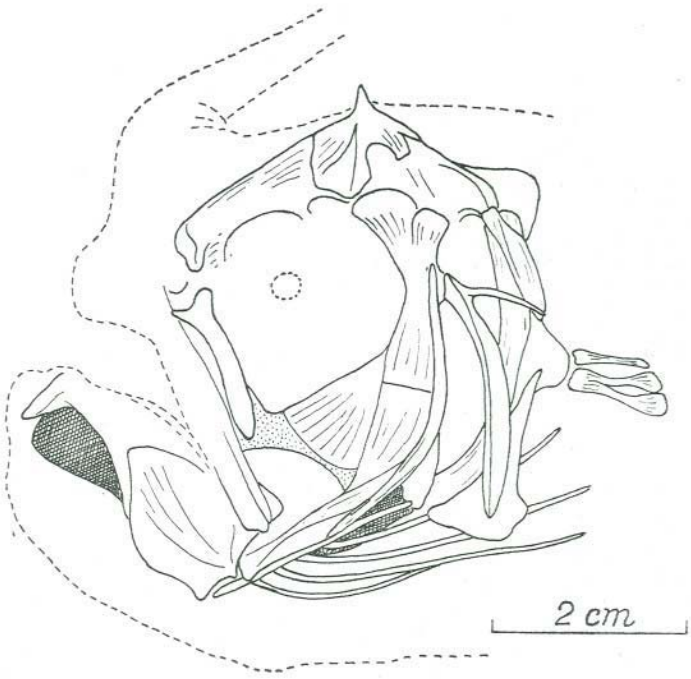

Fig. 3. — *Himantolophus compressus;* specimen from Museu do Seminário collection.

the upper side is brown and the lower side white. The two proximal thirds of the bulb are brown and the distal one third, as well as the swellings and the upper side of the unbranched part of the tentacle are bluish white, all the rest being brown.

Remarks

The *Memorias do Museu Bocage*, in which Osório described his new genus *Corynophorus* and new species *compressus* do not seem to have

been distributed to institutions abroad, as, nowadays, these publications are practically, or perhaps totally unobtainable outside Portugal, and even in this country they are extremely rare. It is probably for this reason that the species has been completely overlooked by ichthyologists, such as Regan, Trewavas and Bertelsen, who have done such extensive work on the Ceratioid fishes. Nobre's *Fauna Marinha de Portugal* (*Vertebrados*) where Osório's description is reproduced, in part slightly abridged, is likewise rare now, having been out of print for a long time. It has, therefore, been decided to reproduce the original description and also give copies of the figures 1 & 2 before discussing the points that led us to refer the present specimen to this species:

«GENERO CORYNOPHORUS, N.G. Este genero distingue-se dos generos *Himantolophus* e *Corynolophus* porque o corpo não é oval, mas acentuadamente piriforme. A altura vae sucessivamente decrescendo a partir de dois espinhos collocados por detraz da primeira barbatana dorsal, reduzida a um raio unico, mas que engrossa na extremidade, o que lhe dá o aspecto d'uma pequena maça (claviforme).

«A linha do contorno abdominal não é recta em todo o comprimento, curva-se na metade anterior, emquanto que é acentuadamente recta a linha dorsal do perfil. (Vid. fig. 1).

«A este caracter generico derivado da forma geral, que pode dizer-se piriforme, e não ovalar como no *Himantolophus* e *Corynolophus,* posso acrescentar outros de maior importancia, e são os seguintes:

«1.º Faltam as lacinias ou fitas, appendices compridos e estreitos, que em maior ou menor quantidade ornam a extremidade do raio dorsal nos generos que acabo de citar, raio que representa a primeira barbatana.

«2.º A falta d'uma cavidade longitudinal onde possa alojar-se *completamente* esse raio grande deitado para traz. No representante do meu novo genero existe uma cavidade cujo perimetro é um pentagono irregular, mas em que só cabe quando reclinado metade do raio alludido. O raio é rigido, conserva-se na posição que se vê na fig. 1, e nenhuma tendencia mostra a curvar-se para se alojar na cavidade, em que, de resto, não cabe. Em seguida ao vertice do angulo mais posterior da cavidade pentagonal, existem, na linha media dorsal, quatro espinhos, estando o ultimo collocado proximo da raiz da segunda barbatana dorsal.

«3.º As narinas não são visiveis, e tanto o labio superiôr como o inferiôr e as regiões proximas são cobertas por numerosas verrugas muitas das quais teem mais d'um milimetro de diametro (Vid. fig. 2).

«*CORYNOPHORUS COMPRESSUS, N. SP.* Fig. 1 e 2. O corpo é muito comprimido lateralmente e vae adelgaçando, a partir das barbatanas peitoraes, até à caudal.

«Numerosos espinhos existem espalhados, tanto pelo lado direito como pelo esquerdo do tronco; mas assim como a disposição não é egual, tãobem não é egual o numero d'elles; assim no flanco esquerdo contam-se 30 espinhos e 25 no direito. No esquerdo encontrei seis espinhos dispostos segundo uma linha recta, dirigida obliquamente de traz para diante, e de cima para baixo, e que vae terminar, em baixo, em frente da peitoral, e em cima no dorso. No lado direito tãobem existem espinhos, mas apenas trez, e muito maiores do que os que existem no lado esquerdo. Todos estes espinhos são muito agudos, ligeiramente curvos, e apresentam uma larga base de implantação no tecido que, em parte, os encobre.

«Em quasi todo o corpo a pelle é nua, molle, negra, de tinta mais ou menos

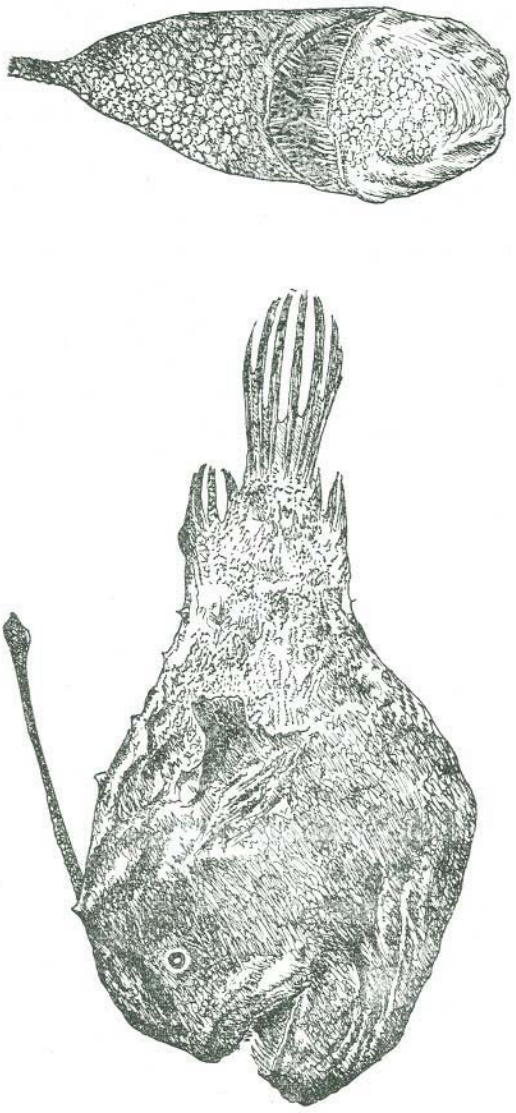

Fig. 4.—*Himantolophus compressus*; from original figures of type. Left: «Fig. 1—*Corynophurus compressus*, Osorio». Right: «Fig. 2—Cabeça de *Corynophorus compressus*, vista de frente».

carregada, por vezes acastanhada. O raio dorsal a que por mais d'uma vez me tenho referido, é tãobem coberto d'espinhos similhantes aos que se encontram aos lados, na linha dorsal e lombar, onde tãobem existem; mas a sua base é mais comprida do que larga; a de alguns que existem espalhados pelo côrpo, principalmente a dos maiores pode dizer-se que é circular. A parte terminal grossa, oblonga, achatada, ellipsoidal, do raio, é desprovida d'espinhos.

«Na base das barbatanas peitoraes, e na da caudal, encontram-se tãobem espinhos, muito agudos, mas o seu numero e disposição varía tãobem d'uma face para a outra.

«Os dentes da maxila superiôr são dispostos em duas ordens, sendo maiores os mais internos; os da maxila inferiôr estão em trez ordens e são sucessivamente crescentes de fora para dentro. A disposição dos dentes impede que a boca se feche d'uma maneira completa.

«Os olhos, relativamente grandes, pois teem o mesmo diametro dos d'um exemplar de *Himantolophus reinhardti* que mede mais de quatro decimetros de comprimento, estão collocados muito mais proximos da extremidade do focinho do que dos espinhos da fronte.

«A altura é menos de metade do seu comprimento total incluindo a caudal. O comprimento da cabeça cabe uma vez e trez quartos no mesmo comprimento total. A espessura do corpo é um pouco mais d'um terço da altura. O raio que tem a forma de maça insere-se na fronte; a inserção fica um pouco mais alta do que os olhos e muito mais abaixo que os dois espinhos frontaes, que estão inseridos nos pontos mais elevados da fronte; *não pode nunca abaixar-se completamente, nem deitar-se inteiramente* para traz. A barbatana peitoral está mais proxima do dorso do que do ventre. A inserção da peitoral é mais proxima da raiz da caudal do que da extremidade do focinho. O comprimento total do exemplar unico $0^{m},18$.

«D 1-5 — A. 4 — P. 18.

«Pescado proximo de Cezimbra.»

Osório, therefore, erected his new genus because of the following characters which he considered to be differing from *Himantolophus*:

1. Pear-shaped body
2. Lack of tentacles on the illicium
3. Lack of a groove into which the illicium could fit entirely
4. The nostrils are not visible
5. Presence of numerous warts on the upper and lower lip.

In the description of the species he gives the following characters:

6. Body strongly compressed
7. Numerous spines on body
8. Colour uniform black, sometimes brown
9. Spines on illicium
10. Two rows of teeth in upper and three in lower jaw, increasing in size from the outer to the inner ones.
11. Relatively large eyes
12. The illicium cannot be lowered completely backwards
13. D I,5; A 4; P 18.

Mr. A. Figueira, assistant at the Museu Municipal, who has seen and examined the type, states that the bulb gives the impression of being incomplete, showing signs of damage at the extremety, so that the percentage of 73.3 calculated from the figure should probably be higher.

On Fig. 1 (Osório) the distinct and abrupt black border separating the pigmented part from the transparent one of the membranes of the dorsal, anal and caudal are clearly visible, showing that about half the distal length of the dorsal and anal membranes are white transparent and in the caudal the white of the central membranes occupies about the two distal thirds, getting gradually shorter between the outer rays.

Considering these 15 characters in *H. groenlandicus* one may begin by eliminating the one given above as 4. The one referring to the invisibility of the nostrils, as this can only mean that they are very inconspicuous and were obviously overlooked by Osório. Characters both species have in common are: 5. The presence of numerous warts on upper and lower lip; 6. The body strongly compressed: 7. Numerous spines on body; 8. Colour uniform black; 9. Spines on illicium; 10. Arrangement of teeth; 13. Fin ray count (approximate). The character of the great length of the illicium, a proportion established from the figure, can be merged into character 12. regarding the absence of the groove into which the illicium could fit entirely. The stiffness eluded to under the same number is most likely to be due to the stiffening in the preservative of the thick tissues surrounding the joint with the basal bone. The relatively large eyes would not be surprising in a young specimen as this is a well-known ontogenetic phenomenon. Lastly, Figueira's observation has made the point regarding the lack of tentacles very questionable.

This rigorous elimination has reduced the number of differing characters most drastically indeed, but, nevertheless, the following three stand their ground against all criticism: 1. The pear-shaped body. 2. The very long illicium, measuring more than 70 % of S.L., and which consequently cannot be entirely fitted into de dorsal groove. 3. The well-defined pigmentation of the unpaired fins.

Unfortunately the author has not been able to examine the type specimen, but the complete agreement with the 3 characters enumerated above have been an enducement to believe that the Madeiran specimen is a representative of Osório's species, and after further examination, in the light of what is now known of the differentiating characters of the Ceratioid fishes in general and those of the genus *Himantolophus* in particular, we

have come to the conclusion that, if we are right in our identification, Osório was justified in describing his fish as a new species though the erection of a new genus can hardly be accepted.

For further details see also comments on the affinity of the new species *H. albinares*.

2. ***Himantolophus groenlandicus*** Reinhardt

Figs. 5-10.

Himantolophus groenlandicus Reinhardt, 1837, Dansk Vidensk. Selsk. Afhandl. (4) VII, p. 116, pl. 4 [not seen]. Girard, 1892, Bol. Soc. Geogr., Ser. 11, No. 9, p. 603, pl. 1. Regan, 1926, Danish «Dana»-Exp. 1920-22. Oce. Rep. No. 2, p. 40, fig. 23 [after Lütken, 1878 (type of *H. reinhardti*)], pl. 12, fig. 1. Regan & Trewavas, 1932, Dana-Rep. No. 2, p. 59, fig. 88 A., pl. 1, fig. 1. Nobre. 1935, Fauna mar. Port. I, Vertebr., p. 233, figs. 105 [after Reinhardt, 1892], 105 a [after Osório, 1909, fig. 6], 105 b [after Lütken]. Bertelsen, 1951, Dana-Rep. No. 39. p. 60, fig. 23 A-J, Figs. 24 A [after Regan, 1926], 24 B [after R. & T., 1932], 24 C [after R. & T., 1932 (type of *H. danae*)], 24 D [after Lütken, 1878 (type of *H. reinhardti*)]. Albuquerque, 1954-1956, Portug. Acta Biol. (B), vol. 5, p. 1059, figs. 433 [after Girard, 1892] and 433 A [after Regan, 1926].

Himantolophus reinhardti Lütken, 1878, Vidensk. Selsk. Skr. 5, R. nat. og math. Afd. XI, 5, p. 320, pl. I-II [not seen]. *«reinhardti»* — Osório, 1909, Contrib. Conh. Fauna Bath., p. 18, est. I, fig. 5 & 6. Fowler, 1936, Bull. Am. Mus. Nat. Hist., vol. 70, part 2, p. 1142, fig. 481 [from Lütken].

Himantolophus danae R. & T., 1932, Dana-Rep. No. 2, p. 60, pl. I, fig. 2.

? *Himantolophus kainarae,* ranoides Barbour, 1942 [*fide* Bertelsen, 1951 *et alt.*].

Corynolophus reinhardti Gill, 1878, Proc. U. S. Nat. Mus., vol. 1, p. 228 [not seen]. Good & Bean, 1895, Oce. Ichth., p. 494, fig. 405.

?Corynolophus globosus Tanaka, 1918 [*fide* Bertelsen *et alt.*].

(Males): *Lipactis tumidus* Regan, 1925, Ann. Mag. Nat. Hist., Ser. 9, vol. XV, p. 566; 1926, Danish «Dana»-Exp. 1920-22, p. 43, pl. XII, fig. 2. Norman, 1930, Discovery Rep., vol. II, p. 357. Regan & Trewavas, 1932, Dana-Rep. No. 2, p. 61. Fowler, 1936, Bull. Am. Mus. Nat. Hist., part 2, p. 1349, fig. 567 [from Regan, 1925 & 1926]. Albuquerque, 1954-1956, Portug. Acta Biol. (B), vol. 5, p. 1062, fig. 434 [from Regan, 1926].

Rhynchoceratias brevirostris Regan, 1925, Ann. Mag. Nat. Hist., ser. 9, vol. XV, p. 566; 1926, Danish «Dana»-Exp. 1920-22, p. 43, fig. 25 a, pl. XIII, fig. 1. Norman, 1930, Discovery Rep., vol. II, p. 357. Regan & Trewavas, 1932, Dana-Rep. No. 2, p. 62. Fowler, 1936, Bull. Am. Mus. Nat. Hist., part 2, p. 1348, fig. 566 [from Regan].

Rhynchoceratias onchorhynchus Regan, 1925, Ann. Mag. Nat. Hist., ser. 9, vol. XV, p. 566; 1926, Danish «Dana»-Exp. 1920-22, p. 44, fig. 25 c, pl. XIII, fig. 3. Regan & Trewavas, 1932, Dana-Rep. No. 2, p. 62. Fowler, 1936, Bull. Am. Mus. Nat. Hist., part 2, p. 1348 [from Regan].

(Larvae): *Himantolophus reinhardti* (?), Lütken, 1878, Vidensk. Selsk. Skr. 5, R. nat. og math. Afd. XI 5, p. 321, pl. II, fig. 4 [not seen. *Fide* Bertelsen, 1951].

Material

One large adult female, very good condition, S.L. 365mm., 24.VII.1959, Reg. No. 16094. One adolescent female, very good condition, S.L. 61mm., 27.II.1957, Reg. No. 11141. One adolescent female, poor condition, S.L. 84mm., 25.I.1961, Reg. No. 18038. ?One larval female, fair condition (abdomen torn), S.L. 10.3mm., 14.IX.1959, Reg No. 16281.

Description

Large adult female. (Reg. No. 16094, Figs. 5 & 6). This was brought here by a Câmara de Lobos fisherman, according to whom the fish was taken on one of their customary long lines they use for the «Espada» *Aphanopus carbo*.

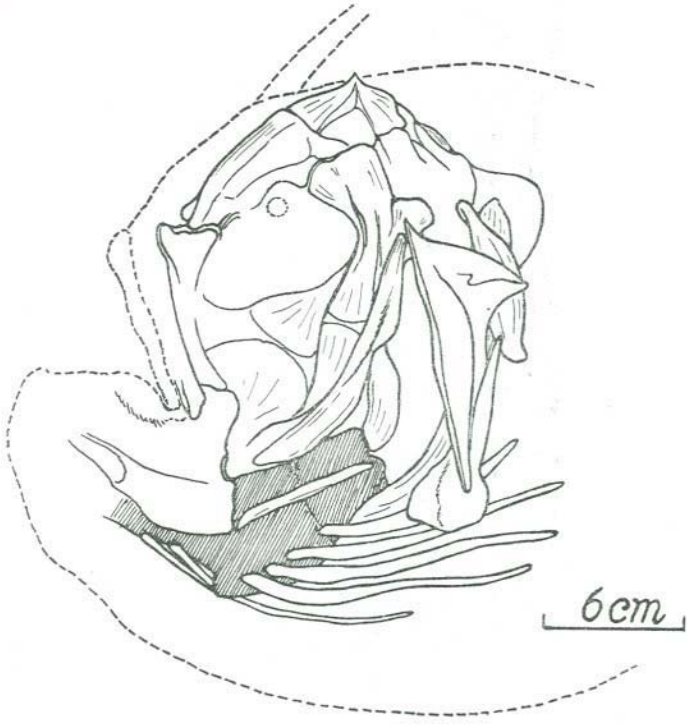

Fig. 5. — *Himantolophus groenlandicus;* Reg. No. 16094

It is in good agreement with earlier descriptions and figures of females of approximate size. Measurements (in mm.) and counts are the fol-

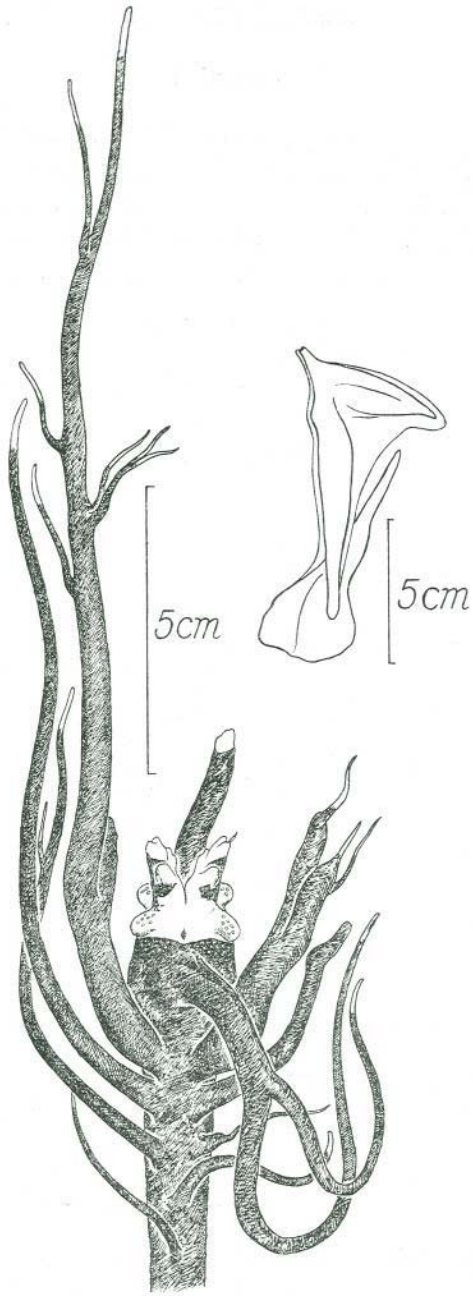

Fig. 6. — *Himantolophus groenlandicus;* Reg. No. 16094. Esca seen from behind and left operculum and suboperculum.

lowing: Standard length 365; head 241; illicium 148; lower jaw 111; operculum 96; subopercular 82. Dorsal 5; anal 4; pectorals 17.

The general lay-out of the arrangement of the tentacles is as described by previous authors: there is an anterior and posterior tentacle near the distal end, part of the anterior one being broken off, the posterior having two ends; distally, about in the middle between these there is a pair of short sturdy appendages each ending in 3 knobs, a higher middle one and two lower lateral ones; round these there are two pairs of swellings («divergent lobes» of Regan & Trewavas and Bertelsen), with the pore between

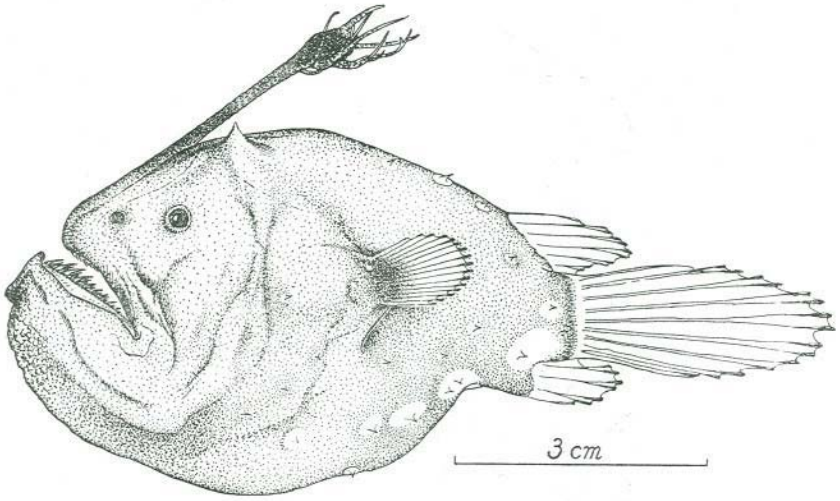

Fig. 7. — *Himantolophus groenlandicus;* Reg. No. 11141

the posterior pair, being at the same level as the latter; just below the posterior tentacle, along the posterior side of the end of the illicium, there are 3 pairs of long branched tentacles and below these 2 unpaired much shorter and unbranched ones. The pigmentation ends abruptly at the end of the esca, just below the 2 pairs of swellings. On the latter and, posteriorly, near the edge of the pigmented part, there are a number of small flat-based spines.

The colour is deep black all over, the only unpigmented parts being the terminal borders of the membranes of the dorsal, caudal and anal fin rays, and the ends of all the appendages of the illicium.

In the stomach a partly digested specimen of *Benthodesmus simonyi* measuring 105cm. was found. Furthermore one dead tapeworm, probably from the stomach of the latter, and a small live Nematod, more likely to belong to the *Himantolophus*.

Adolescent female (Reg. No. 11141, Figs. 7, 8 & 9). This was brought to the local fish market by some fisherman. Its mode of capture is not known.

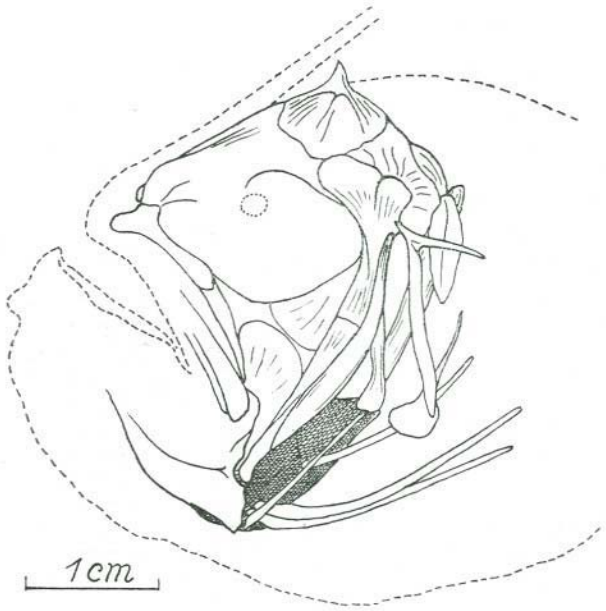

Fig. 8. — *Himantolophus groenlandicus*; Reg.No. 11141. Head partly dissected.

It agrees well with the description of *H. danae* R. & T. (1932, p. 60) measuring 53mm. in total length (*fide* Bertelsen *in litt.*) and which for well founded reasons, has been synonymized with *H. groenlandicus* by Bertelsen.

Measurements (in mm.): Total length 90; standard length 61; head 38; greatest depth 44; illicium 30; lower jaw 26.5; distance between sphenotic spines 20.

Counts: Dorsal 6; anal 4; pectorals 16.

The structure of the illicium is typically that of adult females, differing only in that the tentacles and especially the distal appendages

are less developed. There are no tapering processes on the divergent swellings as is the case with the type of *H. danae*. As in the adult specimen, the black pigmentation reaches up to the swellings. As these are situated

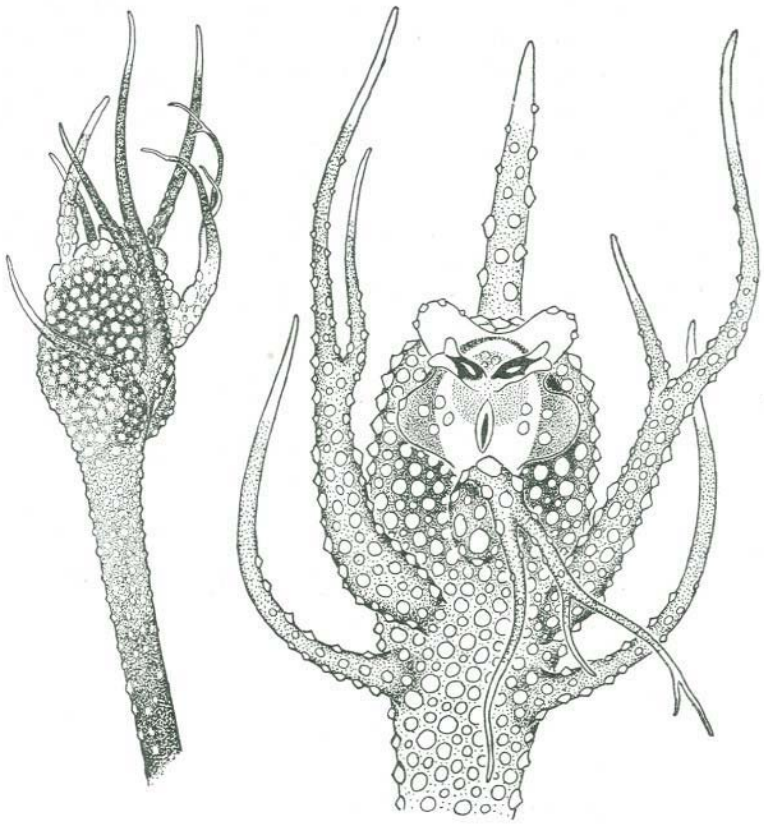

Fig. 9. — *Himantolophus groenlandicus,* esca of small specimen; Reg. No. 11141, showing left side and hind view.

more centrally here, the distal unpigmented portion of the esca is very small. All parts belonging to the illicium are densely and conspicuously studded with white boney plates centrally rising into a very short blunt spine.

The pigmentation of the skin is not strongly developed yet. The distal part of the caudal peduncle and the posterior half of the back are quite

without pigmentation, whereas on the chin, the snout, the illicium and proximal part of the pectoral fins it is fairly strong. The rays and membranes of the unpaired fins are white, the membranes being transparent.

Adolescent female (Reg. No. 18038). From stomach of *Aphanopus carbo*. The skin and with it the soft parts of the esca have been dissolved by the gastric juices, but the skeletal parts are well preserved. All proportions and the formation of the bones, as well as the profile of the whole fish are in good agreement with the well preserved adolescent female of Reg. No. 11141.

Larval female (Reg. No. 16581, Fig. 10). This specimen was taken from the stomach of an *Alepisaurus ferox*, and comes, therefore, from moderate depth (*A. ferox* is generally taken on lines about 100 to 200m. long).

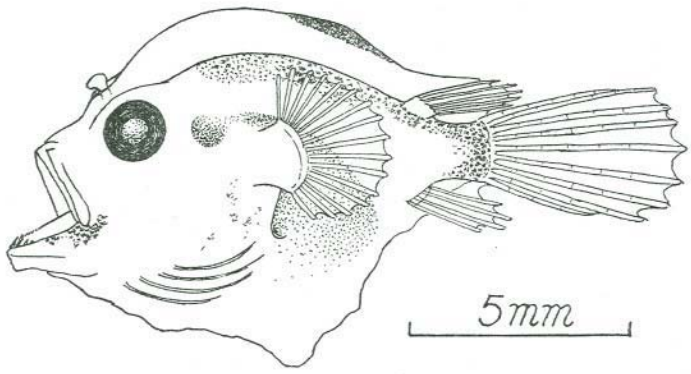

Fig. 10. — Larva of *Himantolophus* sp. (*?groenlandicus*?); Reg. No. 16281.

Comparing this larva with the series of figures given by Bertelsen (p. 62) it most closely resembles that of Fig. 23 I, a larval male measuring 10.7mm. The latter is, therefore, also the nearest in size. The pigment group in the dilated skin under the gill-opening is not visible, but that part of the body is rather damaged in our specimen. Otherwise it has the same dorsal and peduncular pigment, continued below the dorsal fin. It has the median group of melanophores in the skin in front of the dorsal, which Bertelsen has found in about 100 out of a little more than 300 specimens examined by him. In our specimen this pigmentation is rather dense and is, as in

most of Bertelsen's specimens, situated on a hump. On the side of the lower jaw there are the same large stellate melanophores Bertelsen says to have found in 4 specimens from 10.7 to 12.8mm., also shown in his Fig. 23 I.

The fact that the existence of more than one species of *Himantolophus* in the Atlantic Ocean has been established makes it uncertain if Bertelsen's criterian in referring all his larval material of the genus to the species *groenlandicus* is correct. The above mentioned presence of a black hump in some of the specimens and the absence of this character in others may easily signify that there are at least 2 species contained in this material, distinguished by this rather conspicuous character.

3. ***Himantolophus albinares*** sp. n.

Figs. 11-15.

Material

One large female (type) in very good state of preservation. Reg. No. 2598, S. L. 190mm. Brought to the Museum by a Câmara de Lobos fisherman, according to whom it was taken on the «espada» lines. Unfortunately no entry regarding date of capture was made in the catalogue. Judging from memory it was likely to have been in 1933 or 1934.

Description

General aspect. Body compressed, its width about 4 times in S.L. and about $2^1/2$ times in depth. Papillae of various sizes on snout and chin. Illicium thick, very soft and fleshy, its length nearly 2 in S.L. Rays of unpaired fins thick and fleshy. Ends of dorsal and anal only reaching end of hypural. Numerous short but very broad-based spines everywhere on body except the head. Small spines of the same shape along front half of illicium.

Measurements (in mm.). Total length 242; standard length 190; head 106; snout 33; least depth of caudal peduncle 25.5; distance between sphenotic spines 36; greatest width (at cheeks) 49; greatest depth 123; diameter of orbit 5.5; length of lower jaw (bone) 43; distance between sphenotic spine and lowest point of lower jaw bone 88; distance from tip of snout to farthest point of preoperculum 65; illicium 81.

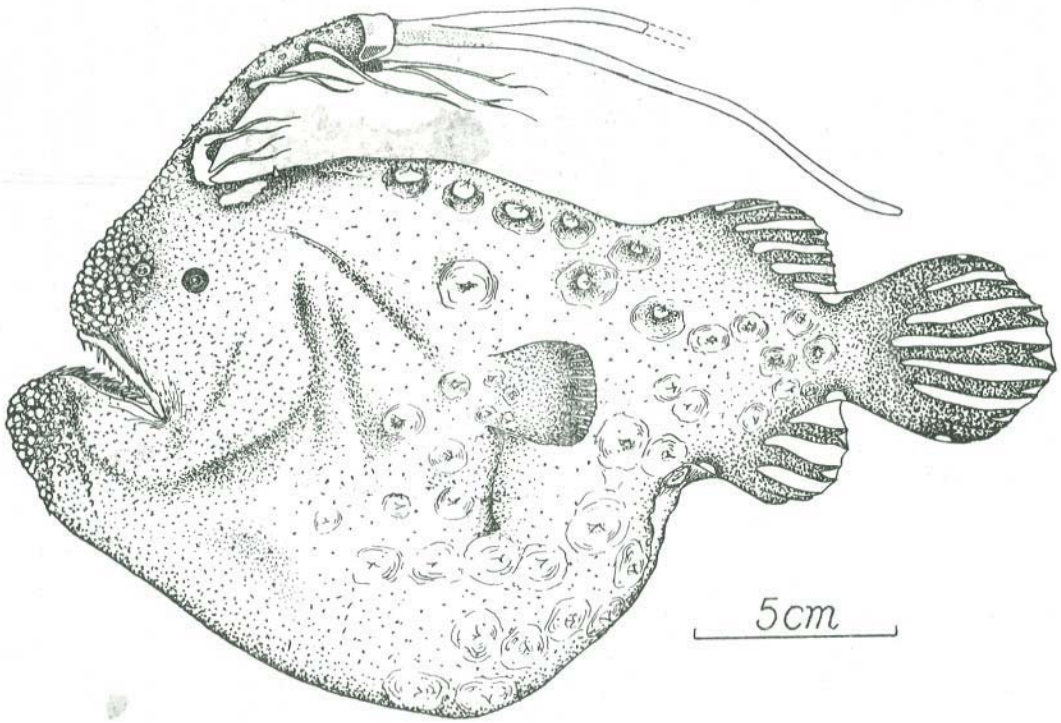

Fig. 11. — *Himantolophus albinares* sp.n., type; Reg.No. 2598

Counts. Dorsal 5; anal 4; pectorals 16.

Teeth. In the upper jaw 1 to 2 rows and in the lower jaw 2 to 4 rows; the outer row consisting of very small close-set ones. As in the other Himantolophids they increase in size inwards and are sharp, thin and slightly curved.

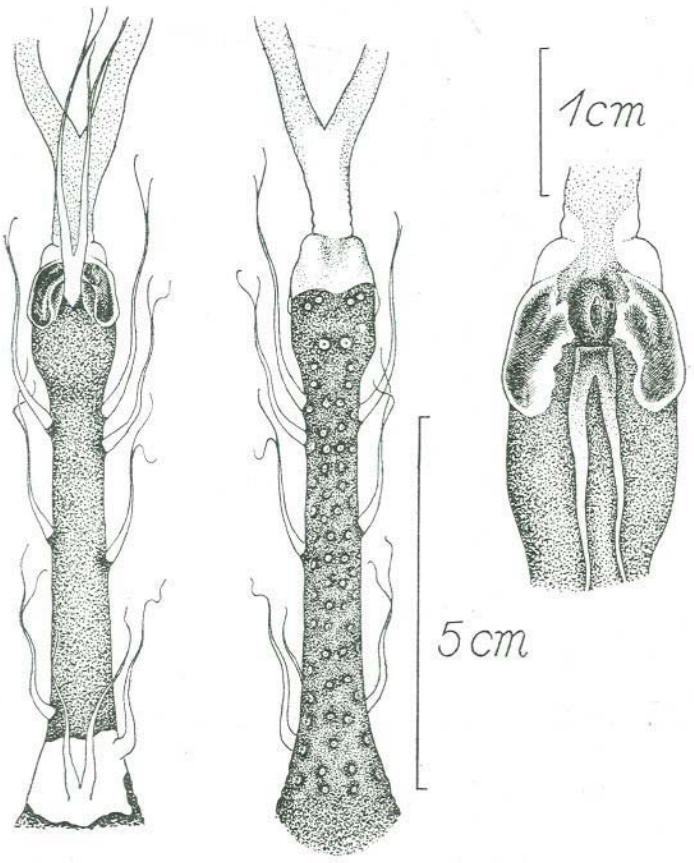

Fig. 12. — Illicium of *Himantolophus albinares* sp. n., type; Reg. No. 2598: left, hind view; middle, front view; rigth, hind view of esca showing position of pore.

Illicium (Fig. 12). Very thick, soft and fleshy. Along the stem, laterally, at more or less equal distances, from point of insertion to beginning of bulb, moderately long simple or branched tentacles. Bulb with

one moderately long double-branched tentacle and one very long thick branched one distally. The posterior pair of swellings is large and long, with the pore between their upper half. The anterior pair is less than half the size of the posterior one.

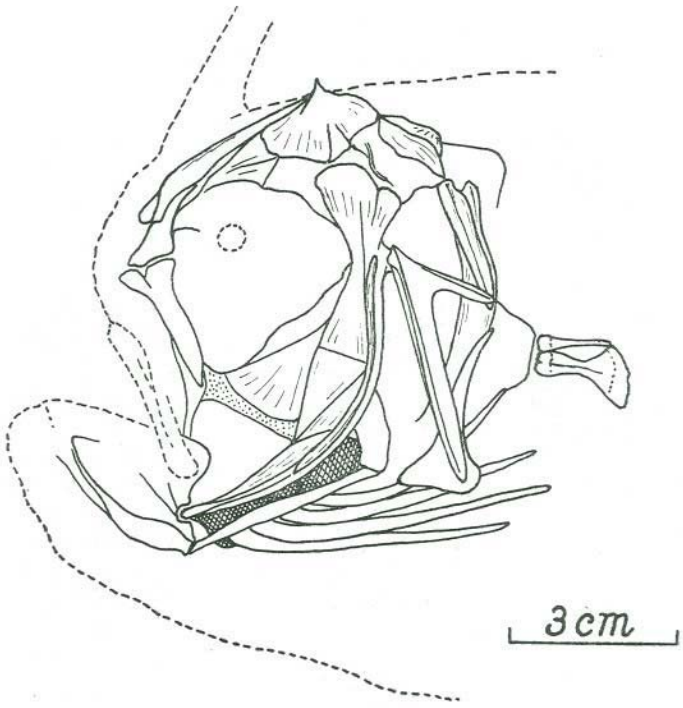

Fig. 13. — *Himantolophus albinares* sp. n., type; Reg.No. 2598

Skeleton (Fig. 13). The specimen has been partially dissected on the left side. The findings of morphological characters of diagnostic importance are the following: The operculum is moderately slender, the upper branch being quite straight and the lower, long one, nearly so. The suboperculum has a very slender long upper point curved backwards, and anteriorly it has a short point curved downwards. Posteriorly, at the base it ends in a prominent round lobe. Its greatest length is contained about $1^1/3$ times in the greatest length of the opercle. The sphenotic is very small.

Colour. Uniform black to brownish black on head, body, illicium and fin-rays. In the posterior nook formed between the illicium and the upper surface of the head, on the outer sides of the first dorsal and anal rays, as well as on the upper and lower caudal rays, and also on top and bottom of the caudal peduncle there are well defined unpigmented areas. They are white translucent and give the impression of being luminous. On the forehead, above each eye, a large white area which is not well defined at the borders but changing from white to black more or less gradually. The membranes of all the fins are white transparent, the black rays being very distinctly defined. On the caudal the transparency of the membranes reaches forward to nearly the base of the fin between the middle rays, becoming gradually shorter towards the outer rays. The oval, papilla-like bulges on which the nostrils are placed are quite white and being surrounded by deep black show up very conspicuously. On the illicium the black pigmentation reaches up to about half the length of the bulb, where it ends abruptly, laterally curving round the lower border of the posterior swellings. Only the posterior one of the tentacles of the bulb has the stem near its base pigmented black, all other tentacles and the upper half of the bulb are white translucent, the long branches of the distal tentacle having some brownish but not dense pigmentation. The upper surface of the tongue is black, but its borders are white.

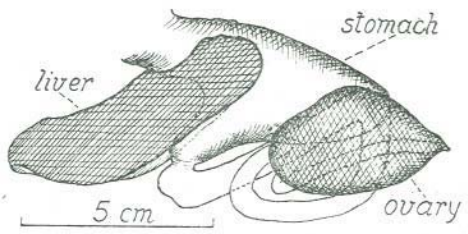

Fig. 14.—Viscera of *Himantolophus albinares* sp. n., type; Reg.No. 2598.

Sexual organs (Fig. 14). The right and left ovaries are of equal shape and size, measuring 45mm. in length, 29 in width and 8 in thickness. The eggs are numerous, their diameter averaging about 1/6mm.

Remarks on the Possible Parasitic Habit of the Male in this Species

A peculiar median white mark (Fig. 15) well behind the chin, more or less perpendicularly below the eyes, deserves special mention. This mark is practically round and measures nearly 1cm. in diameter. Its border is well defined and slightly but abruptly raised. The abrupt nature of the

raising is especially accentuated anteriorly, less so posteriorly where, in one place, the raising is quite gradual, so that there is no distinct border. The border is formed by the disappearance of the outer layers of the skin in the inner portion, which is thus sunk in and has no pigmentation. In a narrow outer area adjoining the border of this mark the black pigmentation of the skin has practically disappeared, but along the inner anterior border there is a fine black irregularly broken line. Whilst the rounded

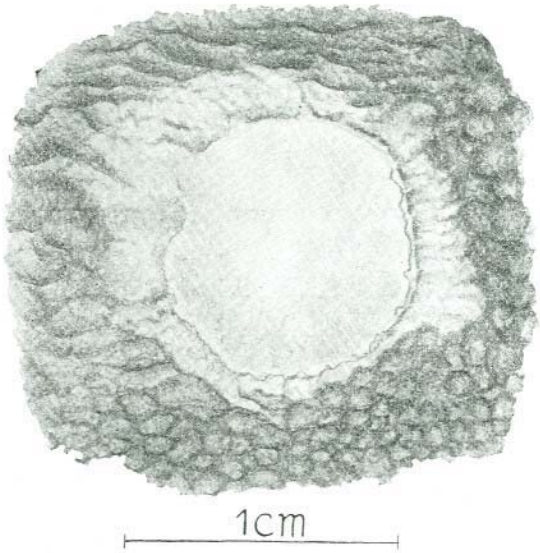

Fig. 15. — White mark on *Himantolophus albinares* sp. n.; type, Reg.No. 2598.

edge of the border is cicatrized, the inner portion has the appearance of a fresh lesion, except near the part where there is no abruptly rising border.

Regan (1925) found by dissection that the small fish grown fast to a large female *Ceratias holbölli* was a male with a fairly well developed testis and concluded that the males of all Ceratioids would attach themselves to their mates in this manner. Since then several discoveries of more or less importance have been made. The discoveries of most consequence were that the so-called «Aceratiidae» were free-living male Ceratioids, and also that some of the mature free-swimming males contained food in their stomachs. Subsequent writers have given their opinions in the light of what had been expounded by their predecessors and the fresh disco-

veries that had been made in the meantime. Thus, in short, Parr (1930) is in agreement with Regan's opinion, supposing that the free-living males («Ceratiidae») sooner or later attach themselves to the females. Some time later, however, Regan & Trewavas consider it more likely that attached males only occur in some families whereas in others they are free-living. The existence of mature free-swimming males could not be reconciled with the previous opinions as they assumed that the males attached themselves at an early stage. Waterman (1939). rightly, objects to this that both free-swimming and attached males have been found in females of the same family, and he is inclined to believe that free-living and attached males might occur in all Ceratioids with sexual dimorphism. Finally, Bertelsen, having worked with a greater bulk of material than any previous writer, is of the opinion, but without coming to a definite conclusion, that all Ceratioid males attach themselves to the females, an assumption based on the fact that all males have jaws transformed for the purpose of doing so. On the other hand, as in some families, including the Himantolophidae, free-living males have been found to grow after metamorphosis and the testicles attain a considerable size, he thinks it most probable that males never become parasitic in these families, «but only attach themselves for a time to the female by means of their denticle apparatus».

The particular interest in the above described mark lies in that it may be the result of an injury caused by a male that had grown fast there and has for some reason become suddenly detached. No doubt it must have taken some time for the edge to have become rounded and healed up, and for the pigmentation to have changed into the above described pattern, while some object that is no longer there was attached in the central portion. It is indeed difficult to explain the formation of this injury with the characteristics as described above other than by the likelihood of a male having been fastened there to the female and the lips having caused the discoloration by pressure and friction which has gone on for a long time.

It might, of course, be suggested that the injury represents the remnant of a much larger wound healing inwards from the edge. But against this possibility it is found that quite a number of the natural wrinkles of the surrounding skin continue right up to the edge. A state which could hardly be expected in newly formed tissue, which, in this case, would be represented by the outer unpigmented area.

While the complete absence of any sign of parasitism in Himantolophids has led to the acceptance of a great probability that males in this family are free-living, never becoming attached to the female to the extent of growing together, it is now for the first time that some sign has been found which might possibly indicate that after all they do live, for some time at least, as parasites of their mates.

Affinity

This new species has the single, long, forked distal tentacle in common with the specimen here referred to *Himantolophus compressus* and I have tried hard to explain the differing characters such as for instance the much shorter illicium and many other proportions on either an ontogenetic basis (as it is nearly twice as large as the specimen of *H. compressus*) or deformation. However, whereas one might consider it possible that the illicium has attained its maximum length when this specimen reaches about 10cm. and stops growing at this stage, becoming proportionally smaller as the animal continues to grow, and whereas one might even accept the possibility that the difference in the relative position of the escal pore is a result of an upward movement in relation to the posterior distal swellings, the study of the bones of the head has revealed differences which are impossible to be interpreted in any other way but the fact that the two belong to different species.

The shape of the opercular and subopercular bones has largely been used by Bertelsen as a diagnostic character both generic and specific, and in this case, whereas both branches of the opercle in the specimen I have referred to *H. compressus* are strongly curved, they are quite straight in the new species, apart from being broader and the difference between the length of the upper and lower being much less. The subopercle of *H. compressus* is on the whole much broader and has no posterior prominent rounded lobe. These differences alone suffice to distinguish one species as different from the other, but there is, apart from a very distinct difference in the whole assemblage of the various bones of the side of the head, a marked difference in the depth of the head. The great depth of the head in *H. compressus* is responsible for the distinctly pear-shaped form of the fish, which is real and not due to deformation. The distance from the snout to the end of the upper branch of the opercle is almost equal to the depth of the head measured from the lowest point of the

angular to the highest point of the sphenotic spine in *H. albinares*, whereas in *H. compressus* it is quite distinctly less.

4. ***Himantolophus*** sp.

Figs. 16 & 17.

Material

One female specimen, probably adolescent, S. L. 54.5mm., 1.III.1960, Reg.No. 16952. From stomach of *Aphanopus carbo*. Some of the dorsal rays and all the pectoral rays have apparently been dissolved by the gastric juices. Unfortunately also the luminous bulb has disappeared. Otherwise the specimen is in fair condition and it was possible to make a careful examination of the skeleton by clearing and staining the specimen.

Description

Measurements (in mm.): Total length 71; standard length 54.5; illicium 26.7; basal bone 16; lower jaw 15.5; distance between sphenotic spines 13,7.

Counts: Dorsal 6?; anal 4; pectorals ?; branchiostegals 6.

There are no dermal spines on what was left of the skin, but these may have been dissolved by the gastric juices.

Comparisons with other Species of *Himantolophus*

The six branchiostegals, the double head of the hyomandibular, the triradiate pelvic bones and the absence of parietals and the anterior spine on the suboperculum range this specimen in the Himantolophidae without a doubt. But there are differences in the shape, relative size and position of the bones of the head that remove it from any of the 3 species of Himantolophids discussed above, as can be seen by a comparison of the skeleton of the species here figured (Figs. 5, 8, 13 & 16).

It is particularly the great slenderness of the operculum and its very low position in relation to the supracleithrum that differ so much from all others (in the latter the upper branch of the operculum forms a more or less acute angle with the lower one and its end overlies the lower end of the supracleithrum, whereas here it is far below it even though it forms nearly a right angle with the operculum).

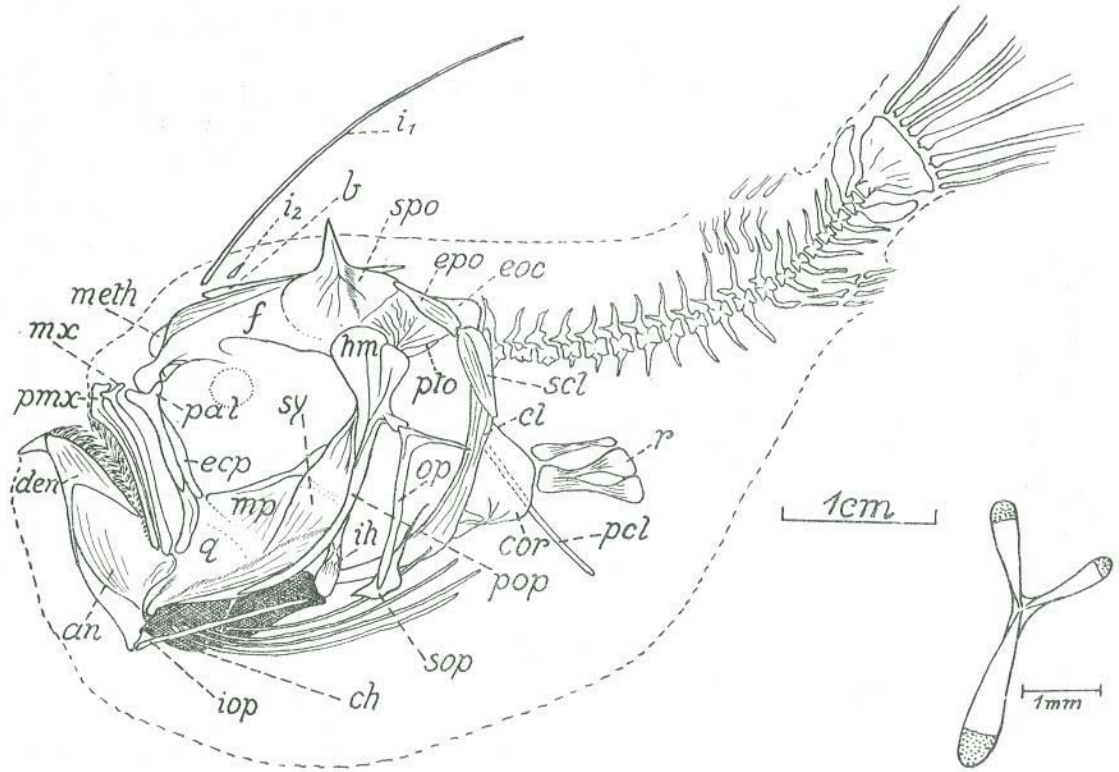

Fig. 16. — *Himantolophus* sp.; Reg. No. 16952. Detail on right, pelvic bone.

Most *Himantolophus* species are figured with distinctly oblique mouths, the same as is found in the 3 species, *groenlandicus, compressus* and *albinares,* described and figured here. There are, however, two species, *Himantolophus globosus* Barbour 1942* not Tanaka 1918 and *Corynolophus sagamius* Tanaka 1918, that stand out from the others by their completely vertical mouths, a feature that strikes us also in the present specimen.

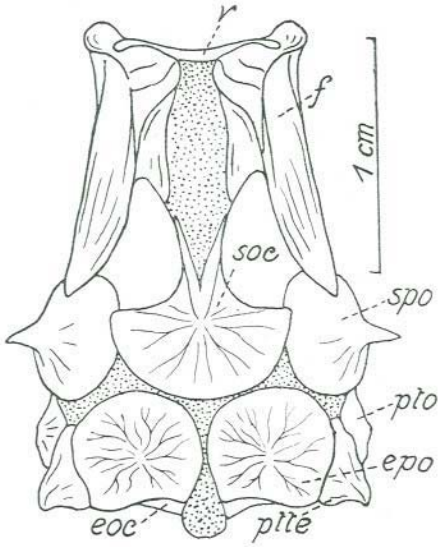

Fig. 17. — *Himantolophus* sp.; Reg. No. 16952.
Skull seen from above.

It is unlikely that this position of the mouth can be attributed to the head being bent backwards, as the vertebral column seems to spring from the cranium in a normal direction (see Fig. 16).

Bearing in mind these considerations it seems possible that there is a vertical-mouthed species of *Himantolophus* typified by *H. sagamius* (Tanaka

* The author has not seen the figure or description of the specimen identified as *Corynolophus reinhardti* by Tanaka (Fishes of Japan, vol. 23, 1908, pl. 1, fig. 5). This specimen was later acquired for the collection of the Museum of Comparative Zoölogy at Havard College and was figured and identified as *Himantolophus globosus* (Barbour, p. 82).

1918) to which the specimen named *H. globosus* by Barbour and the present one may belong.

Family 3. ***Oneirodidae***

Of all the Ceratioid families this is by far the most complex one. Whereas most are composed of only one single genus and a few of a little more, this one consists of 15 genera. Out of this amount 3 are represented among our material. There are 7 specimens in all, 5 of which belong to the genus *Oneirodes*, one to *Dolopichthys* and one to the rare *Lasiognathus*.

Genus A. ***Oneirodes***

Figs. 18, 19, 20, 21 & 22.

The lack of workable size-series and general paucity of specimens of Oneirodids in collections has led Regan and Trewavas to name a large number of species within their genus *Dolopichthys*. Most of these species are based on single specimens and the authors themselves express their doubt as to whether all of them are really specifically distinct. Thus they provisionally recognize 43 species which they divide into 5 subgenera. Bertelsen (1951) has changed this arrangement by eliminating one of their subgenera *(Dermatias)* and by raising the other four *(Microlopichthys, Leptacanthichthys,* and *Pentherichthys)* to generic rank. Regan & Trewavas referred 29 species to their subgenus *Dermatias*, to which, later, 5 more were added, bringing the total up to 34. All these, except one, Bertelsen refers to *Oneirodes*. In this genus *O. cristatus* is maintained as a species represented by 3 specimens measuring 30, 74 and 215 mm. Twenty six species (some doubtfully), 15 of which by Regan & Trewavas, are grouped together in what he calls «the *Oneirodes eschrichti*-group». Two species, both Regan & Trewavas's, fall under «the *Oneirodes flagellifer*-group». One more group, «the *Oneirodes schmidti*-group» is represented by 3 of Regan & Trewavas's species, and, finally, *Oneirodes inimicus* (Fraser-Brunner), *O. acanthias* (Gilbert), *O. carlsbergi* (Regan & Trewavas), *O. luetkeni* (Regan), and *O. melanocauda* Bertelsen 1951 are maintained as separate species.

The 5 specimens here referred to *Oneirodes* must all be ranged into the *Oneirodes eschrichti*-group. They include one specimen (Figs. 19, 20 & 21) described and figured in the Boletim do Museu Municipal do Funchal, No. IV, Art. 11, pp. 34-40, figs, 13-17, 1949, under the name of *Oneirodes*

eschrichtii (sensu lato), and 4 smaller ones, come to hand much later and not reported on previously. The Reg. Nos., dates and other data of all 5 specimens in size order from the largest to the smallest are the following:

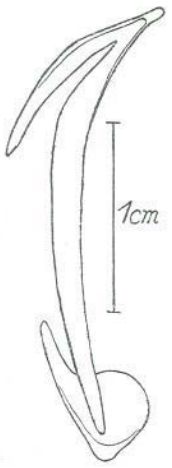

Fig. 18. — Right operculum and suboperculum of *Oneirodes* sp. of *O. eschrichti*-group; Reg. No. 9921

No. 3101 (Figs. 19, 20 & 21), 13.XII. 1948, S. L. 180 mm., caught alive off Funchal. A well preserved specimen described previously by the author in 1949.

No. 16877, 29.II.1960, S. L. 98 mm., taken from stomach of *Aphanopus carbo*. State of preservation poor but no parts missing.

No. 9921 (Figs. 18 & 22 A), 24.X.1956, S. L. 95 mm., from stomach of *A. carbo*. The skin of this specimen has been largely dissolved by the gastric juices, but details of the esca are still recognizable and no parts are missing.

No. 14045 (Fig. 22 B), 16.VI.1958, S. L. 57 mm., from stomach of *A. carbo*. The skin on the back, behind the head, of this specimen has disappeared, which, however, is not likely to be due to the action of gastric juices, as other parts, including the esca, are perfectly preserved.

No. 14044, 14.VI.1958, S. L. abt. 55 mm. This specimen is in extremely bad condition. Its identification is based on osteological characters.

Description of the largest Specimen, No. 3101

This specimen is here redescribed to serve as a basis for comparison with the other specimens referred to above, and only characters of particular interest for the purpose are given, no new ones being added.

Of the bones belonging to the skull (Fig. 20) the lower jaw has a strong symphysial spine and a very large angular, which slants backwards; its length is a little less than half S. L. The articular spines are greatly developed. Operculum deeply incised, both branches thus formed being narrow, the posterior one slightly less than half the length of the anterior one. The length of the latter 1/4 of S. L. The angle between the branches is rather acute. The suboperculum is short and rounded, with a short posterior upper point. The sphenotic spine is well developed. The vomer is very thick and wide, its greatest width being slightly more than 1/6 S. L.

The pelvic bone is expanded posteriorly, more or less hatchet-shaped. The basal bone of the illicium is very long and movable, its posterior end protruding when retracted. Its total length is well over half S.L. The

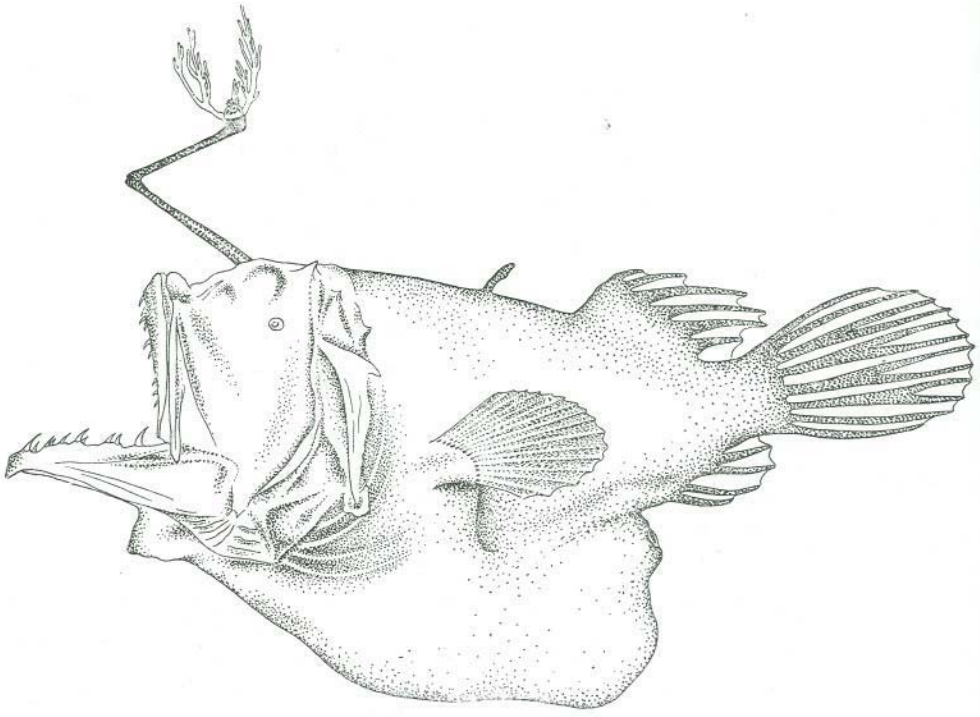

Fig. 19. — *Oneirodes* sp. of *O. eschrichti*-group; Reg. No. 3101. From Maul 1949 «*Oneirodes eschrichtii (sensu lato)*».

illicium is much shorter, measuring only about 1/3 of the basal bone. The pectoral radials consist of 3 bones, the two lower ones greatly expanded posteriorly and united by a single posterior cartilage, the upper one rod-shaped and not connected.

Teeth. There are 13 teeth on each premaxillary, 11 on the right limb of the mandible and 10 on the left. Longest mandibular tooth about 11% of length of mandible. Two large teeth on each side of the vomer, outer

ones slightly larger than the inner ones, about the same size as the largest mandibular ones. Strong teeth on pharyngeals.

The luminous bulb (Fig. 21), not considering its abnormal

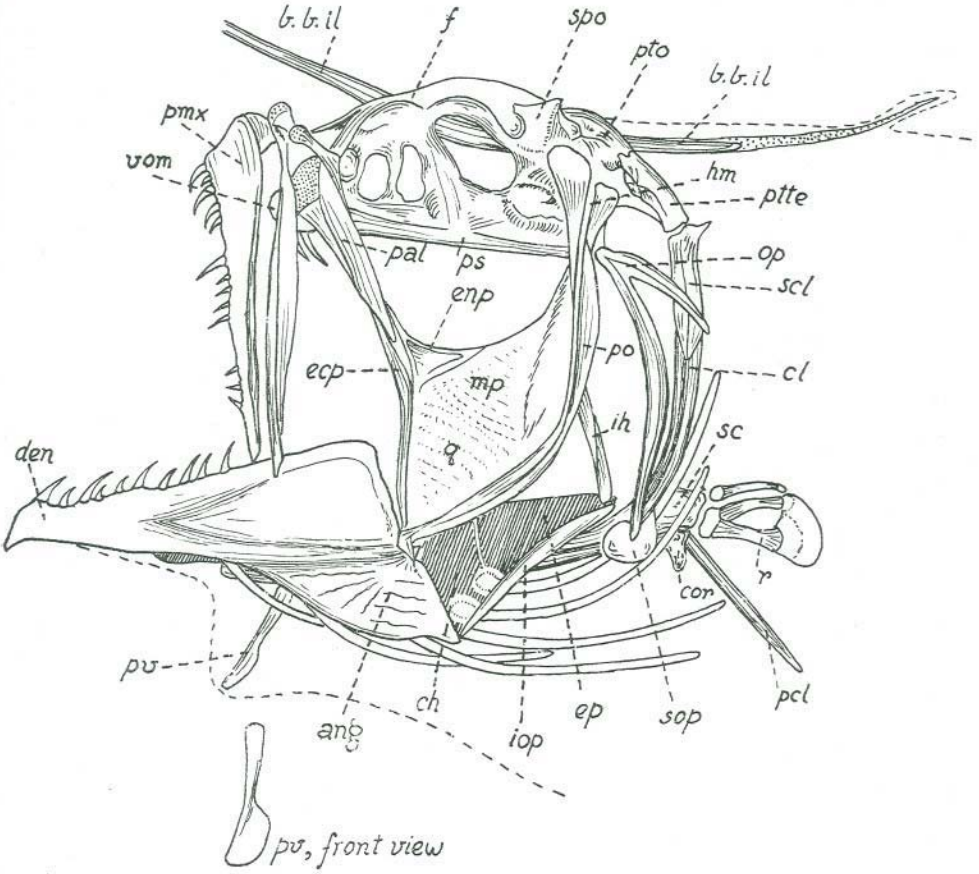

Fig. 20. — *Oneirodes* sp. of *O. eschrichti*-gr.; Reg. No. 3101. From Maul 1949.

twisted position, has the following characteristics: — on the upper hinder surface of a more or less spherical translucent upper part there is a slightly raised papilla with a distant black pigment spot, and two patch-

es of pigmentation in front; posteriorly, just below this papilla, a simple more or less stiff curved filament, about half the length of the unpigmented part of the luminous bulb; just in front of the papilla some very short branched distal filaments. Anteriorly, just opposite the posterior simple filament, a strongly developed digitiform appendage about 2 1/2 times as long as the unpigmented part of the luminous bulb, proximally, along the middle of the anterior side, strongly pigmented; along each side of the thicker proximal part a row of minute branched filaments; on posterior side, between

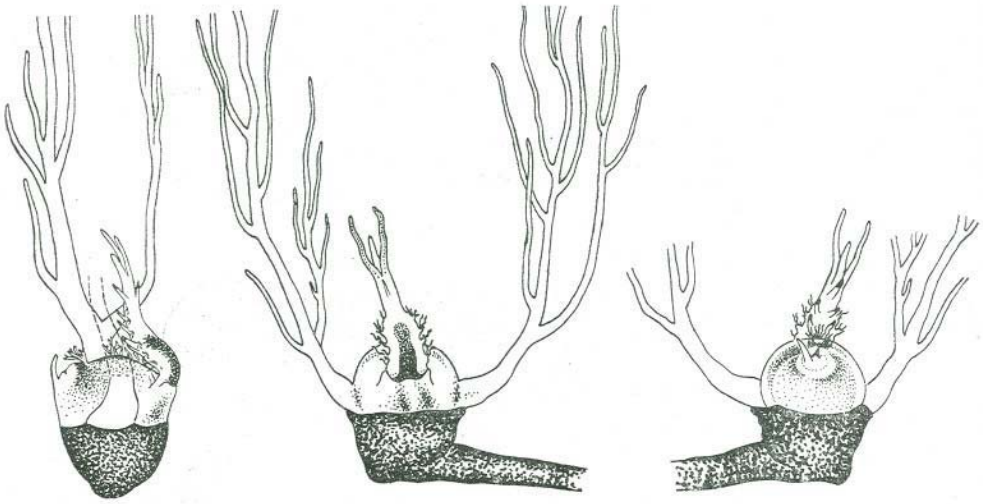

Fig. 21. — *Oneirodes* sp. of *O. eschrichti*-gr.; Reg. No. 3101. Esca: extreme left, right side; middle, front view; extreme right, back view.

the minute lateral filaments, 5 short stoutish appendages with black tips; on the anterior side one similar slightly smaller one; distally 3 longish filaments. Distally on bulb, just behind the digitiform appendage to about the middle of the distal surface of the bulb, a series of very small filaments. Laterally, on either side of the bulb, springing from the lower edge of the unpigmented part of the bulb, there are greatly developed and strongly ramified filaments many times the length of the bulb.

Comparison of the 5 Specimens

Structure and proportions of some bones and numerical values of teeth and fin rays. Morphologically all the bones described above for the largest specimen are practically the same in the smaller ones. Table 1 gives a comparison of relative proportions and numerical values of all specimens except the smallest, which is too badly damaged for measurements.

The only notable difference we find in the above comparison is that of the proportion of the basal bone, which, in the largest specimen is much smaller than in the smallest one. If all 5 specimens really belong to the same species this may either be attributed to the fact that this bone varies very much in size individually, or, more likely, that its growth slows down considerably after the fish has reached about 10 cm. S. L.

The illicium shows a more or less evenly progressive decrease in proportionate size from the smallest to the largest specimen.

There is a curious strong variation in the number of premaxillary and mandibular teeth. They are least numerous in the largest specimen, the next in number being the smallest specimen and the largest amount is in the two that are of a size between the largest and the smallest. A constant renewal of teeth has been observed in a number of species of the Iniomi, such as *Alepisaurus ferox*, *Anotopterus pharao*, etc., which causes their total number to vary greatly sometimes. The same phenomenon may, therefore, be the cause of the variation here.

The remaining 5 characters of a total of 8 compared, namely the mandible, the operculum, the width of the vomer, the posterior branch of the operculum in relation to the anterior one, and the longest mandibular tooth in relation to the mandible, are of quite outstandingly stable proportions in all the specimens.

The luminous bulb (Figs. 21 & 22). Only 3 specimens will be considered here: the large one, No. 3101, whose luminous bulb (Fig. 21) is described above; the small one, No. 14045, with a perfectly preserved bulb (Fig. 22 B); finally the intermediary size, No. 9921, with a somewhat damaged bulb (Fig. 22 A) which, however, still possesses all details, the shape and coloration well enough preserved to show that it is similar to the bulb of the small specimen.

Essentially all are similar in having a raised posterior papilla, below which there is a stiff simple filament. In front, opposite the latter, there

			% of S. L.								Teeth		
No.	T. L.	S. L.	Illicium	Basal bone	Mandible	Operculum	Width of vomer	Ill. (% of b.b.)	Posterior branch of operculum (% of anterior branch)	Longest mandibular tooth (% of mandible)	Mandibles	Premaxillaries	Pectoral rays
3101	220	180	20.5	59	43	25	15.4	35	51	11.6	10/11	13/13	16
16877	123	98	22.5	86	43	25	15.3	26	53	11.9	19/20	20/17	17
9921	117	95	24	94	44	25	15.7	26	50	10.3	18/20	19/19	17
14045	70	57	27	84	45	26	14.4	32	51	10.9	14/15	14/14	17

Table 1. — Comparison of 4 specimens of *Oneirodes* sp.

is a digitiform thickish appendage and between this and the papilla one to several pairs of soft branched filaments. The distal pigment spot or streak on the papilla is present in all, as well as a pair of black patches in front of the base of the papilla.

Differences between the bulb of the large specimen and the other two are the following: — In the former the posterior simple filament is very short; the filaments between the papilla and the digitiform appendage consist of more or less numerous pairs of very short, thin branched filaments placed in a row; there is one pair of greatly developed long ramified filaments laterally at about half the height of the bulb. In the smaller specimens the posterior filament is long; the filaments between the papilla and the digitiform appendage consist of one single fairly large branched pair; there are no lateral filaments.

As a result of this comparison it is difficult to decide whether to conclude that all 4 specimens belong to one species, as already hinted at above (see p. 127), or whether the large specimen belongs to one species and the 3 smaller ones to another. The former conclusion would leave little doubt as to its correctness if the luminous bulb were not taken into consideration. However, the difference in the structure of the bulb is significant. We have seen that this organ is distinguished in the large specimen particularly by the presence of large complex lateral filaments. Comparing this with the bulbs of other species of the *Oneirodes eschrichti*-group similarly placed filaments are only found in *Dolopichthys anisacanthus*, *D. pollicifer*, and *D. diatematus*. In none of these are they greatly developed, but the largest specimen measures only 28 mm. S. L., whereas ours measures 173 mm. Considering other characters such as size, number, position and formation of all the other filaments and the digitiform appendage, as well as the general pigmentation, there is no doubt that the similarity between our specimen and *D. anisacanthus* is very striking. *D. pollicifer* and *D. diadematus* differ in having only one pair of distal filaments. The latter, apart from this, differs in having the stem of the illicium pigmented only in the basal half.

The feature by which the bulb of the small specimen is mainly distinguished from the one discussed above are: — the lack of lateral filaments, the posterior filament being long, and the distal ones only consisting of one rather well developed pair. Bulbs resembling this description well

to fairly well are found in the following 11 species of *Dolopichthys*:—1) *megaceros*, 2) *obtusus*, 3) *tentaculatus*, 4) *plumatus*, 5) *ptilotus*, 6) *bulbosus*, 7) *cirrifer*, 8) *multifilis*, 9) *claviger*, 10) *pennatus*, 11) *frondosus*. Of these the first 5 show the best agreement in having a very long posterior filament and only one pair of distal branched ones.* The remaining 6 either disagree by having a short posterior filament, or by having a long one but several pairs of distal filaments between the papilla and the digitiform appendage, or both a short posterior filament and several pairs of distal ones. They are further distinguished by the following numerical or proportional differences:—only 13 pectoral rays (*D. bulbosus*); lower jaw 50 °/₀ or more of standard length (*D. pennatus*, *D. frondosus*, *D. cirrifer*, *D. multifilis* and *D. claviger*). The total sum of these disagreeing characters enables us to eliminate the latter 6 species from the list of 11 considered above for comparison. On the other hand, the agreement and consistancy of the same characters in the first 5 species make it highly probable that they are the same.

The conclusion based on these considerations suggests that *Dolopichthys anisacanthus* is a good species to which our large specimen belongs (differing only by a much greater development of the lateral filaments) and that the smaller specimens belong to *Dolopichthys megaceros* Holt & Byrne, with *D. obtusus* Parr, *D. tentaculatus* Beebe, *D. plumatus* R. & T. and *D. ptilotus* R. & T. as synonyms. In accordance with Bertelsen's arrangement, therefore, specimen No. 3101 would be *Oneirodes anisacanthus* (Regan) and specimens 16877, 9921 and 14045 *Oneirodes megaceros* Holt & Byrne.

Genus B. ***Dolopichthys*** Garman, 1899

The diagnostic characters of this genus as given by Bertelsen (p. 96) are:—Upper part of suboperculum slender and pointed. Operculum bifurcate. D 5 (4?)-9, A 4-6 (8?), P 17-22, C 9. The 4 species he recognizes are:—*D. allector* Garman, *D. danae* Regan, *D. niger* Brauer and *D. longicornis* Parr.

The specimen of our collection, if judged by the relative length of the illicium and basal bone alone, can only be referred to *D. allector*, hi-

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* There are several pairs of distal filaments in *D. ptilotus*, but they spring from a small area and form one single clump and are of similar formation.

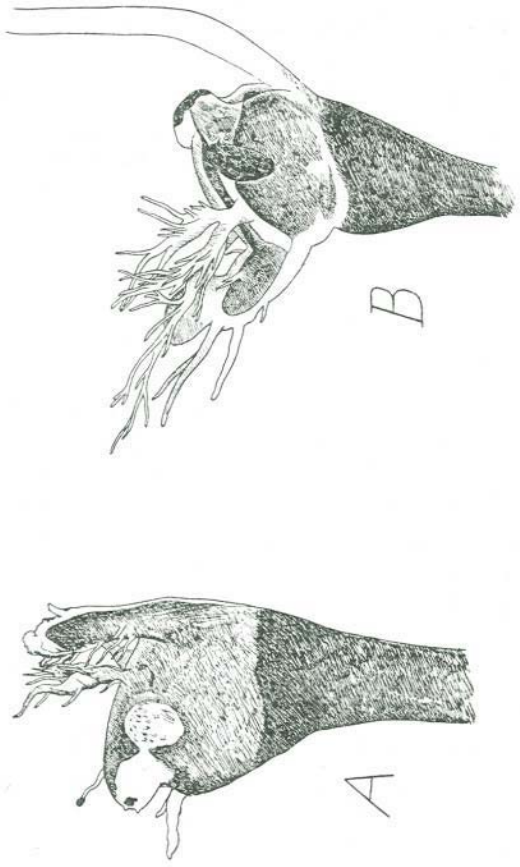

Fig. 22.— *Oneirodes* sp. of *O. eschrichti*-gr.; *A*—right side of esca of Reg. No. 9921, *B*—left side of esca of Reg. No. 14045.

therto only known from the Gulf of Panama. This species is the only one with these bones measuring about 50 °/₀ of the standard length, the others being distinguished by a difference of 15 less or 20 more in this same percentage. As will be seen from the description and figure, the similarity of the other characters is so great that there can be but little doubt that this identification is correct.

1. ***Dolopichthys allector*** Garman, 1899

Fig. 23.

Dolopichthys allector Garman, 1899, Mem. Mus. Comp. Zool., vol. XXIV, p. 81, pl. XII-XV. Regan & Trewavas, 1932, Dana-Report No. 2, p. 80. Beebe & Crane, 1947, Zoologica, Vol. 31, Part 4, p. 161, fig. 7. Bertelsen, 1951, Dana-Report No. 39, pp. 100 & 97.

Material

One specimen, condition poor. S. L. 116 mm., from stomach of *Aphanopus carbo*, 12.IX.1959, Reg. No. 16280 A.

Description

A large part of the skin is badly torn and the luminous bulb is lost, but apart from these defects the specimen is in satisfactory condition. It is possible to see great part of the bones of the head without further dissection, which allows for an easy comparison with the figure of the skeleton of the type of *D. allector*.

Measurements (in mm.). Total length 134; standard length 117; snout abt. 31; distance between sphenotic spines 19; diameter of orbit abt. 2.2; length of lower jaw (bone) 40; distance between sphenotic spine and lowest point of lower jaw-bone 43; illicium 54; basal bone 49.

Counts. Dorsal 7; anal 6; pectorals 20; caudal 9; branchiostegals 6.

Teeth. There is a single row of small very fine sharply pointed teeth of greatly varying length along the entire edges of the jaws, both upper and lower, with those in the latter somewhat larger. On the rather wide head of the vomer, on either side but near to the middle and somewhat back, one single small curved tooth. Six teeth on pharyngeals.

Comparison with the Type of *Dolopichthys allector*

Our specimen is considerably larger than the type, but its relative proportions agree with it almost completely.

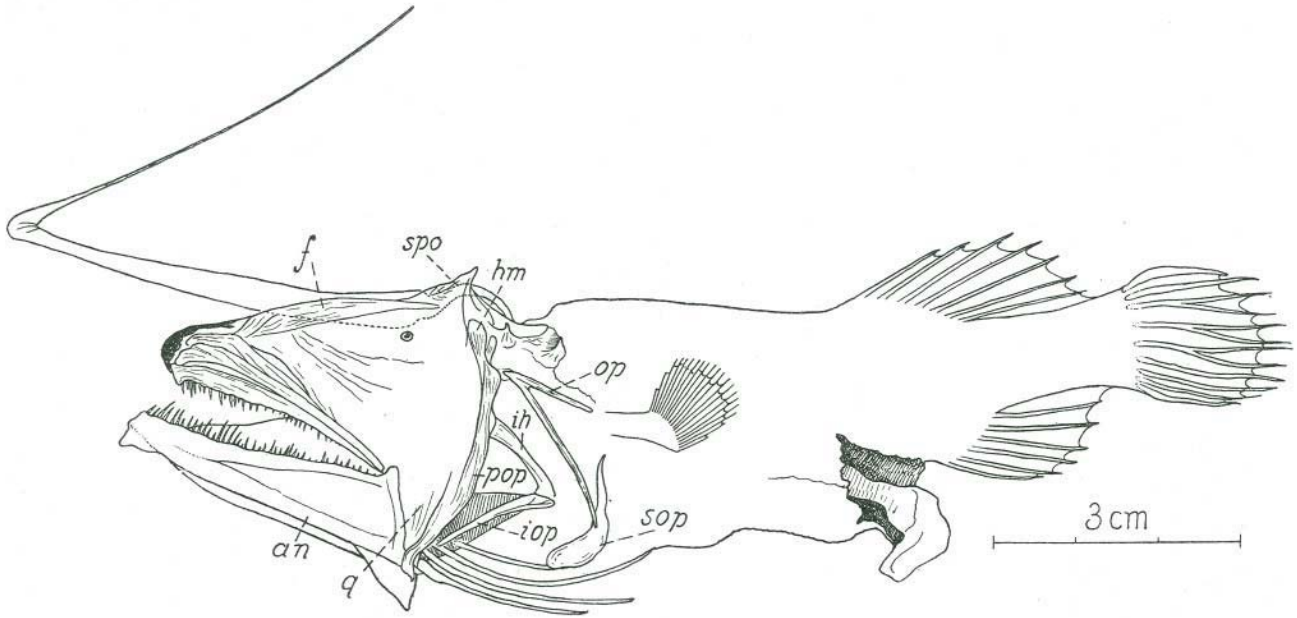

Fig. 23. — *Dolopichthys allector;* Reg.No. 16280A.

Comparing the bones of the head with the figure by Garman, the only difference (though of negligible importance) is the curvature of the suboperculum, which, in the type, is much less pronounced. Otherwise the similarity is most striking.

The loss of the esca in our specimen is rather unfortunate, particularly so as this organ seems deformed in the type, so that we cannot be sure of its normal shape.

In the present specimen there is one more ray in the dorsal, a difference a perfectly normal individual variation can account for. The numbers for all the other rays are exactly the same.

The dentition is also practically the same, except that there are two more teeth on the pharyngeals. The larger size of the specimen may account for this.

Remarks

It seems indeed extraordinary that our specimen should be considered identical with a species from the Pacific rather than with one of the two closely allied ones known from the Atlantic, but taking into account the characters that distinguish the 4 known species it is impossible to arrive at any other conclusion.

Even though it is not possible in this case to use this important character, the esca, for identification, there are still two left perhaps of no less importance. These exist in *D. allector* only. One, the length of the illicium, which has been mentioned before; the other, the shape of the operculum. Bertelsen (p. 98) shows the forks of this bone to widen considerably upwards both in *D. danae* and *D. longicornis*, whereas the figure of the skeleton of the type of *D. allector* clearly shows the very narrow forks, equally broad along their entire length, exactly as in our specimen.

Genus C. ***Lasiognathus*** Regan, 1925

A genus mainly characterized by the greatly projecting upper jaw in advance of the lower, with premaxillaries loosely moving up or down by means of a wide membrane that connects them to the head and an esca furnished with hooks.

Two specimens only were known, each of which is referred to a different species. The third specimen of this genus, recorded here, could not be referred to either species for reasons expounded below.

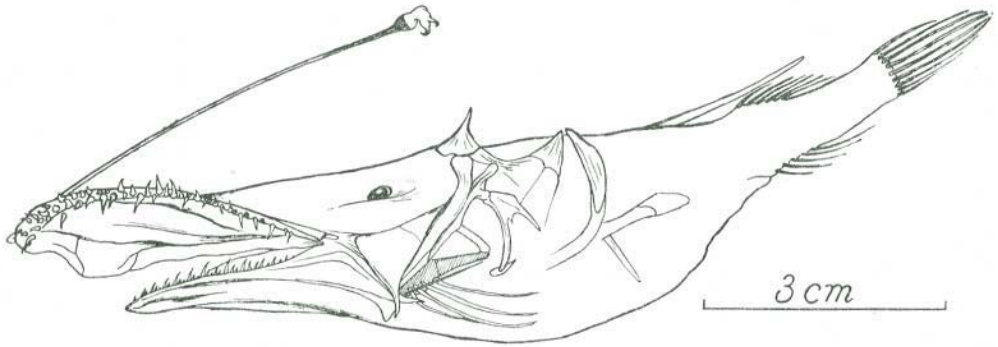

Fig. 24. — *Lasiognathus* sp.; Reg.No. 12839

I. ***Lasiognathus*** sp.

Figs. 24, 25 & 26.

Material

One specimen, fair condition, S. L. 111 mm., from stomach of *Aphanopus carbo*, 28.X.1957, Reg. No. 12839.

Description

On the sides of the head and the caudal peduncle the skin is torn. By removing it further from the head it was easy to lay bare the skeleton

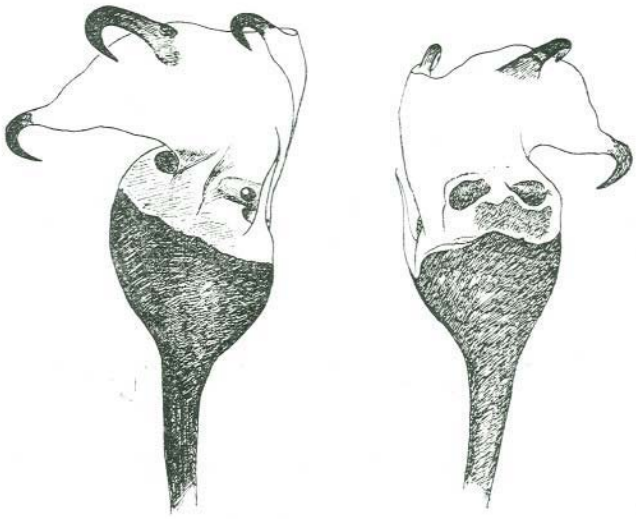

Fig. 25. — Esca of *Lasiognathus* sp.; Reg. No. 12839. Left, left side; right, right side.

of that part so that several of the most important bones could be shown on the drawing of the whole specimen. Apart form this above mentioned damage the specimen is intact and particularly the esca is in perfect condition.

Measurements (in mm.): Total length 124; standard length 111; premaxillary 38; lower jaw 33; distance from tip of snout to point of sphenotic spine 58, to upper meeting points of posttemporal and supra-

cleithrum 69; distance between points of sphenotic spines 17; operculum 10; suboperculum 4.3; illicium 57; basal bone 102; longest tooth in upper jaw 4.7; distance between mouth cleft and eye 7 (between verticals at right angle to roof of head).

Counts. Dorsal 6; anal 5; pectorals 19; caudal 9; branchiostegals 6.

Teeth. In the upper jaw 50 and in the lower 43 small teeth, greatly varying in size. Those of the upper jaw larger on the whole. Teeth of the inner row the largest and the least in number. Vomer toothless.

Luminous bulb (Fig. 25). Small subspherical bulb with black pigment slightly more than half way up. In front a small simple tentacle behind which the opening pore. A short distance above the latter a black

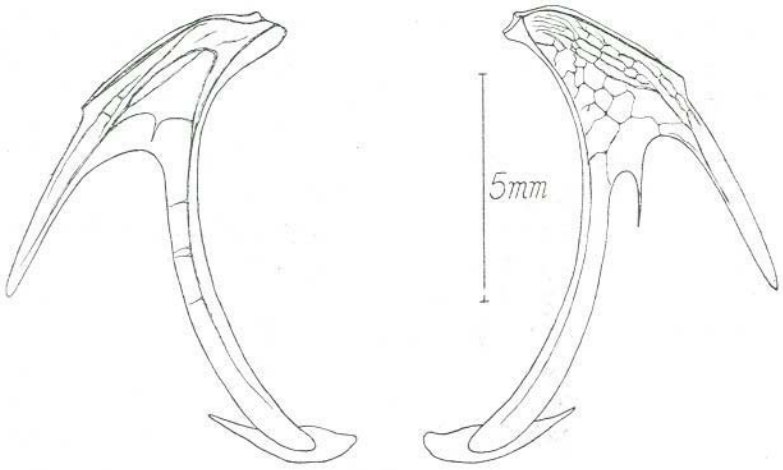

Fig. 26. — Right and left operculum and suboperculum of *Lasiognathus* sp.; Reg. No. 12839.

round spot. From the distal end of the bulb arises a wide but short white membrane with 3 strong black hooks all pointing forwards. Two large black spots on bulb just below membrane on posterior side of bulb.

Opercular bones (Fig. 26). Both the right and the left operculum consist of a small but sturdy bifurcate bone with a curved narrow anterior arm and a straight somewhat narrower and shorter posterior arm. Along these arms and half way down the upper hind edge of the posterior arm there are well elevated supporting ridges, and between these there

is an irregular network of minor ridges. The connecting membrane-like bone plate between the two arms runs out in a thin weak point on the operculum of the left side. This point does not exist on the right operculum, but a weak ridge designs a similar point on the connecting bone plate a short distance from the edge.

The suboperculum is a small fairly narrow bone, rounded in front and ending in a point behind. The point slants very slightly upwards.

Comparison with the other two known Species of the Genus *Lasiognathus*.

To give this specimen a new name would mean the erection of yet another new species based on the unsatisfactory evidence furnished by a single specimen. However, if the former two species are to be maintained there are only two ways out of the dilemma: either to give this specimen a new name or leave it unnamed. For where it shows agreement with one species in one of the most important distinguishing characters it shows agreement with the other in another distinguishing character. This particular circumstance applies to the long filament on which the hooks of the esca are placed in *L. saccostoma* and the very special shape of the operculum in *L. beebei*. But there are other differences that make it difficult to refer our specimen to either one or the other of these species. In Table 2. the main distinguishing characters of all 3 specimens have been compared. As can be seen, there are considerable differences in size and the possibility of ontogenetic development difference must be examined carefully. Thus the 39 mm. *L. beebei* (with an operculum consisting of 4 wide-spread radial arms, connected by membrane-like osseous plates, and hooks directly on esca) might develop into the 75 mm. *L. saccostoma* by a gradual thickening and uniting of the upper 3 radial arms of the operculum and by the extension of the membrane on the distal end of the esca into a long filament. If the present 124 mm. specimen also had an escal filament similar to *L. saccostoma* it might easily constitute a further developmental stage, in which the teeth have become more numerous and relatively smaller and where a few proportional shiftings have taken place. But, unless the possibility of an anomality is admitted in the case of *L. saccostoma* or the possibility of individual variability in the existence or non-existence of the filament, the absence of the long filament in our specimen makes this hypothesis hardly tenable.

	L. saccostoma	*L. beebei*	*Lasiognathus* sp.
T. L. (mm.)	75	38	124
Cleft of mouth to	beyond eye		well before eye
Articular spine of quadrate	in middle between lines (at right angle to roof of head) through centre of eye and point of sphenotic spine		in line (at right angle to roof of head) through centre of eye
Hump caused by upper points of posttemporal and supracleithrum	well in advance of middle of total length		well behind middle of total length
Hooks on esca	on long filament	directly on esca	
Operculum	bifurcate, upper arm broader and with supporting rib giving off 2 weaker ribs	uper arm split into 3, the uppermost at right angle to lower arm	bifurcate. Two supporting main ribs on upper arm, which is narrower, and one on lower arm. All over, an irregular network of less strongly developed supporting ribs
Longest tooth in upper jaw (% of T.L.)	7.6	5.4	3.8
Number of teeth in upper jaw	27/28	abt. 13	50
Dorsal	5		6
Anal	5		
Pectorals	17	?	19

Table 2. — Comparison of the main distinguishing characters of the 3 specimens so far known of the genus *Lasiognathus*. (see p. 138)

Though further material of fishes of this rare and interesting genus may, and probably will, still show that there is really only one species involved here, at this stage, and in the absence of any satisfactory explanation to the contrary, it is felt that the two described species should be maintained. However, should further material prove that 3 different species are involved, they would be distinguished by the following main characters: —

Table 3.

L. saccostoma	*Lasiognathus* sp.	*L. beebei*
Bifurcate operculum		Operculum split into 4 arms
Hooks on long filaments	Hooks directly on esca	
About 25 teeth in upper jaw	About 50 teeth in upper jaw	Less than 25 teeth in upper jaw

Family 4. ***Linophrynidae***

This family is represented in our collection by 13 adult and 19 larval females. The adult females are dealt with under their respective generic or specific headings. The larval material is composed of the following specimens: —

1) ***Haplophryne arborifera*** Regan

Reg. No. 3762, 12.VI.1953, 27 mm. S.L. From the stomach of *Anoplogaster cornutus* taken from the stomach of *Alepisaurus ferox*. Subdermal pigmentation like Reg. No. 17889 (Fig. 27 A) but along upper and lower part of peduncle very dense.

Reg. No. 17902, Oct./Nov. 1946, 18.8 mm. S.L. From stomach of *A. ferox*.

Reg. No. 17903, no date, 29 mm. S.L. No data as to locality but is certain to be from stomach of *A. ferox*.

Reg. Nos. 17889 (Fig. 27 A)-17898, no dates, 22.8-31.5 mm. S.L. No data as to localities but all are certain to come from stomachs of va-

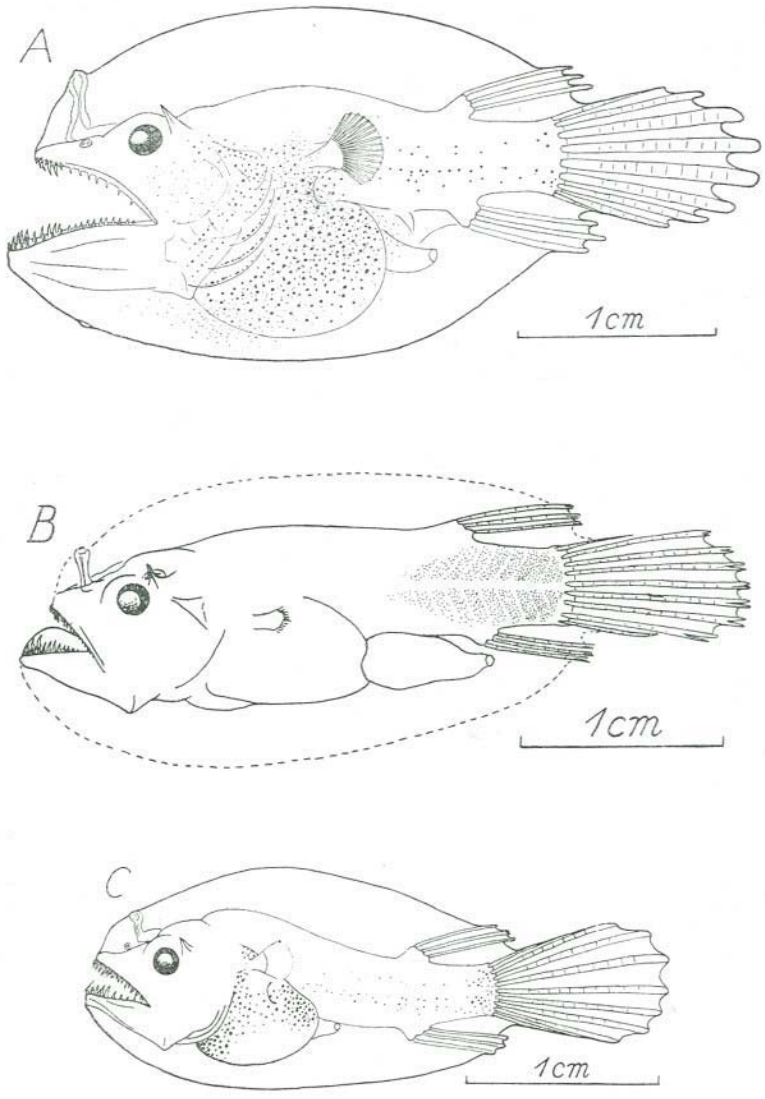

Fig. 27. — Female Linophrynid larvae. *A* — *Haplophryne arborifera*, Reg. No. 17889; *B* — *Linophryne macrorhinus*-group, Reg. No. 2941; *C* — *Edriolychnus schmidti*, Reg. No. 17887.

rious *A. ferox*. One specimen measuring 25.5 mm. S. L. resembles No. 3762 in its subdermal pigmentation, all others are like the figured specimen (No. 17889).

2) ***Haplophryne macrorhinus***-group

Reg. No. 2941 (Fig. 27 B), March 1944, 26 mm. S. L. From stomach of *A. ferox*. The skin of this specimen was removed to show up the subdermal pigmentation.

3) ***Linophryne*** sp.

Reg. No. 4057 (Fig. 28 A), 27.II.1954, 23.4 mm. S. L. and

Reg. No. 17901 (Fig. 28 B), March 1944, 22 mm. S. L. Both from stomachs of *A. ferox*. They have similar subdermal pigment patterns and are not represented among the material investigated by Bertelsen.

4) ***Edriolychnus schmidti*** Regan

Reg. No. 17887 (Fig. 27C), Oct./Nov. 1946, 21 mm. S. L. and

Reg. No. 17888, no date, 22.5 mm. S. L. Both from stomachs of *A. ferox*. They have very similar subdermal pigmentation patterns and are referred to *E. schmidti* on the strength of the distribution of the chromatophores coupled with the lack of the wart-like hyoid barbel which, at the size of these specimens should be well developed if they belonged to *Linophryne*.

5) **«Hyaloceratias»**

Reg. No. 4048 (Fig. 28C), 27.II.1954, 11.1 mm. S. L. From stomach of *A. ferox*. Owing to the small size no generic identification is possible and the specimen has to be referred to the above group which, according to Bertelsen (p. 189), contains larval *Edriolychnus schmidti*, *Linophryne arborifera* and possibly young larval *L. corymbifera*.

Genus A. ***Linophryne*** Collett, 1886

There are 8 adult female specimens in our collection belonging to this genus, but only 4 are well enough preserved for identification. One of the latter is a large female of *L. arborifera* with an attached male, while

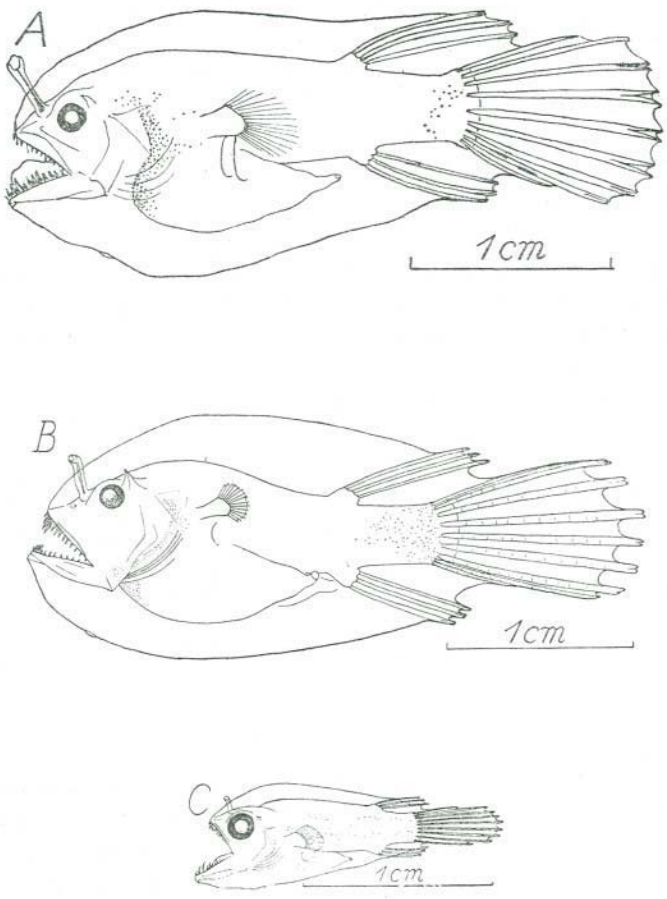

Fig. 28. — Female Linophrynid larvae. *A* — *Linophryne* sp., Reg. No. 4057
B — *Linophryne* sp., Reg. No. 17901; *C* — «Hyaloceratias», Reg. No. 4058

the other 3 cannot be attributed to any of the hitherto known species and are, therefore, described as new. Unfortunately the remaining 4 are not in a state for reliable specific identification. All 4 come from the stomachs of *A. carbo* and the luminous bulbs and hyoid barbels are either missing or are badly damaged. The count of the teeth both in the upper and the lower jaws is rather high compared to those counts given for the 12 female species maintained by Bertelsen. Thus we find a range of 14-27 for the upper jaw and 12-18 for the lower jaw. According to what is given in the literature for all other species of *Linophryne* these values range from 7-13 and 6-13 respectively. The reason for these low counts may be due to the fact that some of the teeth just before and behind the very large ones are very small and situated near their roots. In a specimen in good condition, i. e. with the skin intact and thus covering the jaw bones, these small teeth could easily be overlooked. There is, however, one specimen with such a high count, of mostly well developed teeth, that this explanation does not hold good.

The material at hand, with a few short descriptive notes, is the following: —

One specimen, Reg. No. 11367, S.L. 41 mm., 26.III.1957. Practically all the skin has been destroyed by the gastric juices. Only a short stump of the hyoid barbel left. Luminous bulb present but in poor condition. Dorsal 3; anal 3; pectorals 16. Teeth in premaxillaries 16 (right), 14 (left); in lower jaw 13 (right), 12 (left); vomer toothless. Illicium (bone) 5.5 mm.; basal bone (including short posterior cartilage) 17 mm. Diameter of luminous bulb 2.2 mm. Lower jaw 36 % of S. L. Subdermal chromatophores on part posterior to abdominal cavity a few large widely scattered ones below and above median line, fewer above.

One specimen, Reg. No. 14518, S.L. 43.5 mm., 11.VII.1958. Most of the skin still intact. Luminous bulb present but its distal end is damaged. The hyoid barbel (Fig. 31C) consists of a fairly sturdy stump which obviously is the remnant of a more or less complex long branch that has broken off. Anteriorly there are 4 minor branches, one below the other, the uppermost broken off short, the second very long and simple but with the point broken off, the third, the thickest, intact. The latter has 5 short simple very thin lateral branches, distributed over its whole length at wide but irregular intervals, each ending in one small bulb. This branch, which is about as long as the fish, ends in 5 spherical bulbs (probably luminous) arranged in a row along one side of the end of the branch, the

last one being the smallest and having a slightly curved pointed appendage at its distal surface (see enlarged detail of Fig. 31C).

The only species of *Linophryne* with a barbel that divides from the base or near it are *L. algibarbata, L. quinquaramosus, L. polypogon* and *L. arborifera,* but in all these the various branches spring from a common base and not at all in the manner of the arrangement met with in our specimen, where the 4 thinner branches spring from the anterior side of the main branch, one under the other. Furthermore none have long branches of such general simplicity, on one hand, and, on the other hand, a complexity at the tip of any of the branches as met with here.

Dorsal 3; anal 3; pectorals 16. Teeth in premaxillaries 14 (right), 15 (left); in lower jaw 12 (right), 13 (left). One large straight pointed tooth medianly on vomer. Illicium (bone) 6.6 mm.; basal bone (including posterior cartilaginous point) 18.2 mm. Diameter of luminous bulb 2.8 mm. Lower jaw 59 °/₀ of S.L. Subdermal chromatophores on part posterior to abdominal cavity about 20 fairly large ones in an irregular row below median line and 2 near caudal above.

One specimen, Reg. No. 16079, S.L. abt. 57 mm., 7.VII.1959. General condition very poor. All the skin and with it the illicium and basal bone have diappeared. Only a torn but rather massive stump of the hyoid barbel are left, but it gives the impression that there is no ramification near the base. Of the fins only the anal is complete showing 3 rays. The jaws are intact and the following numbers of the teeth are found:— Premaxillaries 27 (rigth), 26 (left); lower jaw 17 (right), 18 (left); vomer with 3 sturdy median teeth. The lower jaw is about 58 °/₀ of S.L. Subdermal chromatophores on part posterior to abdominal cavity about 20-25 large ones in an irregular row below median line and 4 above, near caudal.

One specimen, Reg. No. 13062, S.L. 67 mm., October 1957. The condition is poor and most of the skin and the hyoid barbel are missing. The luminous bulb is squashed and no details are recognizable. Dorsal 3; anal 3; pectorals 17. Teeth on premaxillaries 20 (right), 19 (left); in lower jaw 12 (right and left); on vomer 4 median teeth, two large and two much smaller ones. Illicium (bone) 13.2 mm.; basal bone (including posterior cartilaginous point) 19 mm. Lower jaw 49 °/₀ of S.L. Subdermal chromatophores on part posterior to abdominal cavity minute, densely and more or less equally distributed above and below median line so as to give the whole a brown coloration.

I. ***Linophryne arborifera*** Regan

Fig. 29.

Linophryne arborifer Regan, 1925, Ann. Mag. Nat. Hist., ser. 9, vol. XV, p. 564.*

Material

One female, in fair condition, S.L. 86 mm., from stomach of *Aphanopus carbo*, 4.IV.1961, Reg. No. 18214; attached male, in perfect condition, S.L. 13.6mm.

Description of female

Measurements (in mm. and % of S.L.). Standard length 86; distance between sphenotic spines 22 (25.6); length of lower jaw (to lower angle of angular) 44 (51.2); longest tooth 9 (10.2); illicium 13.5 (15.3); length of luminous bulb 6 (7); diameter of bulb 3 (3.5); escal appendage 5.2 (6); basal bone of illicium 33 (38.3); hyoid barbel 95 (100+).

Counts. Dorsal 3; anal 3; pectorals 17; caudal 9. Teeth 18 in upper and 15 in lower jaw, 3 on vomer.

Illicium. Stem short, with a bulb of almost equal length. In this specimen the whole illicium is twisted round its axis by nearly 180°, so that the larger appendage, instead of being behind the smaller one, is in front of it. This larger appendage is essentially very much like the one of the type specimen as figured by Bertelsen. There is, however, an additional short, rather thick branch near its base, and a filamentous one above the two lateral opposite ones. The short appendage (here behind the large one) is rather thick and simple. The black pigmentation reaches up to about the lower 40 % of the bulb.

Hyoid barbel. The tremendously developed hyoid barbel is almost as long as the whole fish and is composed of 3 thick main branches originating more or less from a common short and stout basal stump. The foremost branch is the weakest and the hindmost the strongest. The second branch is simple except for one almost equally long and equally thick simple side branch springing from near its base. The foremost branch has near its base two opposite lateral branchlets of equal shape and size and below these about 12 more of varying lengths, distributed

* For synonymy see Bertelsen.

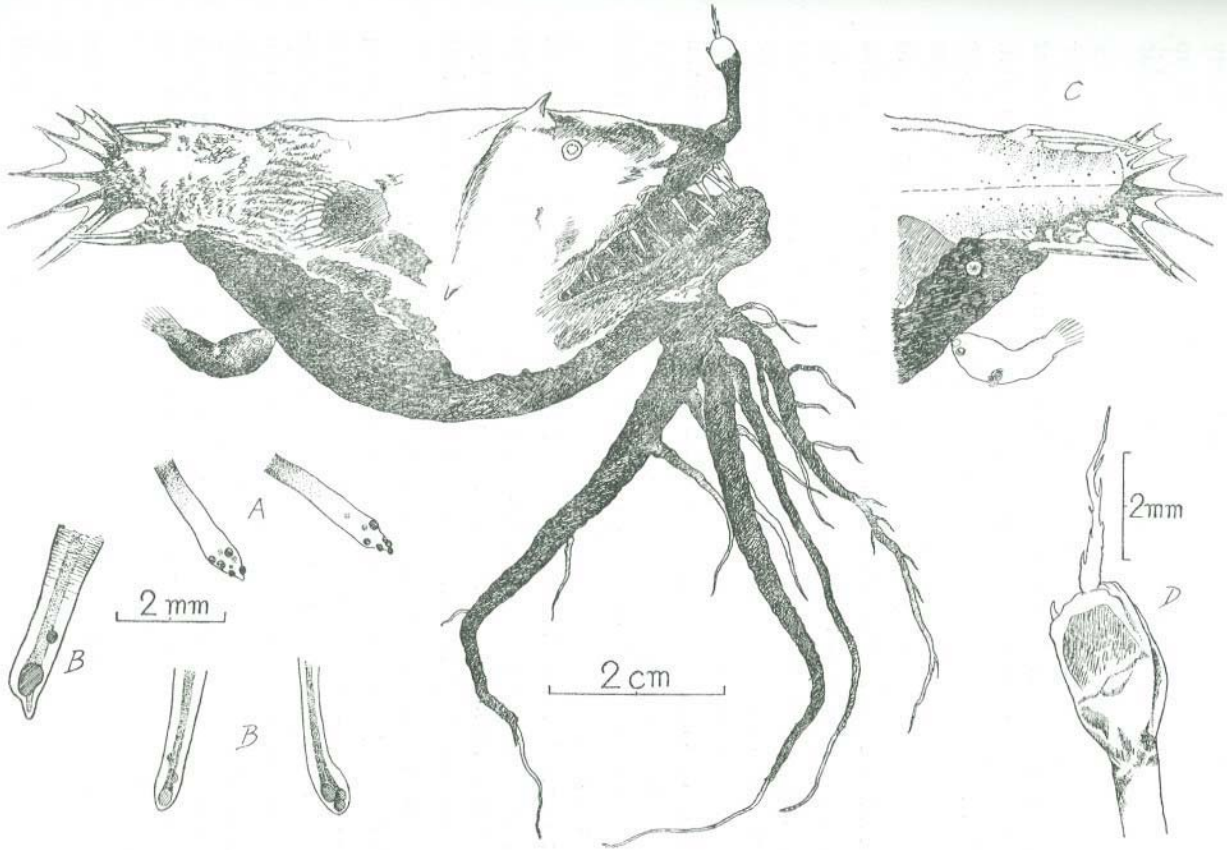

Fig. 29. — Female with attached male of *Linophryne arborifera;* Reg. No. 18214. *A* — ends of upper lateral side branches of foremost main branch. *B* — three examples of ends of barbel branches other than those of figure *A*. *C* — left caudal peduncle, to show subdermal pigmentation. *D* — luminous bulb.

over the whole length of the main branch at more or less equal intervals. The hindmost branch only bears very few filaments growing from widely separated places, the more proximal ones being rather long. There is no sign of a tassel-like ramification at the end of any of the branches or side branches.

About half of the ends of the branches and side branches are perfectly preserved and show that the inner bulbs have an appreciably smaller diameter than the part of the branches where they are situated, so that, when single, they cause hardly any swelling (Fig. 29 B). There are none placed in a row to form a chain, but in some cases there are several close together, in which case the end of the branch is somewhat swollen and becomes club-shaped. The distal ends of the branches, where the bulbs are placed, are transparent.

A fact of some interest is that the arrangement, size, placement and number of these bulbs is quite different in the two uppermost lateral side branches of the foremost main branch. In both of them the bulbs are quite small, about seven in number, and placed near the more or less pointed ends of the branches (Fig. 29 A). A further difference from the other branches lies in the fact that the bulbs are placed near, almost on the outer surface.

This distinct differenciation consisiting of two well-defined types of arrangement of the luminous bulbs in the branches does not seem to be a haphazard coincidence and as the smaller females of this species do not seem to be similarly characterized it may constitute a character linked with species recognition which only developes at maturity.

Subdermal pigmentation. On the left side the skin is torn away from the caudal peduncle, so that the subdermal pigmentation on that part of the body is clearly visible (Fig 29 C). There are densely crowded minute chromatophores on the myomers. They are particularly dense nearer the top and bottom oultine, whereas towards the middle they become less numerous, till they disappear. On top of this pigmentation there is another, consisting of fairly large widely spaced chromatophores (see Fig. 29 C).

Sexual organs. The ovaries are round in transverse section and are about 14 mm. long by 5 mm. in diameter. The present specimen seems to have spawned shortly before capture as there were no eggs to be found between the inner lamella-like folds.

Description of Male

Measurements. The measurements of 20.3 mm. for total length and 13.6 mm, for standard length would, of course, be somewhat increased if they were taken on the specimen in a straight position. The strongly curved shape, as shown in Fig. 29 was even before preservation in formalin of such rigitity that it was difficult to straighten the specimen out.

Counts. Dorsal 3; anal 3; pectorals 16; caudal 9. Olfactory lamellae 11.

Pigmentation. Except for all the fin rays and membranes thereof, uniform brownish black. On the left side the skin was longitudinally cut on the caudal peduncle to examine the subdermal pigmentation. This was found to consist of more or less widely spaced large chromatophores running in two rows along the peduncle, those of the upper row being smaller and less numerous. The arrangement resembles variation 6 and 8 of Fig. 124C (Bertelsen) most closely.

Comparison of Female with Type and some other Specimens

The largest specimens so far described measured 50 mm. in standard length. They were Regan's type and the type of *L. densiramus* Imai, referred to *L. arborifera* by Bertelsen. The present specimen is, therefore, by far larger than any that have been reported on before, but its proportions tally well enough with those of the type so as not to exclude it from this species. The even larger hyoid barbel is quite in line with the ontogenetic development of this organ already noted by Bertelsen and Parr.

The trifid appendage differs slightly in that it has a further short branch near its base and one more filamentous one distally. The hyoid barbel differs considerably in that it does not possess the tassel-like arrangement of distal filaments shown in the barbels of Regan's type and Parr's two figures (1927 & 1934) of this organ. The fundamental arrangement of the main branches is very much the same in all, including the present specimen: there is one strong posterior branch, with some weaker ones, more or less evenly increasing in size from front to back, springing anteriorly from near its base, one below the other. However, there is considerable variation as regards length, number and arrangement of the secondary branches. Thus the tassel-like end filaments are very numerous in the type, whereas in Regan and Trewavas's type of *L. eupogon* the densest formation of tassel filaments does not seem to exceed these.

Unfortunately the nature, size, distribution and shape of the small tubercles inside the ends of the branchlets have not been discussed by former authors in greater detail. Judging from the figure of Regan's type it would seem that they cause an abrupt and distinct swelling at regular intervals along the entire length of the ultimate branchlets. Bertelsen, however, mentions that «in Regan's figure the hyoid barbel is drawn rather schematic and incorrect in several details».

Any doubt as to whether these differences in the structure of the hyoid barbel could indicate that the present specimen does not belong to *L. arborifera* is undone by the further good agreement in the subdermal pigmentation. This, as can be seen in Fig. 29, is almost exactly like the subdermal pigmentation of the type as shown by Bertelsen in Fig. 117 C.

Comparison of the Parasitic Male with the Free-living Males assigned to *L. arborifera* by Bertelsen

The standard and total length of this parasitic male lies well within the range given for 15 specimens of male metamorphosis stages. The inner pigmentation could now for the first time be examined on a specimen known to belong to *L. arborifera* by nature of the known facts regarding male parasitism in these fishes. The distribution and appearance of the large chromatophores shows to be of the same character as in the adult female, and also of the type as found in the free-living males examined for this character and figured in Fig. 124 C by Bertelsen. There is also agreement in the number of olfactory lamellae.

Remarks

The find of a parasitizing male on *L. arborifera* adds a further species to the list of 8 Ceratioid females with attached males we know so far, and the total number, irrespective of species, has been increased to 21.

Bertelsen had suggested that parasitic males possibly only become attached to females larger than the ones known until then. The fact that our specimen is so much larger bears out the correctness of this and shows that probably none of the former specimens were sexually ripe.

The position of the present male is upside down and its place of attachment is thus that it would be able to superimpose the anus of the

female with its own by pressing the length of its body backward to the left side of the female. The position of several other parasitic males on other species shows, however, that this is not always the case and that it is probably not essential for a successful fertilization of the eggs.

2. ***Linophryne maderensis*** sp. n.

Figs. 30, 31 A & B.

Material

Type specimen (Figs. 30 & 31 A), Reg. No. 9094, S. L. 34 mm., 10.VIII.1956. In fair condition. Illicium and esca well preserved, hyoid barbel damaged.

Paratype, Reg. No. 9911 (Fig. 31 B), S. L. 38 mm., 16.X.1956. In fair condition. Luminous bulb well preserved, but posterior filament torn away almost at base. Hyoid barbel complete.

Paratype, Reg. No. 15119 A, S. L. 29 mm., 15.IX.1958. In poor condition. Hyoid barbel as well as the dorsal, anal and caudal fin rays are missing completely, but the illicium and luminous bulb are well preserved. The anterior and posterior escal filaments are broken off fairly short

All 3 are from stomachs of *Aphanopus carbo*.

Description of Type

Measurements (in mm. and °/₀ of S. L.). Total length 47.5; standard length 34; snout 7.5 (22); distance between sphenotic spines 12 (35); length of lower jaw to articular spine) 19 (56); illicium (to end of luminous bulb) 12 (35); basal bone 16.5 (49); longest tooth in upper jaw 4.2 (12); longest tooth in lower jaw 5.5 (16); greatest diameter of luminous bulb 3 (9).

Counts. Dorsal 3; anal 3; pectorals 16. Teeth on premaxillaries 13 (right and left); in lower jaw 10 (right, two of them replacement teeth), 8 (left); on vomer 2.

Teeth. In upper jaw fifth tooth the largest and the foremost second in size, in lower jaw the second is by far the largest. Those of the lower jaw are on the whole much larger than the ones of the upper jaw.

Illicium. Stem thin and short, with a laterally somewhat flattened luminous bulb (Fig. 31A) which is several times thicker than the stem. No terminal filaments or digitiform appendages but one thin simple ante-

rior and posterior filament. Through the colourless transparent skin enveloping the bulb an inner subspherical body is visible which is deep black, except at the part nearest the distal end of the bulb, where it is white.

Hyoid barbel. Of this organ only the unbranched part is left. It is rather thin and at its distal end it still has short remnants of the broken off branches. Its length equals one third of the standard length of the fish.

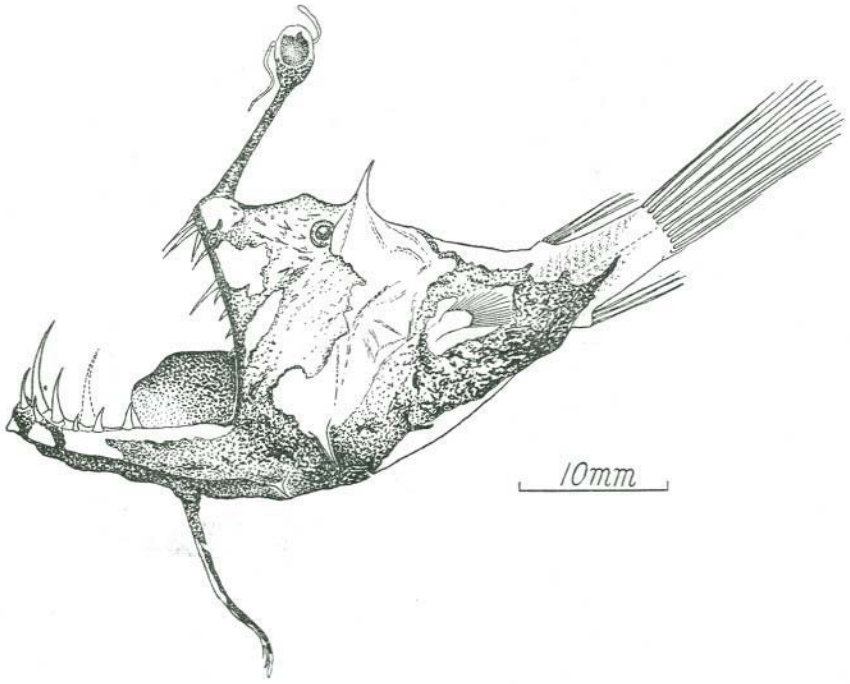

Fig. 30. — *Linophryne maderensis* sp. n.; type, Reg.No. 9094

Subdermal pigmentation. There are numerous minute chromatophores along the miomers of the caudal peduncle above and below the median line.

Description of Paratypes

The two paratypes agree in the proportions, structure and inner pigmentation of the esca exactly with the type, and the length and thick-

ness of the unbranched part of the hyoid barbel in paratype 9911 is of the same proportion. The ramifications (Fig. 31 B) are of fairly simple structure. There are 4 primary branches, one upper simple one with one terminal bulb and 3 ramified ones springing from the same base. One of the latter

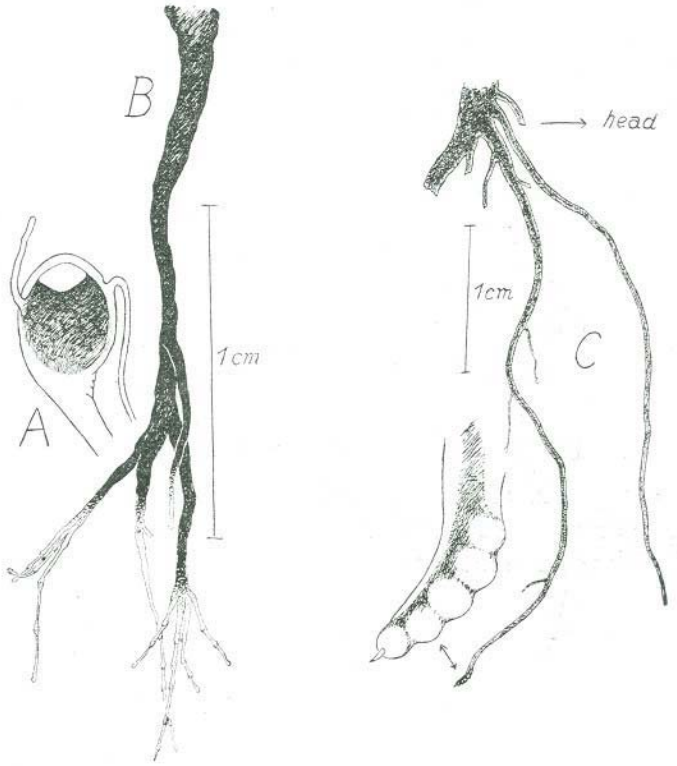

Fig. 31. — *A* — Right side of luminous bulb of *Linophryne maderensis* sp. n.; type, Reg.No. 9094. *B* — Right side of hyoid barbel of *L. maderensis* sp. n.; paratype, Reg.No. 9911. *C* — Hyoid barbel with strongly enlarged point of filament of *Linophryne* sp.; Reg.No. 14518.

divides into two, one into 3 and one into 4 ends. These ends are colourless and have more or less wide-set small bulbs at equal intervals. The number of these bulbs on each branch varies in accordance with the length of the latter, so that we find from one to five on each. The total length of this barbel is about half that of the standard length.

Any characters varying with those of the type are given in the following table:

Table 4

		Type	Paratype 9911	Paratype 15119A
Total length (mm.)		47.5	abt. 51	?
Standard length (mm.)		34	38	29
Snout	% of S.L.	22	20	abt. 23
Distance between sphenotic spines	% of S.L.	35	28	35
Lower jaw	% of S.L.	56	51	—
Illicium + esca	% of S.L.	35	30.5	36
Basal bone	% of S.L.	49	44	40
Longest tooth in upper jaw	% of S.L.	12 (5th)	14 (1st)	12 (5th)
Longest tooth in lower jaw	% of S.L.	16 (2nd)	17 (2nd)	19 (2nd)
Diameter of esca	% of S.L.	9	7	8
Pectorals	% of S.L.	16	17	16
Teeth on premaxillaries (right)		13	15	—
Teeth on premaxillaries (left)		13	12	—
Teeth on mandible (right)		10	13	—
Teeth on mandible (left)		8	11	—
Teeth on vomer		2	3	—

Remarks

This new species differs from all others recognized by Bertelsen by the complete absence of median distal appendages on the luminous bulb, combined with the presence of only one very thin and flexible anterior and posterior filament. In the previously known species this organ is either quite devoid of distal or lateral filaments or digitiform appendages (*L. algibarbata*) or it has but two short distal appendages (*L. lucifer*) or presents sturdy digitiform distal appendages (*L. coronata. L. quinqueramosa, L. arborifera, L. arcturi, L. macrodon, L. brevibarbis, L. argyresca*) or numerous simple and thin lateral filaments (*L. polypogon*) or numerous ramified filaments and one distal one (*L. racemifera*). The hyoid barbel is somewhat similar in structure to that of *L. macrodon* but differs greatly from all others.

Genus B. ***Edriolychnus*** Regan, 1925

The only adult specimen in the collection pertaining to this genus has a central cusp on the preopercular spine directed outwards, in common with *E. roulei* Regan & Trewavas 1932, but on the esca it bears a very short strongly flattened fringed appendage («tag») which, according to these authors is a character common only to species other than *E. roulei*,

the latter being said to have a pair of filaments or a single bifid filament instead. The combination found in our specimen, therefore, further substanciates the correctness of Bertelsen's opinion that the species recognized by Regan & Trewavas are the same and that the differences they had found in the shape of the preopercular spines were no more than individual variations, a fact Bertelsen demonstrated by showing that in 3 individuals the right preopercular spine differed considerably from the left one. Our specimen is, therefore, here attributed to *E. schmidti* and the genus *Edriolychnus* continues to be represented by one single species.

I. ***Edriolychnus schmidti*** Regan, 1925

Fig. 32.

Edriolychnus schmidti Regan, 1925, Proc. R. Soc. B. XCVII, p. 398, fig. 8 and 9 [not seen].*

Material

One specimen, very well preserved. S. L. 30.8 mm., from stomach of *A. carbo*. 10.IX.1956, Reg. No. 9586,

Two female larvae, Reg. Nos. 17887 (Fig. 27 C) and 17888 (see p. 142).

Description of adult

Measurements (in mm. and °/₀ of S. L.). Total length 43.7; standard length 30.8; snout 7.5 (24); distance between sphenotic spines 12 (39); length of lower jaw (to lower angle of angular) 12.2 (40); diameter of luminous bulb 3 (10).

Counts. Dorsal 3; anal 3; pectorals 15. Teeth about 25-28 in one to two rows in upper and lower jaw, vomer toothless.

Teeth. In both jaws the teeth are weak. They are composed of two general sizes; the smaller being about half the size of the larger one. On the whole those of the lower jaw are larger, and a good many are depressable in both jaws.

Luminous bulb. Sessile and rather large. No distal filaments, but posteriorly there is a flap-like small flat appendage which has a few minute fringes round its edge.

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* For synonymy see Bertelsen.

Spines on head. The sphenotic spines are very long and pointed and in front of them, at about one third the distance to the tip of the snout, there is another rather long pointed spine springing from the frontals. Both the right and the left preopercular spines have 3 radiating cusps and one central outwardly directed one.

Subdermal pigmentation. The caudal, forward to about the abdominal cavity, is brown. Near the end there are several large chromatophores above and below the median line and some very few similar

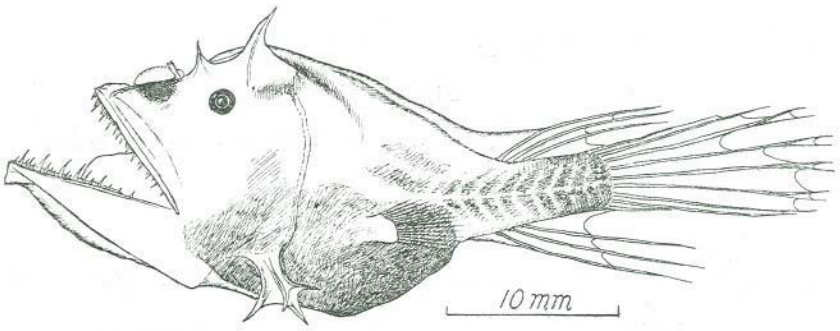

Fig. 32. — *Edriolychnus schmidti;* Reg. No. 9586.

ones along and just below the median line reaching up to above the stomach.

General colour. There is no trace of an outer pigmentation, the skin being white translucent to transparent all over, and through it the subdermal pigmentation can easily be seen, as well as the black peritoneum.

For larvae see p. 142.

III. SUMMARY

Ten species of adult female, one attached male and 5 larval female Ceratioids are listed and descrided. One Himantolophid is described as new to science and one goes unnamed because of its incomplete state of preservation, but is found to differ from all other Himantolophids in the collection.

A circular partly healed wound behind the chin of the above mention-

ed new species is discussed in detail, suggesting that it may have been caused by the attachment of a male.

The old species *Himantolophus compressus* erected by Osório is found to be valid and one of the present specimens is attributed to it.

On the basis of findings among the material of Oneirodids it is concluded that *Oneirodes anisacanthus* and *O. megaceros* are good species, both represented among the Museum's material.

Due to more or less important differences found and partly in order to maintain the two known species of *Lasiognathus* a specimen of this genus is described as «*Lasiognathus* sp.».

Among the Linophrynidae 5 different larval species are listed and described and 3 specimens belonging to the genus *Linophryne* are found to be new to science. *Linophryne arborifera* with an attached male is recorded for the first time.

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