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U. Post

Results of the research cruises of FRV "Walther Herwig" to South America. L.*)

A new genus and species of bobtail eel (Anguilliformes, Cyemidae) from the South Atlantic.

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With 9 figures

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Kurzfassung

Ergebnisse der Forschungsreisen des FFS „Walther Herwig“ nach Südamerika. L. Eine neue Gattung und Art eines Stutzschwanz-Aals (Anguilliformes, Cyemidae) vom Südatlantik.

Neocyema erythrosoma gen. nov., spec. nov. wird bisher von zwei Exemplaren vertreten, die während einer Expedition des FFS „Walther Herwig“ 1971 im Südatlantik in 2000 m Tiefe gefangen wurden. Die wichtigsten spezifischen Merkmale der neuen Gattung und Art sind eine hell-ziegelrote Körperfarbe, 101—108 Wirbel, reduzierte Augen, weit auseinandergerückte Nasenöffnungen, relativ große Kiemenöffnungen, abgerundete fleischige Pectoralia, eine sehr kurze praemaxillar-ethmovomerale Zahnscholle, raspelförmige Zähne auf den Kiefern, sowie das Fehlen eines Operculums und des Pectoralskeletts. Durch sie unterscheidet sich *Neocyema erythrosoma* deutlich von *Cyema atrum*, der einzigen anderen Gattung und Art der Familie Cyemidae. Nimmt man zu den aufgezählten Merkmalen noch hinzu, daß der Körper zu seiner Länge relativ hoch ist und daß der etwas größere Paratypus Eianlagen von 0.3 mm Durchmesser hat, so rechtfertigt das, *Neocyema erythrosoma* als neotaene Art zu deuten.

Abstract

Neocyema erythrosoma gen. nov., spec. nov. represented by two specimens collected in 2,000 metres in the South Atlantic, has a bright red body colour, 101—108 vertebrae, reduced eye, widely separated nostrils, a relatively large branchial aperture, rounded fleshy pectoral, very short premaxillary-ethmovomerine tooth patch and rasplike teeth on the jaws. The opercular and pectoral skeleton is absent. It is therefore quite distinct from *Cyema atrum*, the only other genus and species of Cyemidae. The above characters, the deep body and the presence of ova of 0.3 mm diameter suggest that *N. erythrosoma* is neotenous.

A. Introduction

During the South Atlantic transect of its 1971 cruise (Stations 348—417, South America to South Africa, along approx. 40° S.) the FRV "Walther Herwig" collected two apparently metamorphic specimens of a strange leptocephalus, characterised by its bright red colour and its similarity to *Cyema atrum* Günther, 1878. Comparison of these specimens with *C. atrum* showed them to be distinct from this eel in a number of major characters. In consequence a new genus and species to contain them is herein described.

*) Results of the research cruises of the FRV "Walther Herwig" to South America, XLIX. The otoliths of *Diretmus* Johnson, 1863 (Osteichthyes, Beryciformes, Diretmidae). Von A. Post und T. Hecht in Mitt. Hamburg. zool. Mus. Inst. 74: 165—170, 1977.

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Furthermore, an assessment of the characters of the new genus and species, including the observation that one of the specimens bears relatively large ova, suggests that it is neotenus.

B. Morphology

1. *Neocyema* gen. nov.

Type species: *Neocyema erythrosoma* spec. nov.

Diagnosis

A genus of eels (Anguilliformes) in which the body is red in colour and covered by a soft transparent integument which reveals the underlying myomeres. Dorsal and anal fins are present and confluent with a reduced caudal, the dorsal origin over the level of the anus which is near the end of the second third of the body. Pectoral present, with a rounded margin. Cephalic and lateral line pores absent. Branchial aperture relatively large, vertical, its upper half in front of pectoral base. Snout moderately produced, its tip slightly in advance of lower jaw. Nostrils simple, widely separated, low on snout. Eye minute, inconspicuous, beneath the transparent integument of head. Cleft of mouth extending to well behind eye. Teeth on jaws minute, forming a rasplike band of about three longitudinal rows. Teeth on premaxillary-ethmovomer in a short tear-shaped patch on tip of snout.

Vertebrae 101–108. No ossified opercular or pectoral skeleton. Branchial arches reduced to a single pair.

Etymology: Gk. *neos*, new; *Cyema*, the single hitherto known genus of the family Cyemidae. Feminine gender.

2. *Neocyema erythrosoma* spec. nov. Figures 1-4, 7-9

a) Material

Holotype: ISH 1194/71, "Walther Herwig" Station 412—II/71, 37° 08' S, 05° 23' E, 21. 3. 1971, 2100–2200 m; 140 mm total length.

Paratype: ISH 956/71, "Walther Herwig" Station 384—I/71, 39° 45' S, 17° 40' W, 13. 3. 1971, ca. 2000 m; 160 mm total length.

b) Diagnosis

The single known species has the characters of the genus.

c) Description

Proportional measurements in percent of standard length (paratype in parentheses). Head 16.2 (19.4), snout 5.8 (4.4), eye 0.4 (0.5), mouth 9.3 (7.5), branchial aperture 1.5 (1.4), pectoral 2.9 (1.9), predorsal 64.9 (66.5), snout-anus 64.2 (63.9), depth at pectoral 6.1 (6.6), depth at anus 8.0 (10.8). Dorsal rays 111 (114), anal rays 75 (86), myomeres before vent 50 (ca. 47), total myomeres 108 (ca. 101). Teeth along outermost maxillary row ca. 76 (ca. 70), teeth along outermost row of dentary ca. 81 (ca. 87), teeth on ethmovomerine patch ca. 46 (ca. 45).

The holotype is a slender, delicate eel which has the muscle segments showing conspicuously through a soft, transparent integument. The whole of the body and fins on capture was bright red but in alcohol it is a creamy-tan. The snout and lower jaw are acute but

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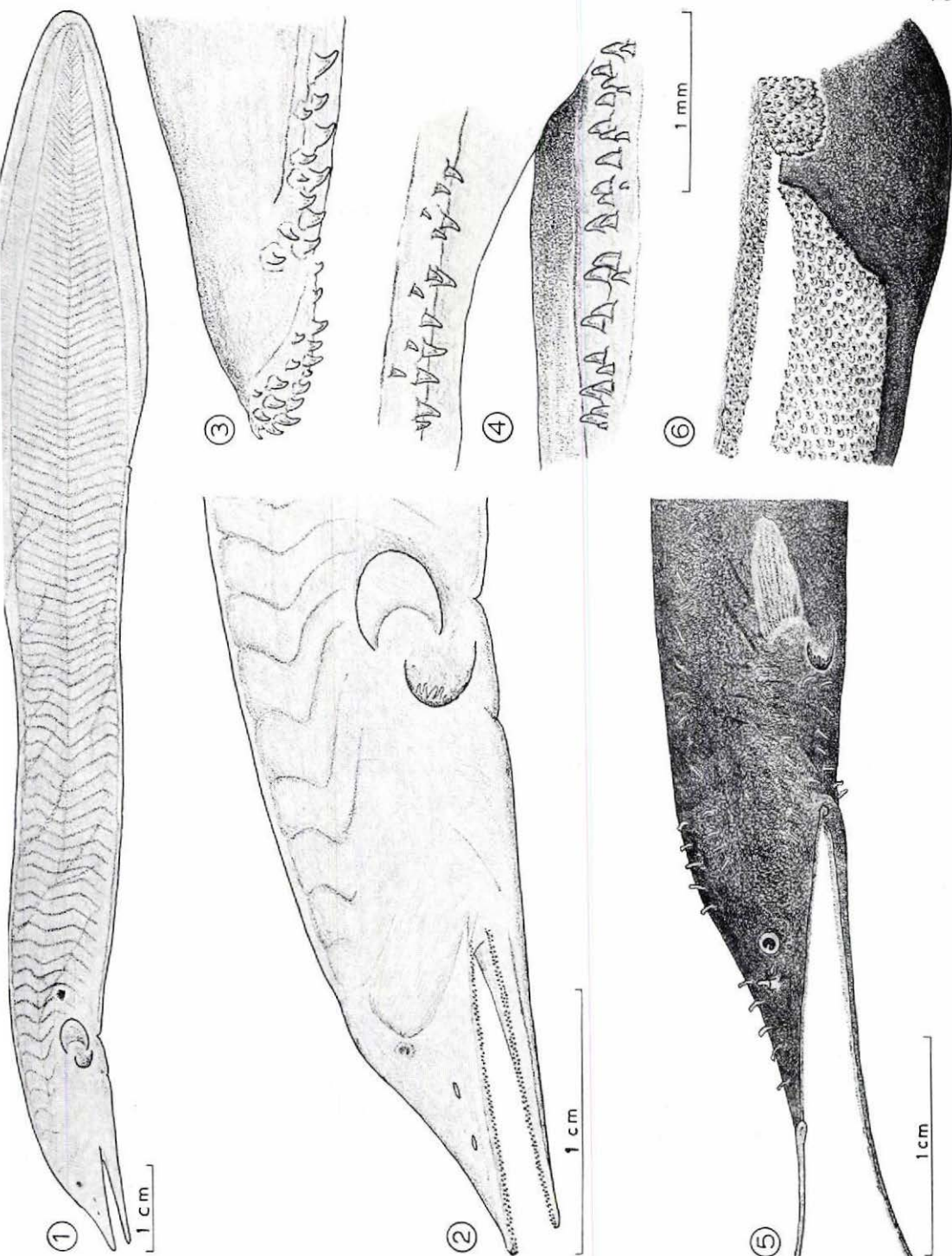


Fig. 1—4: *Neocyema erythrosoma* gen. et spec. nov., holotype 140 mm TL (Fig. 3 — teeth on anterior tip of upper jaw; Fig. 4 — teeth on posterior tips of upper and lower jaws).

Fig. 5—6: *Cyema atrum*, ISH 2709/71.

not markedly produced forwards. The small eye lies inconspicuously beneath the transparent integument of the head. There is a vertical, crescentic branchial aperture and flap-like, rounded pectoral.

Head conical, with jaw musculature obvious behind eye; snout acute, its dorsal profile slightly concave, nostrils as simple, oval openings, distinctly separated and relatively low on snout; eye almost vestigial, beneath integument; cleft of mouth long, extending to well beyond eye and slightly oblique.

Teeth present in more or less three longitudinal rows along almost the full length of each maxilla and dentary and in a very short, tear-shaped patch on the ethmovomer. All teeth minute, conical, recurved, just visible to the naked eye.

Branchial aperture relatively large, vertical, crescentic, its upper half level with the lower half of pectoral base but the aperture placed forwards of the base. Dorsal and anal fins delicate, transparent, relatively deep, supported by fin rays which may be counted through the integument; caudal fin short.

Myomeres readily visible along body length, W-shaped anteriorly, but becoming V-shaped posteriorly. No lateral line or cephalic sensory pores or organs.

Minute ova present in holotype, ova of approx. 0.3 mm. diameter in paratype.

Etymology: Gk. *erythros*, red; *soma*, the body.

C. Osteology (Fig. 7–9)

The following description of the skeleton of *Neocyema erythrosoma* is based on the paratype, cleared and stained in trypsin and alizarin according to the method of TAYLOR (1967). The tips of the snout and lower jaws of the paratype were broken, presumably during capture, and after clearing the front portion of the neurocranium including ethmovomer and both dentaries, became detached. The tip of the caudal region was absent and after clearing some terminal vertebrae became detached from the remainder of the vertebral column. Despite extreme care with this delicate specimen, the integument, including as well the pectoral fin, macerated completely during the clearing process. The skeleton took up alizarin strongly but the process was not suitable for determining the presence of cartilage.

The ossified skeleton of *N. erythrosoma* is much reduced: there is no primary upper jaw, opercular series or pectoral girdle and fin supports; the branchial skeleton is represented by a single arch and upper and lower tooth plates; there are no lateral line or cephalic sensory ossifications. However, the vertebral column is well developed excepting the caudal skeleton.

a) Neurocranium

In lateral and dorsal views the neurocranium is elongate, narrow anteriorly and broader posteriorly. The long narrow anterior portion is formed partly of the anterior, fused extension of frontal, the parasphenoid and the ethmovomer. These enclose an elongate interorbital vacuity. There is a short, tear-shaped patch of acute teeth on the ethmovomer, the most anterior teeth projecting forwards at the tip of the neurocranium.

As far as can be determined, the frontals are separate posteriorly but fused for the main extent of their narrow anterior portion. Each frontal expands laterally on each side as a broad plate behind the interorbital vacuity. The parietals are relatively large and form most of the roof of the cranial cavity.

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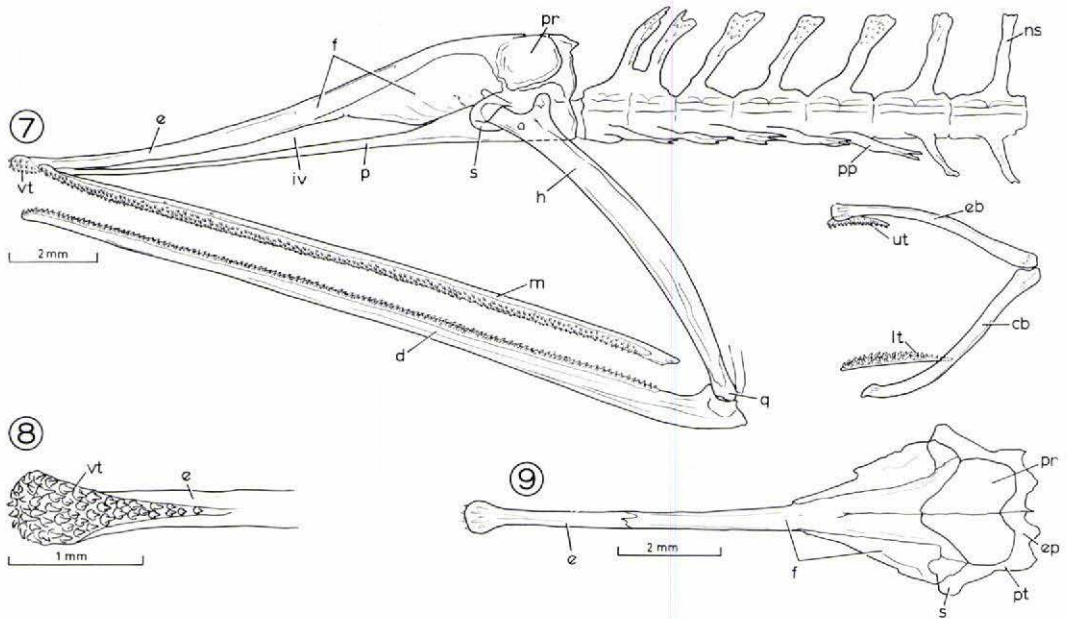


Fig. 7—9: *Neocyema erythrosoma* gen. et. spec. nov., paratype 160 mm TL, cleared and stained skeleton (Fig. 7 — cranium, branchial arch and anterior vertebrae; Fig. 8 — dorsal view of neurocranium; Fig. 9 — ventral view of vomerine tooth patch).

cb — ceratobranchial, d — dentary, e — ethmovomer, eb — epibranchial, ep — epiotic, f — frontal, h — hyomandibula, iv — intorbital vacuity, lt — lower toothplate, m — maxilla, ns — neural spine, p — parasphenoid, pp — parapophysis, pr — parietal, pt — pterotic, q — quadrate, s — sphenotic, ut — upper tooth plate, vt — vomerine teeth.

The dorsolateral and posterior walls of the cranial cavity are formed from a complex of bones which are not clearly distinguished from one another. However, there appears to be a well developed sphenotic, markedly concave on its ventral surface and into which the anterior condyle of the hyomandibula fits. The remainder of this complex may be formed from pterotic, epiotic and exoccipital as distinguished in the neurocranium of *Cyema atrum* by TREWAVAS (1933). There is no supraoccipital. The anterior portion of the lateral wall is not ossified (i. e., there is no pterosphenoid).

The floor of the neurocranium is ossified but not divided by sutures.

b) Jaws

The upper jaws are represented by the paired maxillae, each of which is greatly elongate and straight, except for the slightly spatulate, upturned anterior end at its attachment with the ethmovomer. The maxillae are toothed for almost their entire length. There is no palatopterygoid arch although the quadrate may be present as a small element at the distal end of the hyomandibula. The lower jaw is formed from the two elongate, toothed dentaries; there are no identifiable articular bones.

c) Suspensorium

There is a long, curved hyomandibula articulating with the sphenotic by a single, anterior condyle. Although the posterior portion of its proximal end expands as a prominent

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process, this does not articulate with the presumed pterotic portion of the neurocranium. Attached to the posterior surface of the distal end of the hyomandibula is a muscle mass termed in *C. atrum* the m. depressor mandibulae by TREWAVAS (1933) and containing, as in *C. atrum*, a minute ossification.

d) Branchial Arches

These are represented on each side by an upper and lower curved element, possibly homologous with what TREWAVAS (1933) termed the epibranchial and ceratobranchial of the fourth branchial arch. Pairs of upper and lower tooth plates, each bearing many recurved teeth, lie at the anterior ends of these elements. The lower plates are somewhat larger than the upper plates.

e) Vertebral Column

There are 101 vertebrae in the paratype but the caudal tip is missing and therefore there may have been more vertebrae in the intact specimen. All vertebrae carry strongly developed neural spines, the most anterior of which are short and robust and slightly expanded distally. The remaining neural spines are elongate and very thin and delicate. The most anterior 5–6 neural spines are directed slightly posteriorly, those of the terminal vertebrae markedly so, but those of the intermediate vertebrae are more or less vertical. Because the lateral muscles of the specimen have not completely cleared it is impossible to determine the number of precaudal vertebrae. The parapophyses are posterolaterally directed in the anterior 5–6 vertebrae (above the branchial cavity) but progressively more ventrolaterally directed further back. Dorsal and anal fin are not ossified.

D. Discussion

The major external characters of *Neocyema* are set out in the generic diagnosis. Of these the acute but not greatly produced jaws, the short vomerine patch, restricted to the anterior tip, the simple and separated nostrils, the reduced eye, the position of the branchial aperture, the rounded pectoral and the inconspicuous but not microscopic teeth all serve to distinguish this genus from *Cyema* Günther with its single species *C. atrum* Günther, 1878 (Fig. 5–6). In *Cyema* the jaws are long and the upper “beak” is formed by the “premaxillae” (TREWAVAS, 1933). The vomerine patch extends forwards between these and backwards on the roof of the mouth to the level of the eye. The nostrils are close together immediately in front of the eye and the anterior one has a short tube of which its medial rim is produced into a flap. The eye is small but not vestigial, the branchial aperture is reduced and lies wholly before and below the pectoral base. The pectoral is thin, elongate-oval and supported by soft rays. The most striking difference is in the size and number of the teeth. Those of *Cyema* are extremely minute and on each jaw together take the form of a rasplike surface, similar to the skin of many sharks. Furthermore, the posterior end of the maxilla forms a ball-like structure, the surface of which is covered with minute teeth.

While *Neocyema* lacks any obvious surface sensory structures *Cyema* has several rows of minute, transparent papillae on the head and a row along the lateral line, each papilla marking the position of a lateral line pore.

The wholly red body colour of *N. erythrosoma* is in marked contrast to the black of *C. atrum*.

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On the basis of the above external differences, generic distinction from *C. atrum* is accorded *N. erythrosoma*. However, major osteological differences between the two strongly support this distinction.

As might be expected from the general similarity in body form, the morphology of the skeleton of *N. erythrosoma* is rather similar to that of *C. atrum*. It is overall much more reduced and differs principally in the following ways. The ethmovermer and dentaries are very much shorter. The parietals are smaller and there are less conspicuous sutures between the cranial bones. A distinct pterotic is not evident, although the frontal expansion may correspond to the bone TREWAVAS (1933) termed the pterotic in *C. atrum*. The maxilla lacks the ball-like tooth-covered expansion which is so characteristic of *C. atrum*. The hyomandibula in *N. erythrosoma* is longer and much narrower and lacks the plate-like element (termed the operculum by TREWAVAS) which is attached to its proximal posterior margin in *C. atrum*. In *Cyema* there are several ventral branchial elements in addition to the much larger epibranchials and ceratobranchials of the fourth arch also present in *Neocyema*. *Cyema* has a narrow, curved cleithrum, several pterygiophores and pectoral fin-rays but the pectoral skeleton is absent in *Neocyema*. The anterior neural spines and parapophyses are much more conspicuously developed in *Neocyema*. Vertebrae number 74—78 in *C. atrum* (BERTIN, 1937) and myomeres number 68—80 in larvae (CASTLE, 1969), compared with 101 + and 108 vertebrae in *N. erythrosoma*.

When originally collected the two specimens of *N. erythrosoma* were considered to be metamorphic larvae. The rather gelatinous nature of the body, the incomplete development of the fins and their skeletal supports, the wide separation of the nostrils and the absence of lateral line organs, were all apparent evidence for this view. However, the strongly ossified skeleton, the complete series of what are obviously definitive teeth and particularly the presence of developing ova lend support to the view that the specimens are essentially adults which yet have retained the larval characters listed above. In this way the specimens must be regarded as neotenus as defined by DE BEER (1958) and compare with certain other fishes, particularly the Aphyonidae (NIELSEN, 1969). What might be considered the contrary paedogenetic condition of larvae having precocious gonads exists in *C. atrum* (BERTIN, 1937) and in the nettastomatid *Facciolella* (CASTLE, 1978).

The larval stages of *C. atrum*, characterised by their very deep body, acute head and conspicuous, scattered melanophores, are well known (BERTIN, 1937; CASTLE, 1969). SCHMIDT (1909) described a distinct cyemid larva, *Leptocephalus holti*, from the North Atlantic, having ca. 125 myomeres, a shallower body than that of larval *C. atrum*, a smaller eye and more regular lateral pigmentation. RAJU (1974) described what is apparently a second species of this type from the Pacific, having 102 myomeres. It is not possible to refer either of these to *Neocyema erythrosoma* but neither can that possibility be entirely discounted. However, insofar as the conspicuous lateral pigmentation of larval *C. atrum* is known to continue through metamorphosis into the juvenile (BERTIN, 1937) it seems unlikely that either is a larval *Neocyema*.

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